Infection Prevention
High Stakes
Higher Standards
Welcome!

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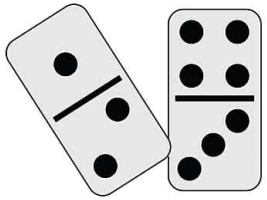

APIC New England Spring Conference
Friday May 1, 2026 | Springfield, MA

APIC New England Chapter Updates

Membership Update

- Total active members: 411
- New to the profession: 99 members (24%)
- CIC certified: 178 members (43%)
- LTC-CIP certified: 5 members (1.2%)

Nominating & Awards Committee Update

Congratulations

- Karen Miller- In Person APIC National Conference
- Laurie Trezza & Aminat-Alarape-Raji- Virtual APIC National Conference
- Abegail Pangan- First Place Shirley Bradley Award
- Manju Matthew- Second Place Shirley Bradley Award

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Agenda Highlights

Agenda Topics

- Surgical Prophylaxis
- Applying ASHRAE Guideline 43 to Empower IPs to Strengthen Ventilation-Based Infection Prevention
- Measles
- Project Management
- Legionella: The Silent Killer

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Biography: Rebecca Wang, MD

Rebecca is an Infectious Disease physician at Dartmouth Hitchcock Medical Center. She received her MD from Geisel School of Medicine at Dartmouth. She went on to complete her Internal Medicine residency and Infectious Diseases fellowship at the Hospital of the University of Pennsylvania. She joined as faculty at Dartmouth Hitchcock Medical Center in 2021. She has training and interest in antimicrobial stewardship as well as quality improvement, and she currently serves as Co-Director of the Antimicrobial Stewardship program.

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Peri-Operative Antibiotic Prophylaxis

Rebecca Wang, MD

Co-Director of Antimicrobial Stewardship Program

Dartmouth-Hitchcock Medical Center

Dartmouth Health

Dartmouth GEISEL SCHOOL OF MEDICINE

Financial Disclosures

I have no financial disclosures.

Objectives

1) Review peri-operative antibiotic selection and administration for prevention of surgical site infection

2) Discuss antibiotic allergies in the context of peri-operative antibiotic selection

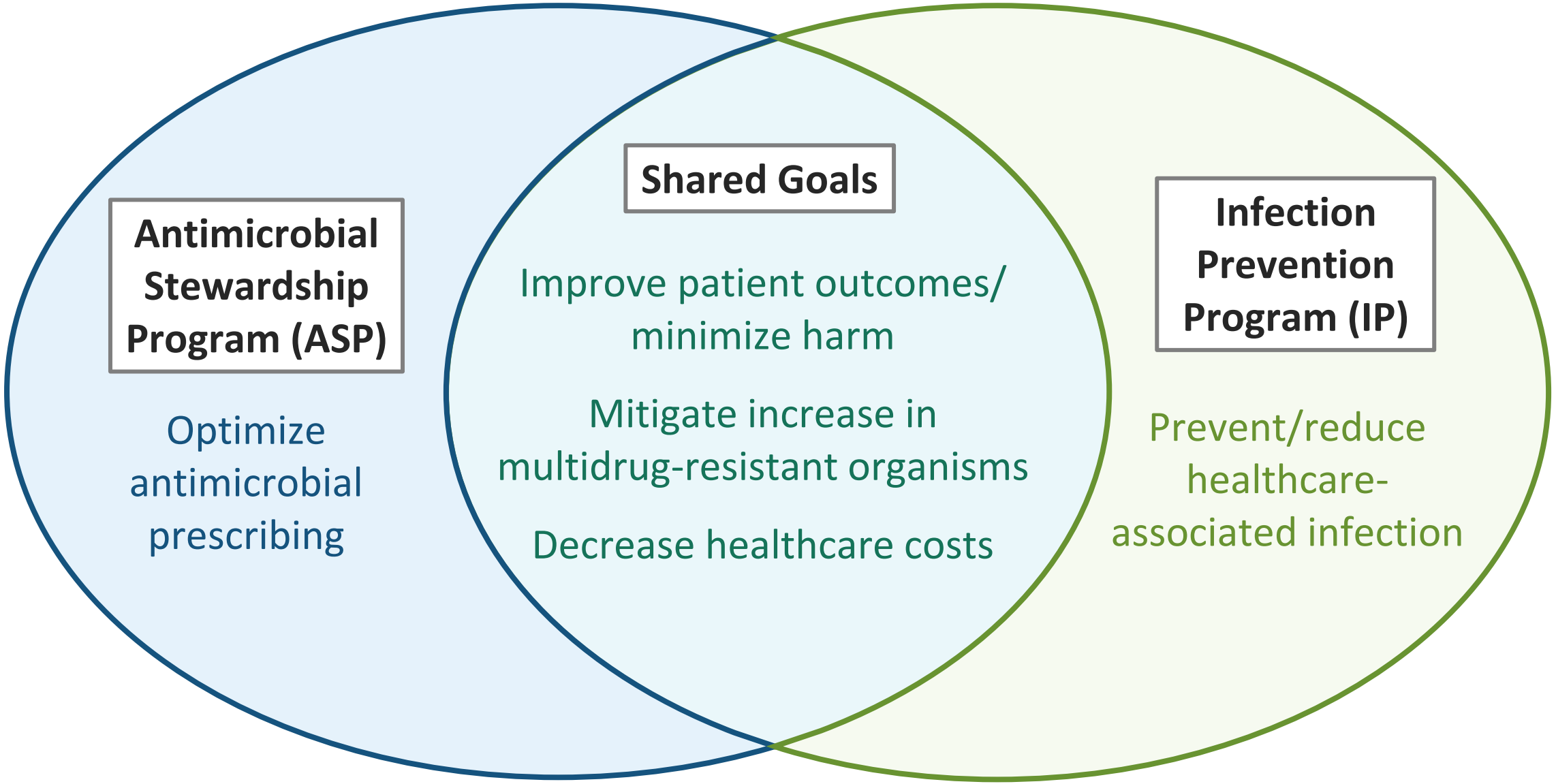
3) Discuss adjunctive strategies to prevent surgical site infection

4) Highlight areas of collaboration between antimicrobial stewardship, infection prevention, and other quality champions

Definition of Antimicrobial Stewardship

"Coordinated interventions designed to improve and measure the **appropriate use of antimicrobials** by promoting the selection of the optimal **drug regimen, dose, duration of therapy, and route of administration**."

- Consensus statement from IDSA, SHEA, and PIDS



Med Clin N Amer 2018 Sept; 102: 873-882.

Common Areas of IPP/ASP Collaboration

IPP Focus	ASP Collaboration	Shared Goal
Catheter-associated urinary tract infection (CAUTI)	- Diagnostic stewardship for urine testing - Education regarding asymptomatic bacteriuria	**- Decrease unnecessary antibiotic prescribing** **- Decrease CAUTI rates**
C. difficile infection (CDI)	- Diagnostic stewardship for *C. difficile* testing - Optimization of *C. difficile* treatment and prophylaxis - Optimization of high-risk antibiotic use	**- Decrease unnecessary antibiotic prescribing** **- Decreased CDI rates**
Surgical site infection (SSI)	- Creation of institutional peri-operative antibiotic prophylaxis guideline	**- Optimize peri-operative antibiotic administration** **- Decrease SSI rates**

Med Clin N Amer 2018 Sept; 102: 873-882.

Surgical Site Infections (SSIs)

- Occur in ~1-3% of patients undergoing surgery at acute care hospitals, depending on procedure type
- Associated with negative downstream consequences, including…
  - Increased length of stay
  - Increased rates of re-operation
  - Increased attributable mortality
- One of the most costly HAIs, contributing to ~$3.5 to 10 billion in healthcare expenditure annually
- **Up to 60% are preventable using evidence-based guidelines**

JAMA. 2023 Jan 17;329(3):244-252.
Infect Control Hosp Epidemiol. 2023 May;44(5):695-720.

Principles of Antibiotic Prophylaxis

Chosen antibiotics(s) should be…

- Active against pathogen(s) most likely to contaminate surgical site
- Given at an appropriate time and dose to ensure adequate serum concentrations during time of potential contamination
- Administered for shortest effective period of time, to minimize adverse effects and development of antimicrobial resistance

Am J Health Syst Pharm. 2013 Feb 1;70(3):195-283.

Antibiotic Selection

Procedure Type	Implicated Pathogens	Preferred Therapy
Clean (Uninfected wound, no viscus entered)	Skin pathogens: *S. aureus,* coagulase-negative Staphylococci, Streptococci	**Cefazolin**
Clean-contaminated (Uninfected wound, viscus entered under controlled circumstances)	Skin pathogens: *S. aureus,* coagulase-negative Staphylococci, Streptococci GI pathogens: Enteric Gram-negative rods (e.g., *E coli, Klesbiella* spp.), Enterococci, GI anaerobes	**Cefazolin* +/- Metronidazole** *Depending on local resistance rates, consider substituting a beta-lactam with "broader" Gram-negative coverage, such as ceftriaxone

Am J Health Syst Pharm. 2013 Feb 1;70(3):195-283.

Dartmouth Health

Organisms

Per CLSI guidelines, there should be 30 or more isolates to be considered statistically adequate for selecting antibiotics for treatment.

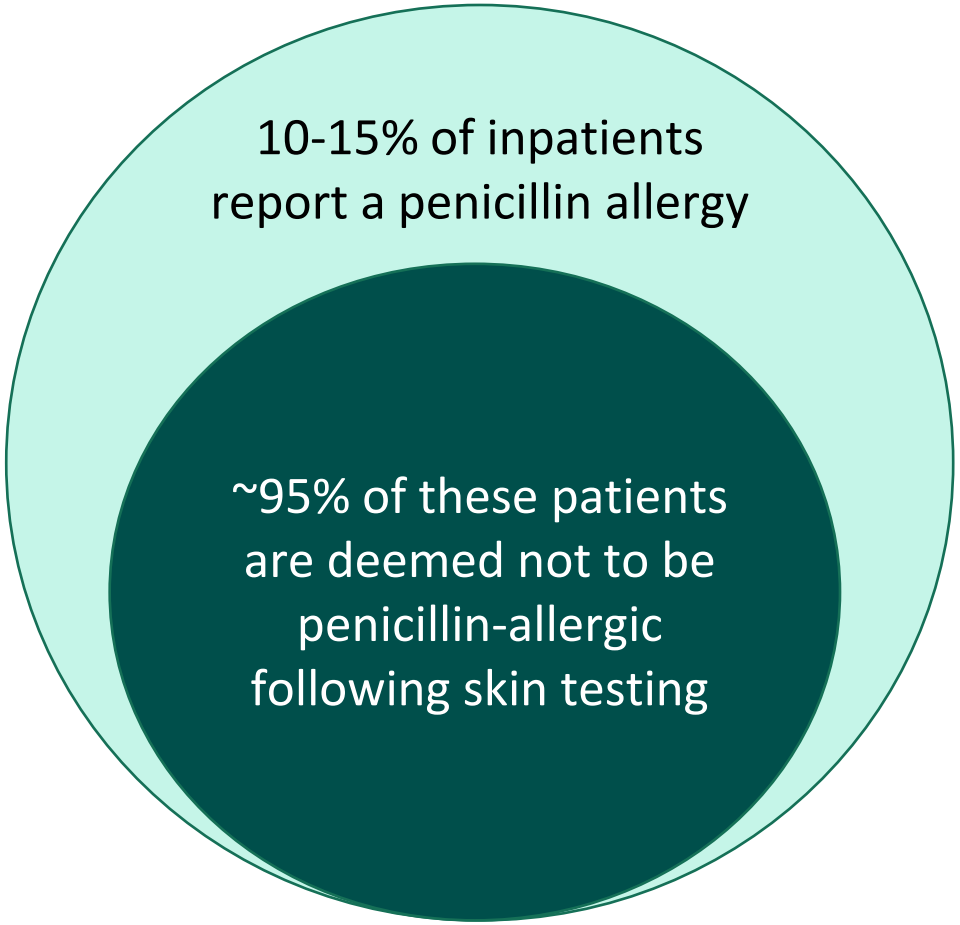
Organisms	Number of Isolates	Penicillin	Ampicillin	Ox/Nafcillin	Ampicillin/Sulbactam	Piperacillin/Tazo	Cefazolin (first)	Cefuroxime (second)	CefTAZidime (third)	CefTRIaxone (third)	Cefepime (fourth)	Meropenem	Daptomycin	Linezolid	Gentamicin	Tobramycin	Vancomycin
GRAM POSITIVES																	
Staphylococcus aureus - ALL [1]	861			61			61						100	100	100 [2]		100
-*Staphylococcus aureus* - MSSA	526			100			100						99	100	100 [2]		100
-*Staphylococcus aureus* - MRSA	335			0			0						100 [3]	100	100 [2]		100
Staphylococcus lugdunensis	41			93			93							100	100 [2]		100
Staphylococcus coagulase negative sp.	153			47			47						100	100	92 [2]		100
Streptococcus pneumoniae	34	77								97		91					100
-*Streptococcus pneumoniae* (meningitis)	34	76								97							
Enterococcus faecium	47	19	19				0	0	0	0	0		93 [3,4]	100	96 [2,5]		28
Enterococcus faecalis	101	100	100				0	0	0	0	0		100 [3]	100	85 [2,5]		97
Strep. anginosus grp (*S. milleri*)	72	100 [6]								100 [6]							
Cutibacterium acnes	36	100										100					
GRAM NEGATIVES																	
Haemophilus influenzae	54		74 [7]														
Escherichia coli	280		62 [8]		69	94	86 [8]	88 [8]	91 [9]	87	90	100			92	92 [9]	
Enterobacter cloacae complex	71		0			81	0		77 [9]	70	88	100			96	92 [9]	
Klebsiella oxytoca	39		0		77	90				90	100	100			100		
Klebsiella pneumoniae	109		0		79	94	90 [8]	87 [8]	86 [9]	87	85	99			97	90 [9]	
Proteus mirabilis	44				89	98			98 [9]	96		100			91	95 [9]	
Pseudomonas aeruginosa	163		0			85			82		80	95				98	

Cefazolin

- Most widely studied antibiotic for peri-operative prophylaxis, with proven efficacy
- Has a desirable spectrum of activity against commonly encountered pathogens
  - Including enteric Gram-negative rods, such as *E. coli* and *Klebsiella* spp.
- Has a R1 side chain that is distinct from all penicillins and all other cephalosporins (except ceftezole)
  - Safe to use in the context of many beta-lactam allergies
- **Preferred prophylactic antibiotic for many procedure types**

Am J Health Syst Pharm. 2013 Feb 1;70(3):195-283.

Beta-Lactam Allergy



Penicillin allergy associated with:

- Increased use of alternatives to beta-lactams
- Increased rates of surgical site infection
- Increased rates of *C. difficile* infection
- Increased rates of MRSA colonization and other antimicrobial resistance
- Increased length of stay
- Increased cost to hospital systems

Clin Infect Dis. 2018 Jan 18;66(3):329-336.

Cefazolin in Beta-Lactam Allergy

- Recent meta-analysis[1] shows rates of dual allergy to penicillin and cefazolin to be as low as…
  - **Less than 1% for patients without a "confirmed" penicillin allergy** (e.g., positive skin test)
  - ~3% for patients with a confirmed penicillin allergy
- Updated American Academy of Allergy, Asthma, and Immunology (AAAAI) practice parameter[2] endorses use of cefazolin for patients with a history of anaphylaxis to penicillin, **without any need for additional testing or precautions**
  - No need for skin tests or test doses, decreasing logistical barriers

[1]JAMA Surg. 2021 Apr 1;156(4):e210021.
[2]J Allergy Clin Immunol. 2022 Dec;150(6):1333-1393.

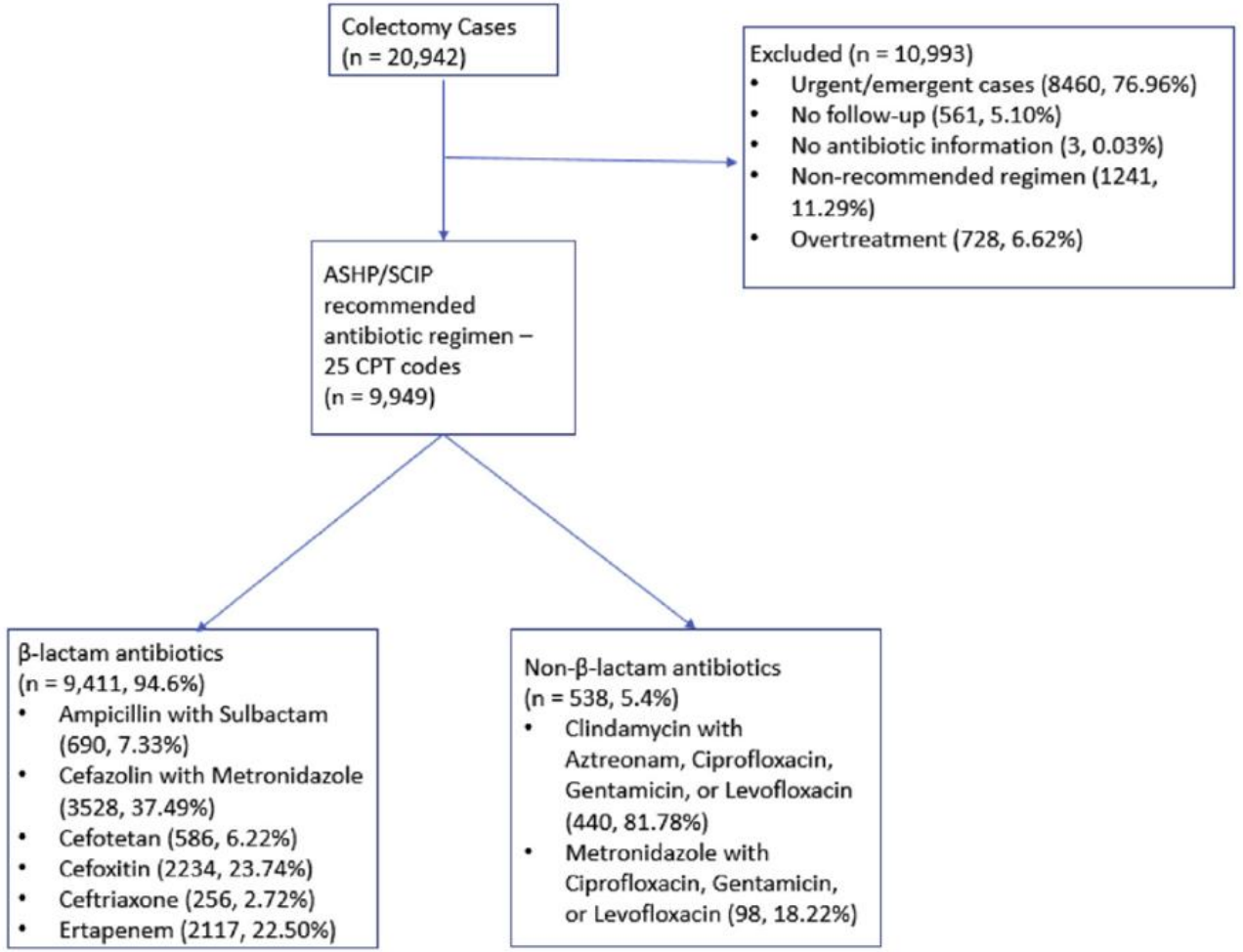
Beta-Lactam vs. Alternative Prophylaxis for Elective Colorectal Surgery

Retrospective cohort study of elective colectomy cases from an institutional QI database

<u>Number of SSIs</u>

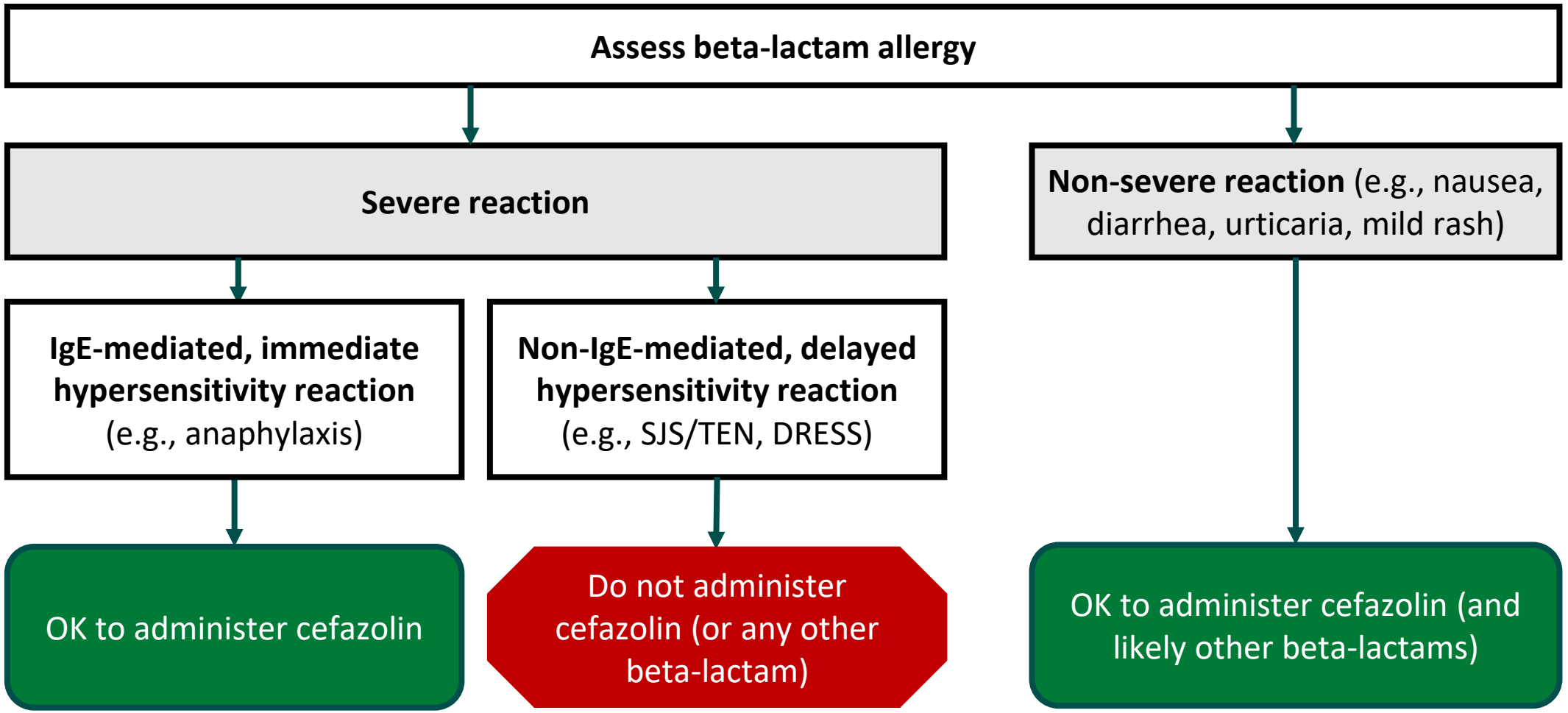
- Beta-lactam: 571 (**6.3%**)
- Non-beta-lactam: 51 (**9.5%**)

Adjusted OR for SSI associated with use of a non-beta-lactam antibiotic was **1.65** ($p < 0.01$)



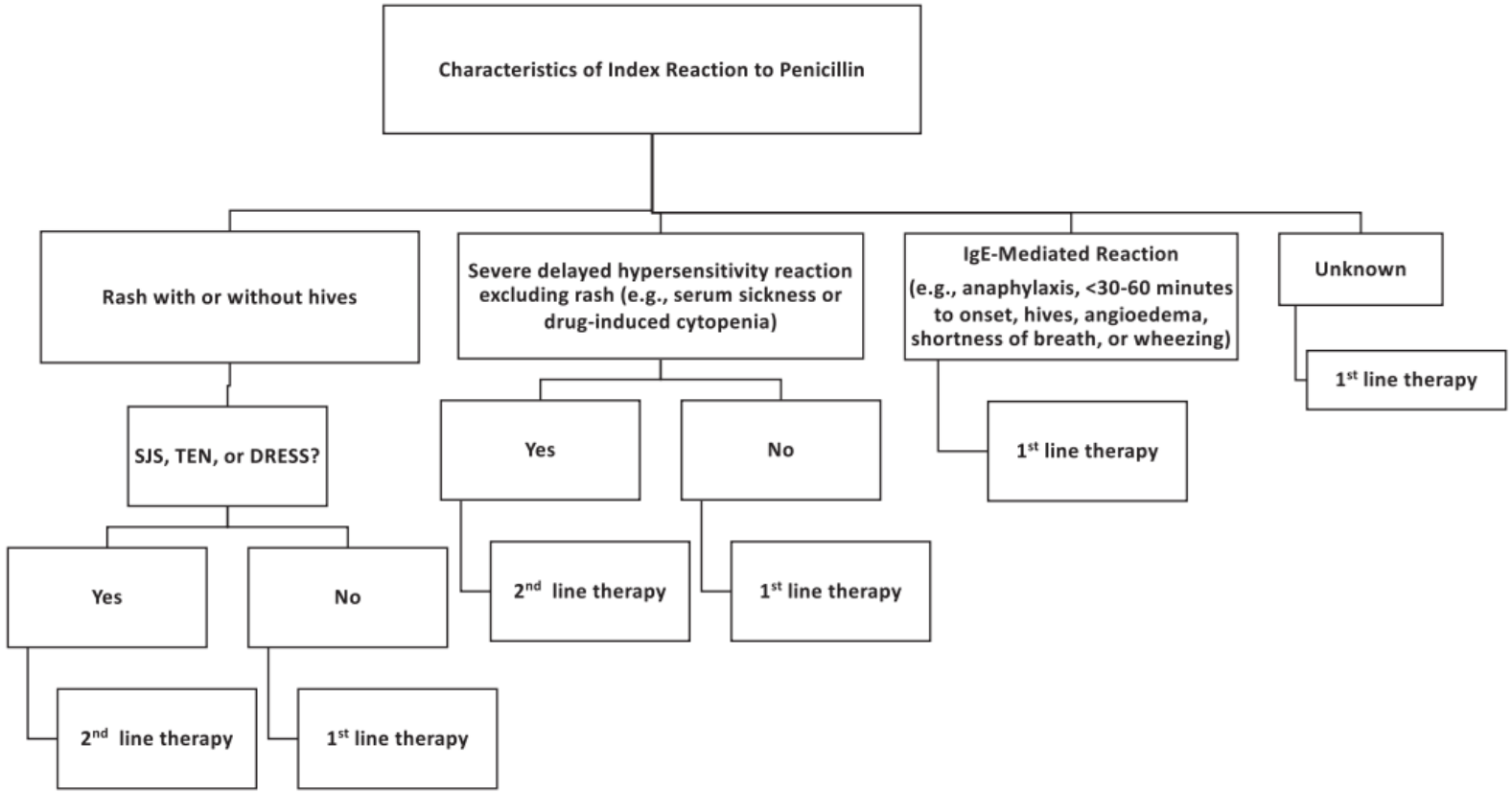
J Am Coll Surg. 2019 Nov;229(5):487-496.e2.

Beta-Lactam Allergy Assessment



Promoting Cefazolin Prophylaxis in Patients with Reported Penicillin Allergy

- Surgical prophylaxis guideline updated in 2022, expanding use criteria for cefazolin in those with penicillin allergy
- Pre- and post-intervention study sought to assess the impact of this update



J Allergy Clin Immunol Glob. 2024 Nov 26;4(1):100377.

Promoting Cefazolin Prophylaxis in Patients with Reported Penicillin Allergy

*Adjusted OR for cefazolin use = **1.87** (95% CI 1.67-2.10)

TABLE III. Outcomes of patients with penicillin allergy labels undergoing surgery before and after the updated surgical guideline implementation

Outcomes	Before guideline release (n = 3085)	After guideline release (n = 4102)	*P* value
No. of antibiotics received, mean ± SD	1.5 ± 0.9	1.5 ± 1.0	.294
Medication administration, n (%)			
Cefazolin	2256 (73.2)	3390 (82.6)	<.001
Vancomycin	273 (8.9)	330 (8.0)	.223
Clindamycin	444 (14.4)	350 (8.5)	<.001
Gentamicin	482 (15.6)	313 (7.6)	<.001
Safety outcomes, n (%)			
Anaphylaxis	0 (0)	1 (0.02)	1.000

J Allergy Clin Immunol Glob. 2024 Nov 26;4(1):100377.

Non-Beta-Lactam Alternatives

Procedure Type	Implicated Pathogens	Preferred Therapy	Alternative Therapy
Clean (Uninfected wound, no viscus entered)	Skin	**Cefazolin**	**Vancomycin** (Or Clindamycin)
Clean-contaminated (Uninfected wound, viscus entered under controlled circumstances)	Skin, GI	**Cefazolin* + Metronidazole** *Depending on local resistance rates, consider substituting a beta-lactam with “broader” Gram-negative coverage, such as ceftriaxone	**Levofloxacin + Metronidazole**

Dosing + Intra-Operative Redosing

- Initial antibiotic dose should be administered at a time to provide serum and tissue concentrations that exceed MICs for the probable organisms at the time of incision
- Intra-operative redosing is needed if duration of the procedure exceeds two half-lives of the antibiotic
- Earlier redosing of most antibiotics is needed if there is excessive intra-operative blood loss (i.e., >1500 mL)

Am J Health Syst Pharm. 2013 Feb 1;70(3):195-283.

Dosing + Intra-Operative Redosing

Antibiotic	Dose	Infusion Time	Pre-Operative Dose (Prior to Incision)	Intra-Operative Redosing Interval
Cefazolin	2g if <120 kg 3g if ≥120 kg*	5-30 min	Within 60 min	CrCl ≥20: Q4h CrCl <20: Q6h
Ceftriaxone	2g	5-30 min	Within 60 min	Q12h
Clindamycin	900 mg	30 min	Within 60 min	Q6h
Levofloxacin	500 mg	**60 min**	**Within 120 min**	CrCl ≥20: Q12h CrCl <20: None
Metronidazole	500 mg	30 min	Within 60 min	Q12h
Vancomycin	15 mg/kg	**Variable**	**Within 120 min**	None

*Recent meta-analysis remarks on a lack of need for obesity dosing [Anesthesiology. 2025 May 1;142(5):929-948]. Guidelines have not yet been updated, and adoption into clinical practice has been variable.

Antibiotic Timing vs. SSI Risk

TABLE 3. Association Between Timing of Prophylaxis and Infection Risk

Timing Interval Relative to Incision	Infection/N-at-Risk	Infection Risk*	Unadjusted Relative Risk of Infection (95% CI)	Adjusted Risk Odds Ratio for Infection From Conditional Logistic Regression (95% CI)†
Group 1: Vancomycin/fluoroquinolones within 60 min or cephalosporins‡ within 30 min before incision	38/1844	2.1%	Referent Group	Referent Group
Group 2: Vancomycin/fluoroquinolones 61–120 min or cephalosporins‡ 31–60 min before incision	43/1796	2.4%	1.16 (0.75, 1.79), $P = 0.50$	1.48 (0.92, 2.38), $P = 0.06$
Group 3: Any other preincision administration regimen	18/644	2.8%	1.36 (0.78, 2.36), $P = 0.28$	1.30 (0.70, 2.41), $P = 0.39$
Group 4: Post-incision	10/188	5.3%	2.58 (1.31, 5.10), $P = 0.005$	2.20 (1.03, 4.66), $P = 0.02$

- Trend towards decreased SSI risk when antibiotics were administered closer to time of skin incision, though not statistically significant
- Higher rates of SSI seen if first dose of antibiotic was given AFTER skin incision

Ann Surg. 2009 Jul;250(1):10-6.

Antibiotic Timing vs. SSI Risk

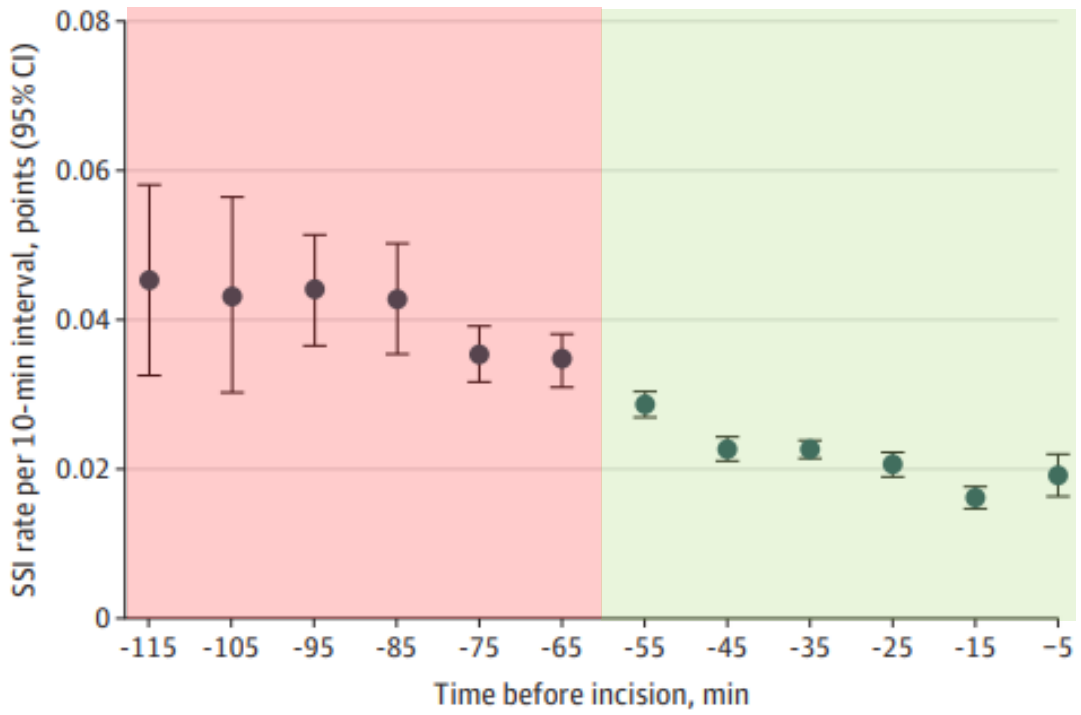
Large cohort study from a national Swiss database, with the following inclusion criteria…

1) Undergoing 1 of 11 elective surgical procedures
   - Including knee/hip arthroplasty, laminectomy, spondylodesis, cardiac surgery, colon surgery, cholecystectomy, hernia repair, gastric bypass, Cesarean delivery, hysterectomy
2) Surgery occurred between January 2009 and December 2020
3) Administration of cefuroxime (with or without metronidazole) in the 120 minutes prior to surgical incision

JAMA Netw Open. 2023 Jun 1;6(6):e2317370.

Antibiotic Timing vs. SSI Risk

Figure 2. Crude Surgical Site Infection (SSI) Rate Relative to Timing of Surgical Antimicrobial Prophylaxis (SAP)



Timing of cefuroxime administration vs. SSI risk

- *0-30 min*: **aOR=0.85** (95% CI 0.78-0.93), p<0.001
- *31-60 min*: **aOR=0.91** (95% CI 0.84-0.98), p=0.01
- *61-120 min*: Reference

Suggests that “optimal” timing of pre-operative antibiotic administration may be closer to time of skin incision

JAMA Netw Open. 2023 Jun 1;6(6):e2317370.

Antibiotic Duration

- Previous guidelines recommended discontinuation of antibiotics "within 24 hours" of surgery
- Meta-analysis[1] showed no evidence that additional antibiotic doses after incision closure lead to reduced rates of SSI
  - If compliant with timing of initial antibiotic dose and subsequent intra-operative doses
- Updated SHEA compendium[2] recommends discontinuing antibiotics after incision closure in the operating room
- Antibiotics should NOT be continued due to presence of a drain

[1]Lancet Infect Dis. 2020 Oct;20(10):1182-1192.
[2]Infect Control Hosp Epidemiol. 2023 May;44(5):695-720.

No Antibiotics for Low-Risk Procedures?

- Retrospective review of patients who underwent simple knee arthroscopy between 2007 and 2012
- Looked at SSI rates based on whether antibiotic prophylaxis was given

Table 2. Infections by Antibiotic Status

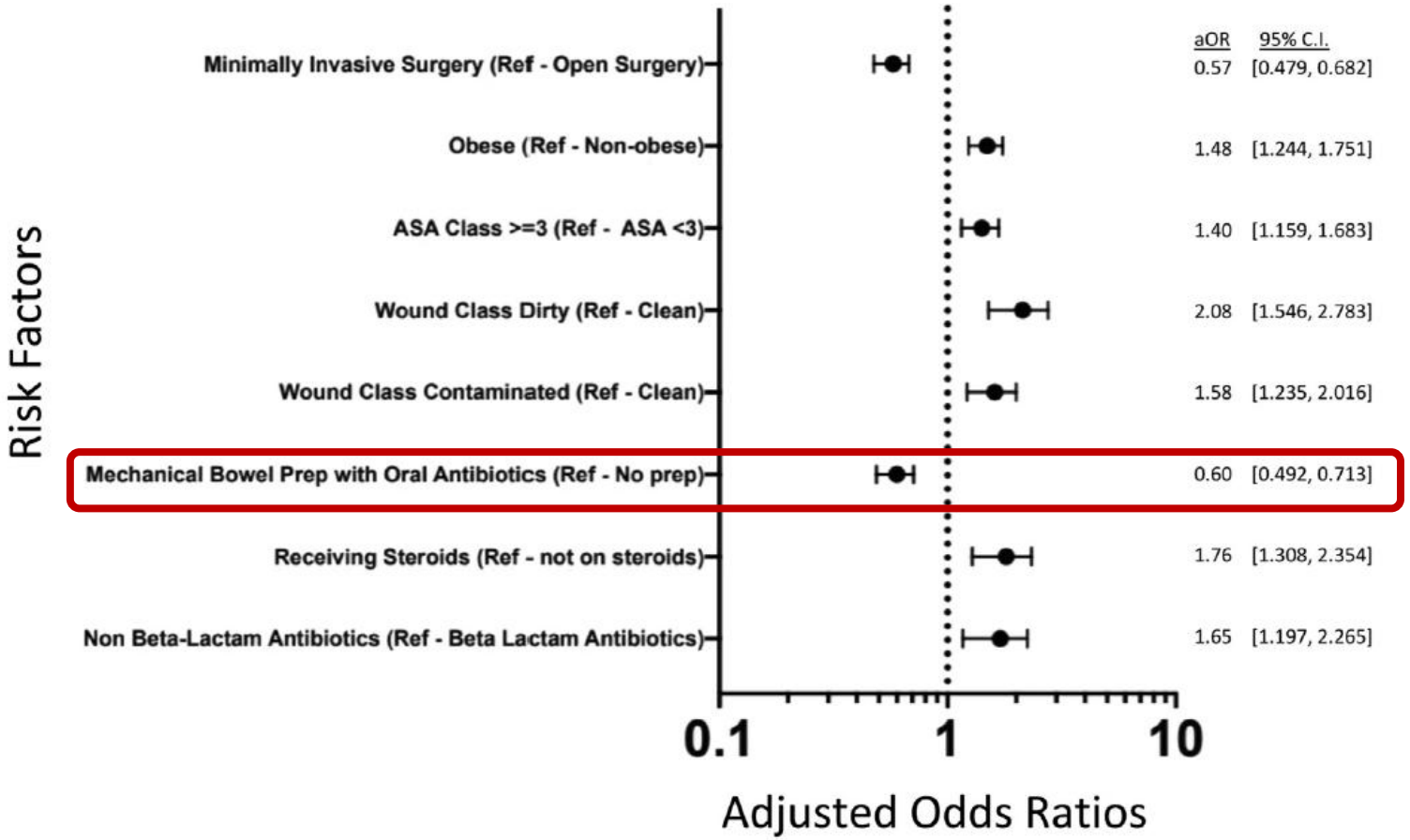
Category	Antibiotics	No Antibiotics	Total	Risk Ratio	95% Confidence Interval	*P* Value
No. of study patients (%)	32,836 (80.5)	7,974 (19.5)	40,810 (100)			
Infection (%)	159 (0.48)	43 (0.54)	202 (0.50)	0.90	0.64-1.26	.53
Deep	25 (0.08)	11 (0.14)	36 (0.09)	0.55	0.27-1.12	.10
Superficial	134 (0.41)	32 (0.40)	166 (0.41)	1.01	0.69-1.49	.93
Antibiotic* (%)						
Cefazolin	29,662 (90.3)					
Clindamycin	2,742 (8.4)					
Vancomycin	472 (1.4)					
Other	17 (0.1)					

*57 knee arthroscopies had more than 1 antibiotic given (total = 32,893).

Arthroscopy. 2017 Jan;33(1):157-162.

Role of Oral Antibiotics?

- No role as stand-alone prophylaxis
- Have demonstrated benefit when given in addition to IV antibiotics (with or without mechanical bowel preparation), for elective colorectal surgeries



J Am Coll Surg. 2019 Nov;229(5):487-496.e2.

Role of Oral Antibiotics?

Meta-analysis of oral antibiotics (OAB) and/or mechanical bowel prep (MBP) for elective colorectal surgery:

- OAB + MBP was associated with the lowest risk of SSI
- OAB alone ranked as second best, though data available on this approach was limited
- No difference between MBP only vs. no adjunctives

➢ **Endorsed by SHEA as an essential practice for SSI prevention**

JAMA Netw Open. 2018 Oct 5;1(6):e183226.
Infect Control Hosp Epidemiol. 2023 May;44(5):695-720.

Addition of MRSA Coverage?

- Routine MRSA coverage is not needed for antibiotic prophylaxis, regardless of procedure type
- However, may be utilized in select scenarios...
  - Patients known to be MRSA colonized, particularly if implantation of prosthetic material is planned
  - In the setting of proven outbreaks of SSIs due to MRSA
- Preference is to ADD vancomycin to cefazolin, rather than replace
  - Vancomycin has no activity against Gram-negative pathogens and has less potent activity against MSSA than beta-lactams
- Combination prophylaxis increases the risk of adverse events

Infect Control Hosp Epidemiol. 2023 May;44(5):695-720.

Combination vs. Single-Agent Prophylaxis

- Retrospective cohort study utilizing VA database (n=20,101)
- **Amongst cardiac surgeries, combination prophylaxis was associated with a significantly lower incidence of SSI**, compared to single agent prophylaxis (0.95% vs. 1.48%, aOR=0.61)
  - Held true for those who were MRSA colonized (NNT=53) and not MRSA colonized (NNT=176)
- No benefit to combination prophylaxis seen for orthopedic, vascular, colorectal, or hysterectomy procedures
- **Higher AKI rates with combination prophylaxis** [23.8%, vs. 20.8% (vancomycin alone) vs. 13.9% (beta-lactam alone)]

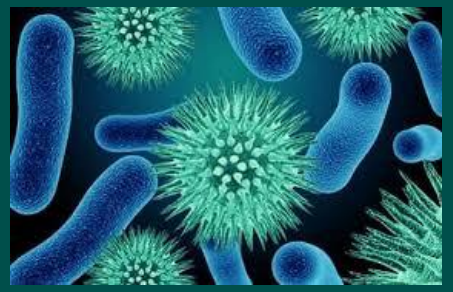
PLoS Med. 2017 Jul 10;14(7):e1002340.

Role of *S. Aureus* Decolonization?

- Endorsed as essential practice by SHEA for cardio-thoracic and orthopedic procedures
  - Can be considered for other procedure types involving implantation of prosthetic material
- Published data most supportive of intranasal mupirocin, though there are emerging data on use of intranasal povidone-iodine
  - Latter is logistically easier, as this is applied immediately before surgery
- Universal vs. targeted decolonization are both options, though former may be easier to implement

Infect Control Hosp Epidemiol. 2023 May;44(5):695-720.

Should Prophylaxis be Adjusted if Recent Infection or Colonization w/ MDR Organism?



Pathogen
- Organism
- Susceptibilities

Host
- Comorbidities

Procedure
- Extent of surgery
- Proximity of reservoir to incision and operative sites

SSI Prevention in Antibiotic Resistance Era

Stewardship Framework

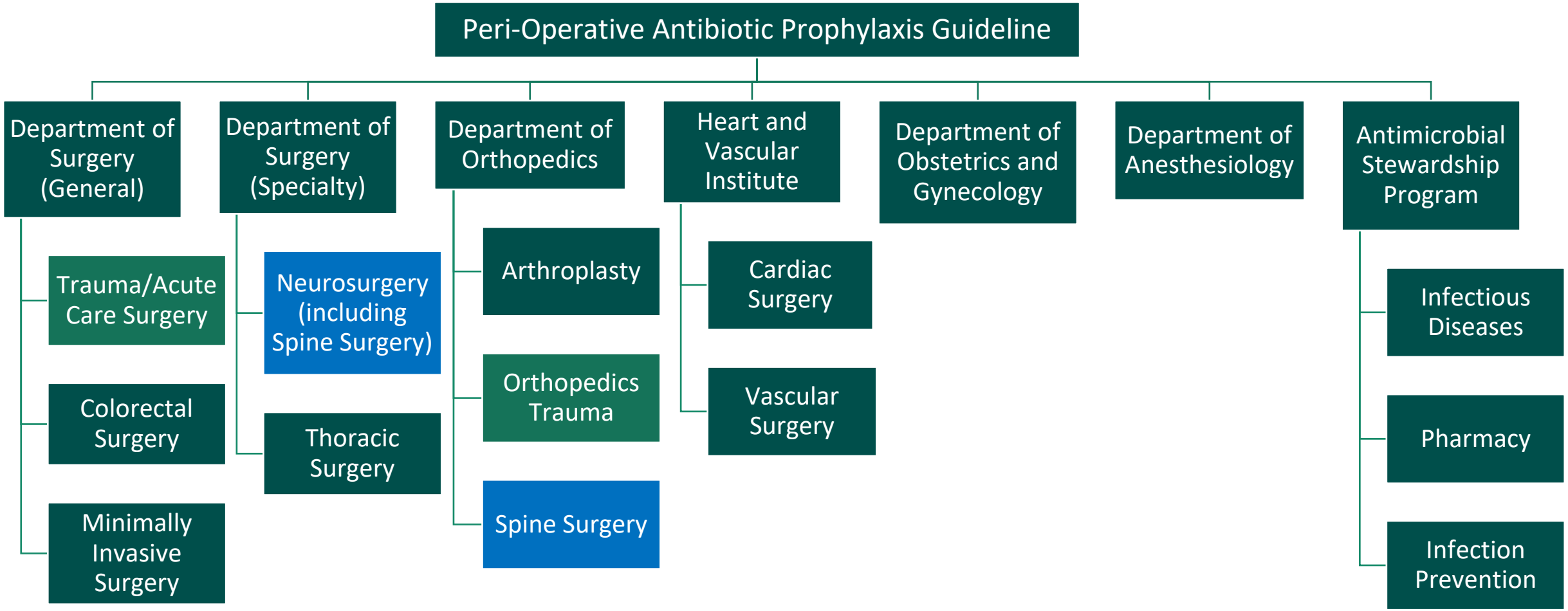
1) Avoid antibiotics in contexts where studies indicate that they are not beneficial
2) Consider antimicrobial strategies with lower-risk profiles
3) Maximize the effect of antibiotic prophylaxis through more targeted use
4) Leverage non-antibiotic SSI prevention measures
5) Consider new models of SSI pathogenesis

JAMA Surg. 2024 Aug 1;159(8):949-956.

Creation of a Local Guideline

1) Begin with published national guidelines and/or examples from other institutions
2) Tailor recommendations to:
    a) Local antibiotic resistance patterns
    b) Breakthrough SSIs?
    c) Practices of local surgeons, as clinically appropriate
3) Identify key stakeholder(s) from surgical groups to collaborate and serve as champions
4) Do not try to account for every possible clinical scenario
5) Incorporate considerations of all sites in health system, as feasible

Defining & Engaging Key Stakeholders

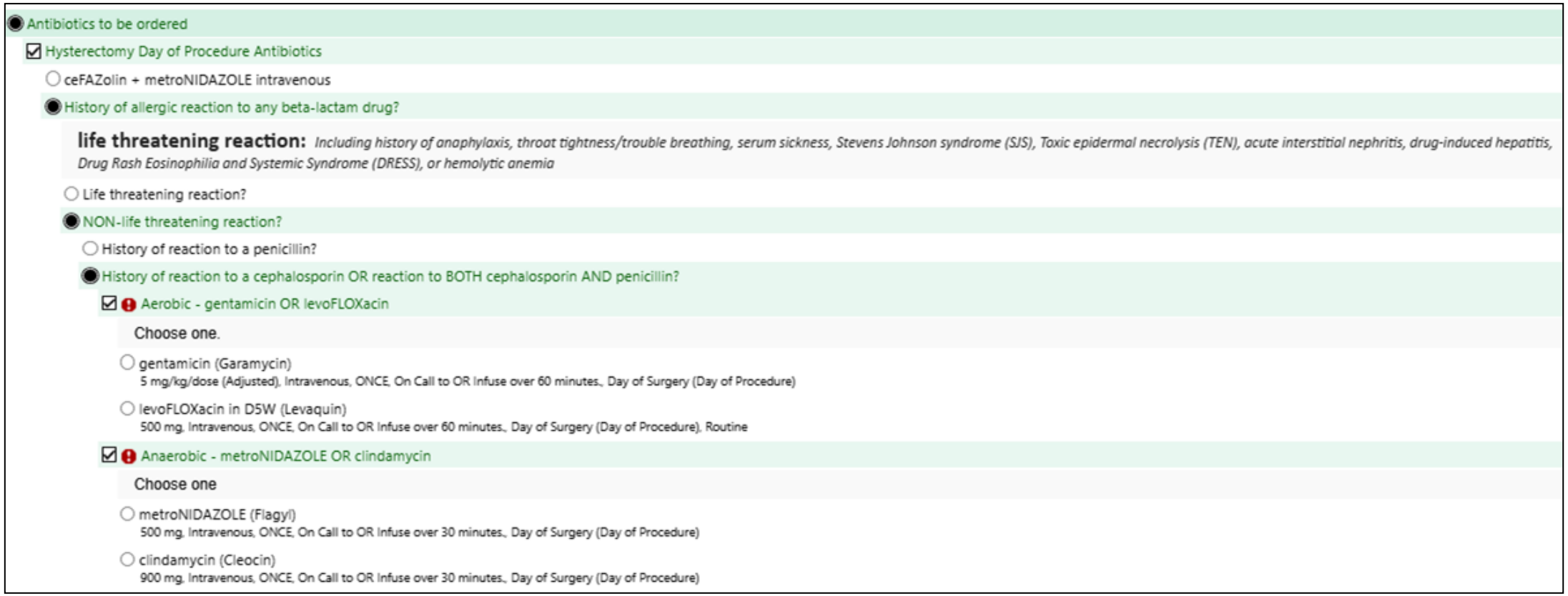


Workgroup & Presentation Forums

Forum	Type	Date
Antimicrobial stewardship committee	System	2/2026
SSI prevention task force	Local	3/2026
Peri-operative quality council	Local	4/2026
Surgical efficiency and quality group	Affiliate	5/2026
Antimicrobial drug and practice specialty panel (of the system pharmacy and therapeutics committee)	System	6/2026

Translating Guidelines into Action

Embed real-time decision support for ordering providers at the point of prescription

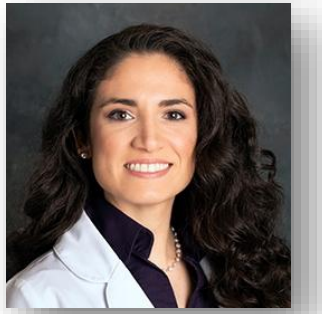


Thank You ☺

Michael Calderwood, MD, MPH

Quality & Safety

Antimicrobial Stewardship



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Rebecca Wang, MD

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Gabriela Andujar Vazquez, MD

Infection Prevention

Thank You!

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Biography: Bryan Connors, MS, CIH, HEM

Bryan Connors directs Environmental Health & Engineering's (EH&E) healthcare practice, which specializes in physical environment-related infection prevention, Joint Commission Environment of Care compliance, and environmental health and safety program management. Bryan is a Certified Industrial Hygienist who has spent his career in healthcare as a direct hospital employee/Industrial Hygienist and consultant for over 25 years. He has led numerous investigations of infection outbreaks and developed proactive programs related to air and water quality matters, working closely with facilities and infection prevention teams.

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Applying ASHRAE Guideline 43 to Empower IPs to Strengthen Ventilation-Based Infection Prevention

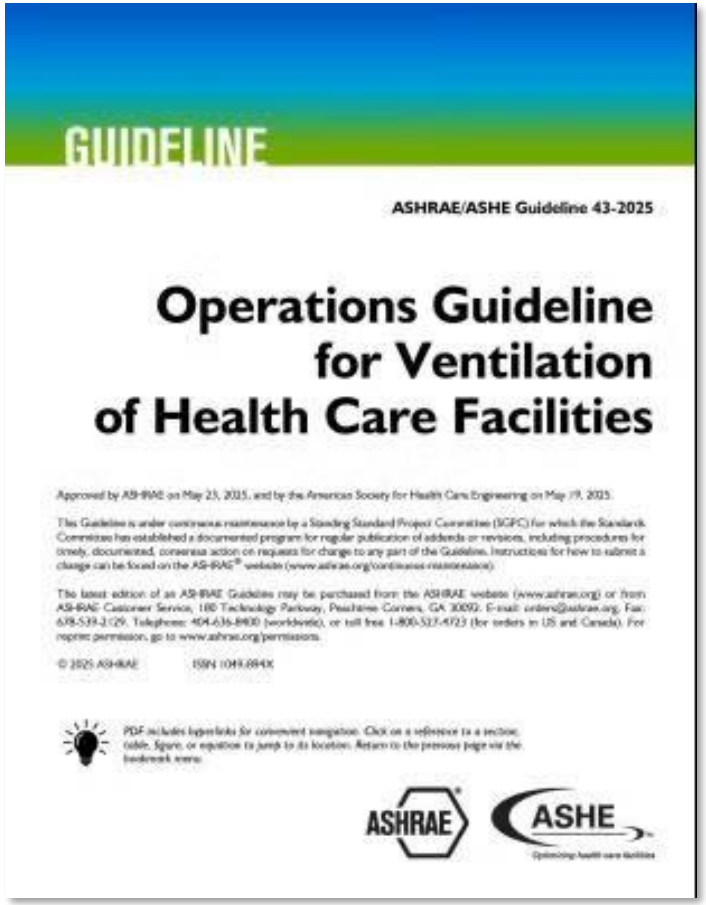
May 1, 2026

Bryan Connors, M.S., CIH, Managing Principal Consultant, Healthcare, EH&E

Environmental Health & Engineering

What is ASHRAE/ASHE 43?

- Operations Guideline for Ventilation of Health Care Facilities
- Provides clear instructions on operation and maintenance of healthcare facility ventilation systems
  - Acceptable ranges for specific parameters
  - Requires written ventilation management plan (VMP)
- Released July 2025
- Guideline, not a code or regulation



ASHRAE/ASHE 43 Fills Longstanding Compliance Gap

ASHRAE 170, Ventilation of Health Care Facilities

- Design standard – not intended to be an operational guideline
  - JC/CMS have treated it as such regardless!
- Historically used to guide operation of HVAC in healthcare
  - Required by CMS – 2008 edition (or version in place at time of design/construction)
- No insight on managing excursions from temperature, humidity, or relative pressure requirements
- No guidance on monitoring for excursions

What is a Ventilation Management Plan?

- Comprehensive management document
- Guidelines on inspection and maintenance activities
  - Based on manufacturer's requirements, infrastructure capabilities, and risk ranking
- Clarity on addressing unexpected ventilation excursions
  - Internal policies and procedures to address temperature, rH, or pressure excursions

Developing your Ventilation Management Plan

1. Identify Stakeholders
   - Multi-disciplinary – should go beyond Facilities/Engineering
   - Infection Prevention/Control
   - Other key stakeholders
     - Surgical Services
     - Transplant
     - Oncology
   - Consider creating a Ventilation Management Committee
     - Combine with water management committee?

Developing your Ventilation Management Plan

2. Assess Systems and Spaces
   - What spaces require special temperature, humidity, relative pressure?
   - Do you have an inventory?
   - Is it reviewed regularly?
   - Consider NFPA 99 systems ranking (Categories 1-4)

Key Decisions in Step 2

Must Identify:

- ❑ Critical vs. non-critical spaces
- ❑ Function/level of risk for each space with a requirement
- ❑ Specific temp/rH/pressure requirements
- ❑ Applicable version of code
- ❑ Frequency of monitoring

Developing your Ventilation Management Plan

3. Develop the Plan
   - Define maintenance intervals (as needed)
     - Encourages the use of reliability-centered maintenance practices to optimize system performance and resource use (where allowed by code)
   - Schedule for measuring/monitoring temperature/rH/pressure
   - Outline excursion response plans
     - Planned and unplanned excursions
     - Time-based
     - Risk-based

Developing your Ventilation Management Plan

4. Establish Policies
    - Based on response plans
    - Educate staff

Essential Information for a Model VMP Program

Compliance Reference

- Year of Design (for every space)
- Use of Most Current Standard applicable to your newest area of the hospital for all areas
- Use of Most Current Standard

Monitoring

- Parameters to be monitored
- Frequency of monitoring
- Risk-Based Frequency

Excursion Management

- What response will occur with an excursion?
- Risk-based where some excursion for some limit of time result in increase monitoring
- When to close spaces

Maintenance

- Manufacturer recommendations
- Reliability-centered maintenance

Regulatory Implications

Joint Commission – Previous Standard

- EC.02.05.01 Risks Associated with Utility Systems
- EP 15: In critical care areas designed to control airborne contaminants (such as biological agents, gases, fumes, dust), the ventilation system provides appropriate pressure relationships, air-exchange rates, filtration efficiencies, temperature and humidity.
  - ORs, Protective Environment Rooms (positive); Airborne Infection Isolation Rooms (negative)
  - Form and function of assessment per hospital policy
- EP 16: In non–critical care areas, the ventilation system provides required pressure relationships, temperature, and humidity.
  - Note: Examples of non-critical care areas are general care nursing units; clean and soiled utility rooms in acute care areas; laboratories, pharmacies, diagnostic and treatment areas, food preparation areas, and other support departments.

Joint Commission – New Standard Jan. 1, 2026

- PE.04.01.01 Building Safety and Facility Management
- EP 3: The hospital has proper ventilation, lighting, and temperature control in all pharmaceutical, patient care, and food preparation areas

Use Case Scenarios for a VMP

Planned OR Temperature Excursions

- Expectation that OR temperature range is 68°F – 75°F and rH is <60%
- Humidity and pressure must stay within range/expected values
- Temperature excursions are allowed but **cannot** be blanket allowances
  - ASHRAE table specifies allowances to go outside required range
  - Must:
    - Have an established organizational policy
    - Be on a case-by-case basis
    - Be restored to normal ranges following the procedures (based on either surgeon, patient or procedure)
- Testing and Balancing reports requested/reviewed

Operating Room Temperature Excursions

- Ventilation Management Plan
- Work with OR leadership, IP/IC experts to determine parameters and processes for requesting an excursion
- Document, document, document!
  - Document process within the VMP
  - Each request for an excursion must be documented

Different Codes and Standards

- Many hospitals have built areas of their hospitals under different versions of ventilation codes
- Only required to meet the requirements of the code at the time of construction. But this can be confusing for some areas; you want to protect the patients regardless, and some work is required to document and assess risk
- One hospital had 6 different versions of the FGI/AIA/ASHRAE 170 guidelines applicable to their hospital. Decision included:
  - Important differences include AII anteroom pressure differences, Endoscopy pressure, humidity requirements, and OR air exchanges
  - Client did not try to/could not achieve the increased air exchange rates
  - Some relative pressure requirements were taken from the newer version of the code for standardization/patient protection
  - Risk assess and document in VMP

Case Studies:
How Adopting ASHRAE 43 Can Strengthen Your Infection Prevention Program

Case Study 1: Unplanned Relative Humidity Excursion

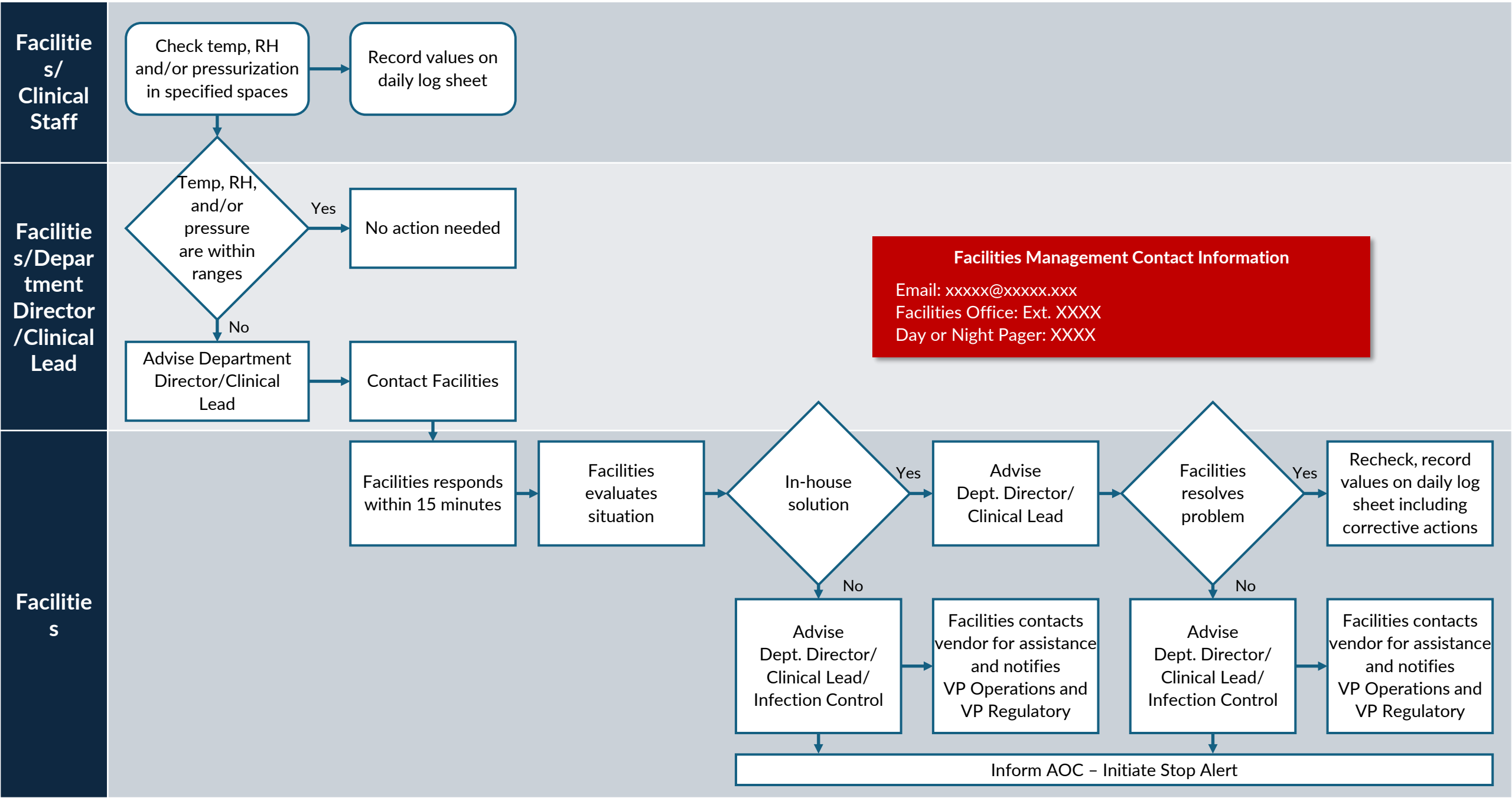
Background

- Relative humidity exceeded FGI guidelines during the day for 3 days in mid-summer
- Temporary measures were taken; however, non-compliance continued.
- Disagreement among leaders on the correct actions to take
  - Some leaders thought the supplies had to be disposed of (thousands of dollars)
  - No clear guidelines in ASHRAE 170

Outcome

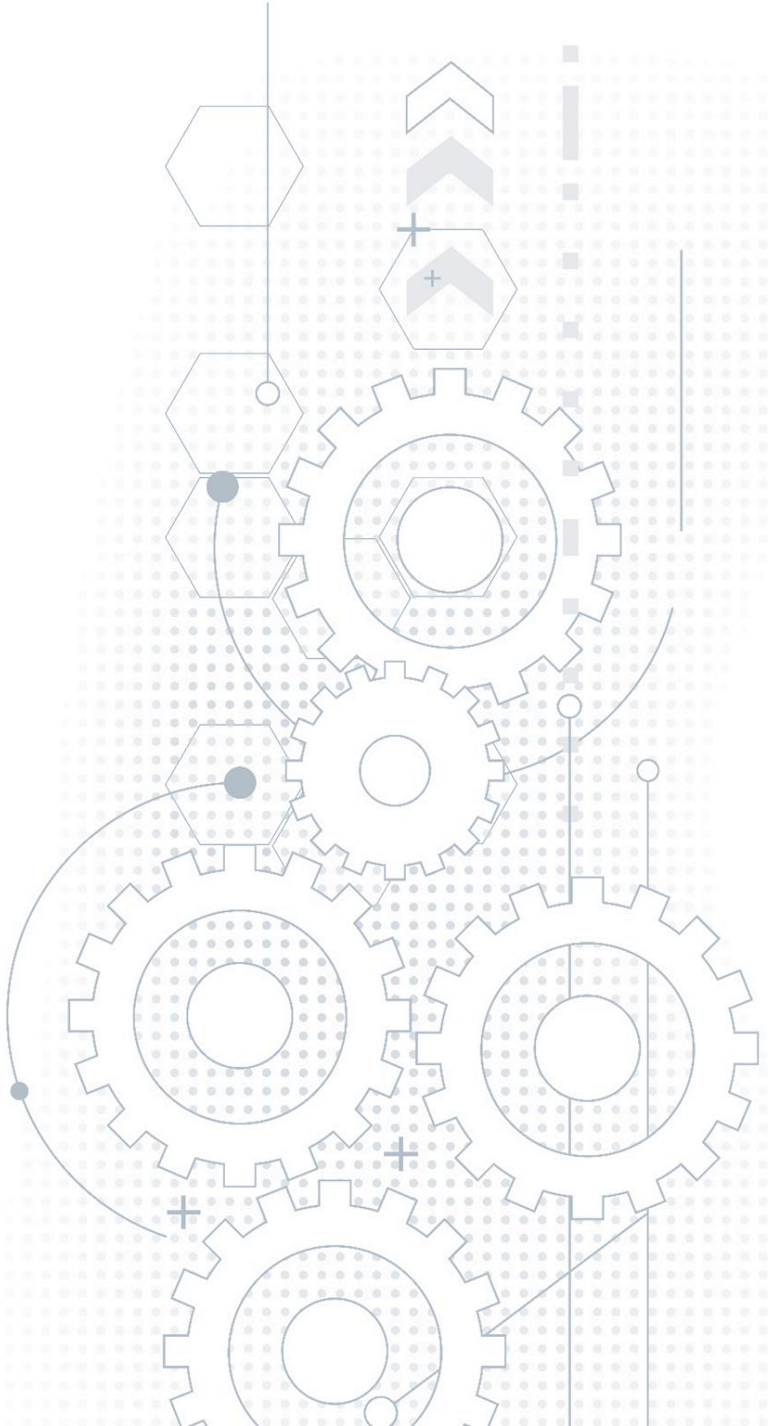
- Issue resolved due to weather change but client wanted a plan implemented for future
  - EH&E designed a surveillance and risk assessment program
  - A clear policy and decision algorithm was developed to document how these issues would be addressed going forward

Critical Area Temperature, Relative Humidity (RH) or Pressurization Alert Algorithm



Case Study 1: How a VMP Would Have Improved Response

- Response is not delayed while a plan is developed in the “heat of the moment”
- VMP includes a planned excursion response that enables a more rapid, smooth response
- Correct actions would have been previously agreed to by all stakeholders and documented
- Eliminate disagreements among leaders



Why a VMP May Be Even More Needed in the Future

According to Climate Central, Columbia University research found climate change is increasing the number of extreme humid heat days. In most regions, humid heat extremes have already doubled in frequency since 1980.

Parts of New England have increased by 2.5 times.

https://www.climatecentral.org/climate-matters/humid-heat-extremes-on-the-rise

https://news.climate.columbia.edu/2020/05/08/fatal-heat-humidity-emerging/?shareadraft=baba77757_5e8c736da48a5

Case Study 2: Relative Pressure Monitoring Gap

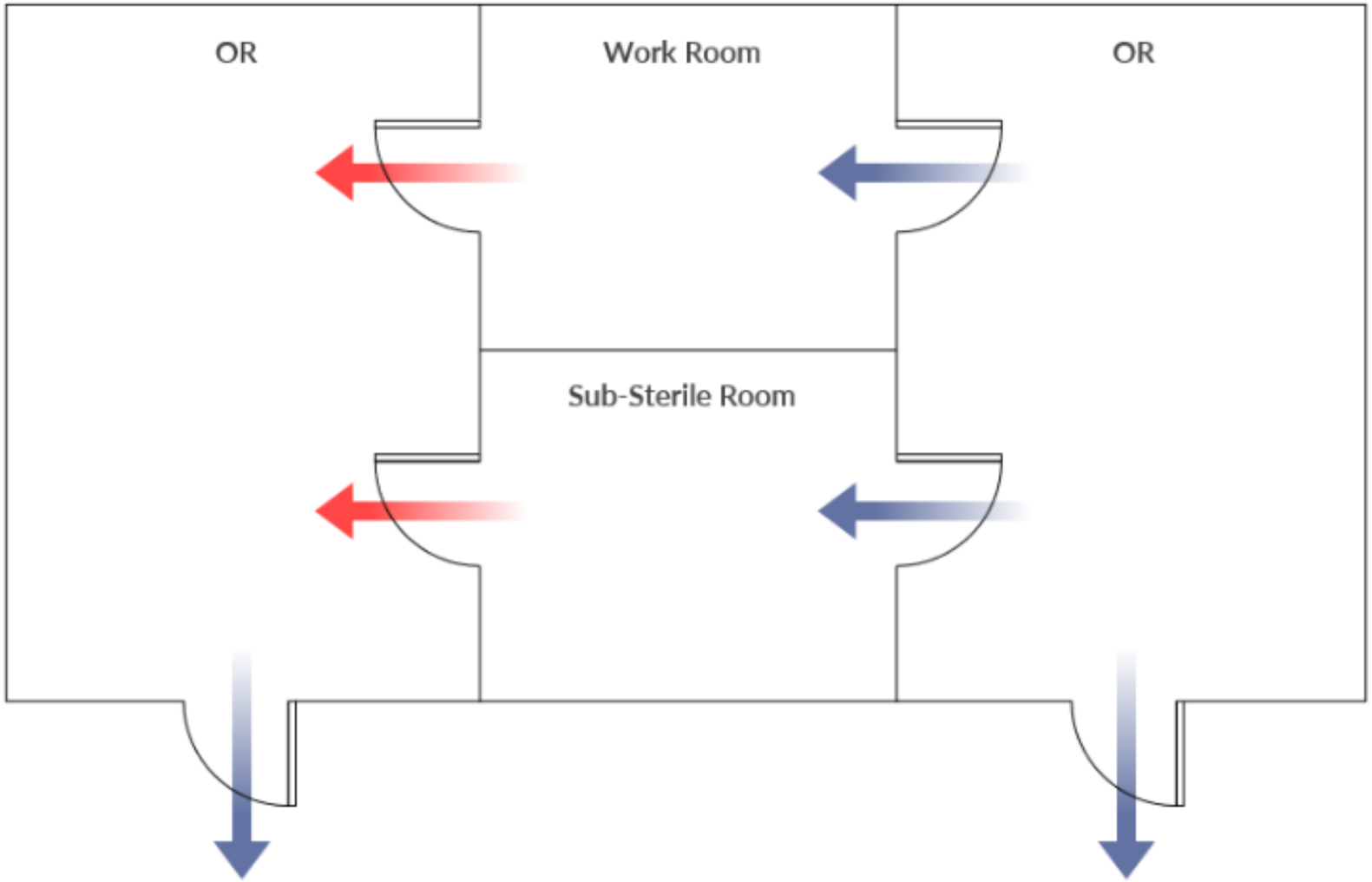
Background

- Bacterial infections in one OR lead to physical environment assessment
- Laminar airflow design
- Prior assessment observed issues with downflow velocity
- Pressurization was found out of compliance/design specification from sub-sterile room

Outcome

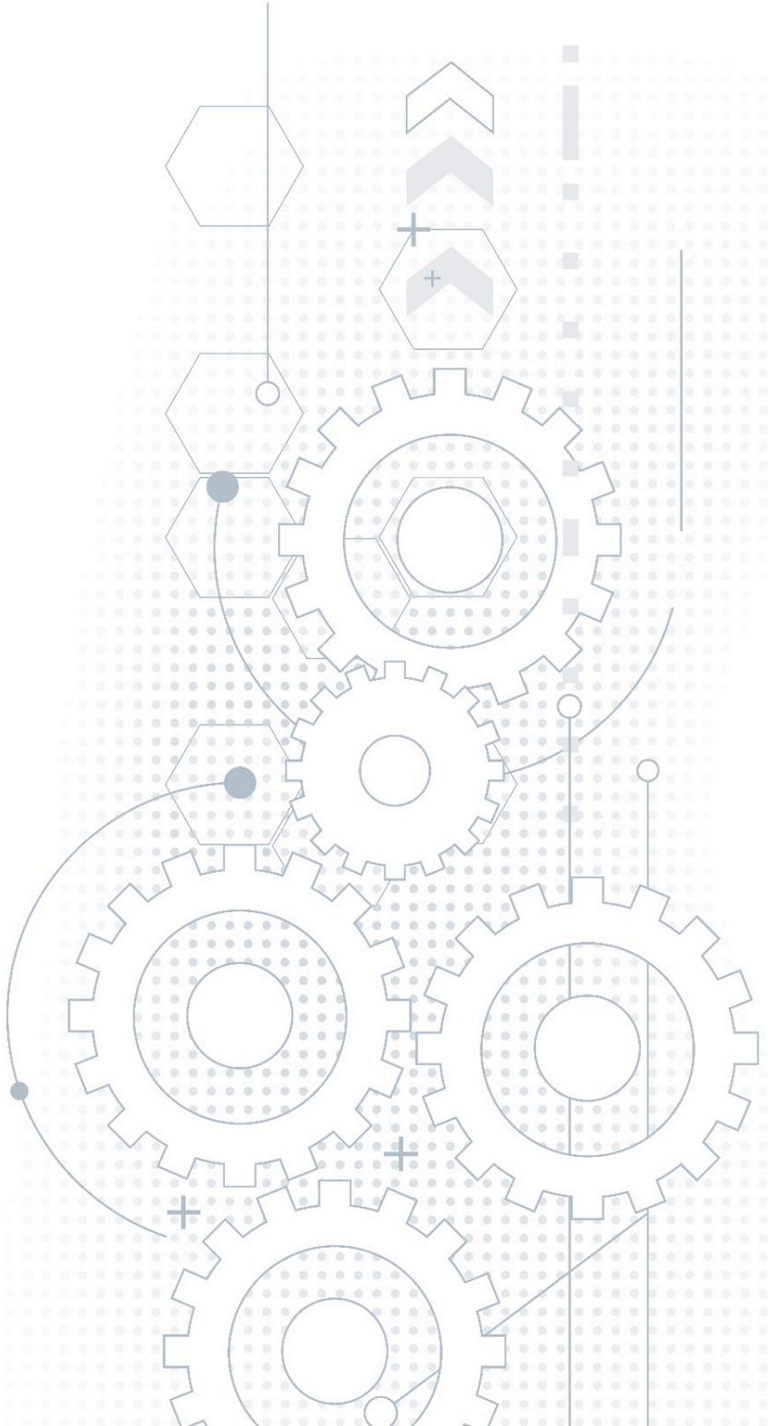
- Change monitoring procedure to reflect adjacencies

Investigation



Case Study 2: How a VMP Would Have Improved Response

- Clarity on which areas get assessed for pressure
  - Though a pressure sensor is not required on all doors, it can be part of a periodic assessment of high-risk spaces
- Team knowledge is a key element of VMP including with clinical users



Wrap-up

Benefits from an Infection Prevention Perspective

Improved Reliability

Enhanced Infection Prevention

Standardized Practices

Excursion Management

From a Regulatory Vantage Point

- ASHRAE 43 is a guideline – compliance is not required, but there are strong benefits to adoption
  - Documentation of risk assessments/procedures for planned excursions
  - Creation of process for unplanned excursions
- Unknown future adoption by Authorities Having Jurisdiction
  - Still must maintain compliance with FGI/ASHRAE 170
  - Any deviation must be documented
    - Excursions or other design standards
- Make sure staff can speak to plans/procedures

ASHRAE 43 Provides Clarity on Healthcare Ventilation Management

Bryan Connors, M.S., CIH
Managing Principal Consultant, Healthcare
bconnors@eheinc.com
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Environmental
Health & Engineering

eheinc.com
800-825-5343

Thank You!

APIC NEW ENGLAND

Biography: Scott Roberts, MD

Scott Roberts trained at the Albert Einstein College of Medicine in Bronx NY, completed his internal medicine training at the University of Michigan, Ann Arbor, and his infectious diseases training at Northwestern Memorial Hospital, Chicago IL. He started as an Assistant Professor in Infectious Diseases at the Yale School of Medicine in 2020, where he also has an administrative role as the Associate Medical Director, Infection Prevention, Yale New Haven Hospital.

APIC NEW ENGLAND

Measles

Scott C Roberts, MD, MS

May 01, 2026

Assistant Professor, Infectious Diseases

Associate Medical Director, Infection Prevention

Yale School of Medicine | Yale New Haven Health

scott.c.roberts@yale.edu

Yale Medicine | Yale NewHaven Health

Disclosures

Shionogi – advisory board, COVID-19 antivirals

Pfizer – advisory board, COVID-19 antivirals

Learning objectives

Learn the core concepts of preventing measles in healthcare

Recognize the methods for identifying and diagnosing measles infection

Understand the impact of measles and future strategies to prevent spread

Case

Yale Medicine | Yale NewHaven Health

Case

9 year old boy presents to the ED

- Fever (T max 104) x 6 days
- Day prior to the ED he developed a rash on his cheeks that spread to the neck and trunk
- Also with cough, rhinorrhea, decreased oral intake, and lethargy
- Denies sore throat, shortness of breath, diarrhea
- ROS: lethargy, decreased oral intake

Case

Exam:

Vitals: T 99.7, P 123, BP 97/67, R 18, O2 99% RA

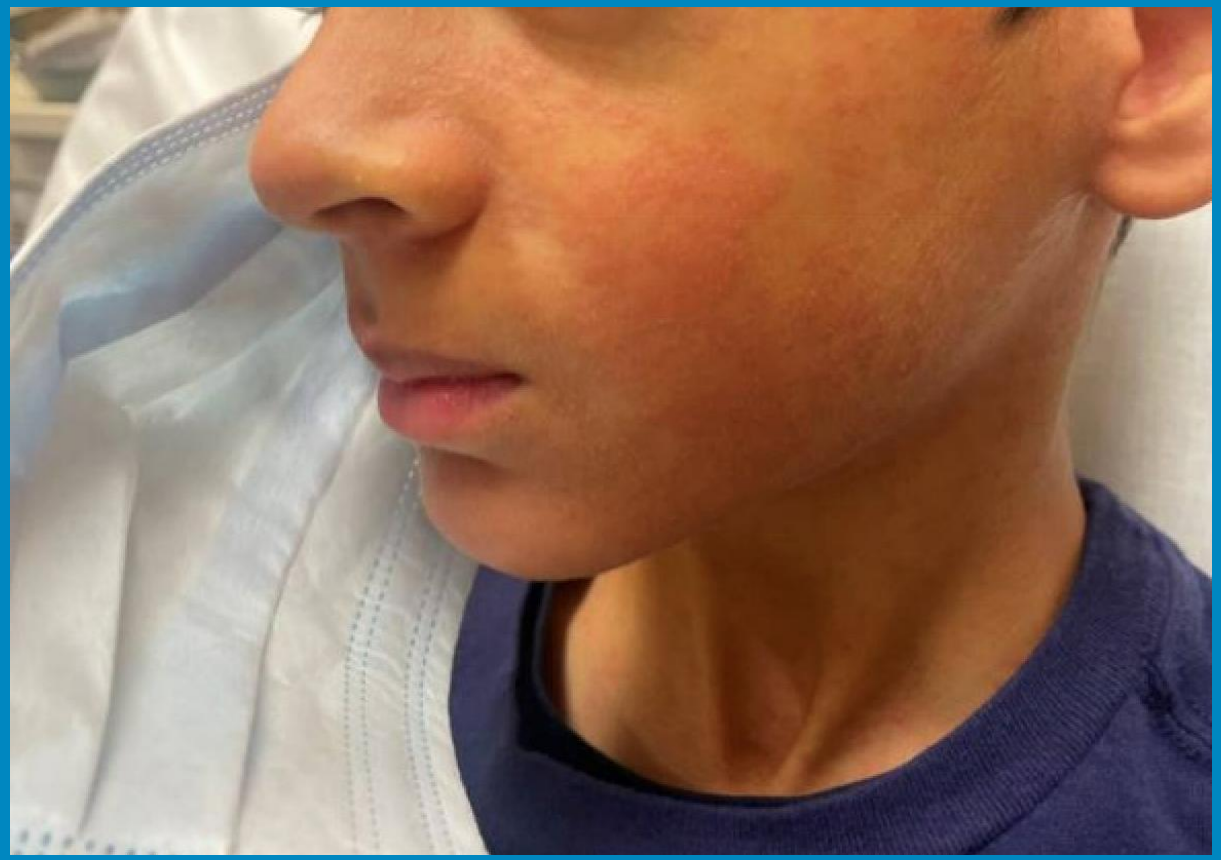
Gen: no distress, conversant

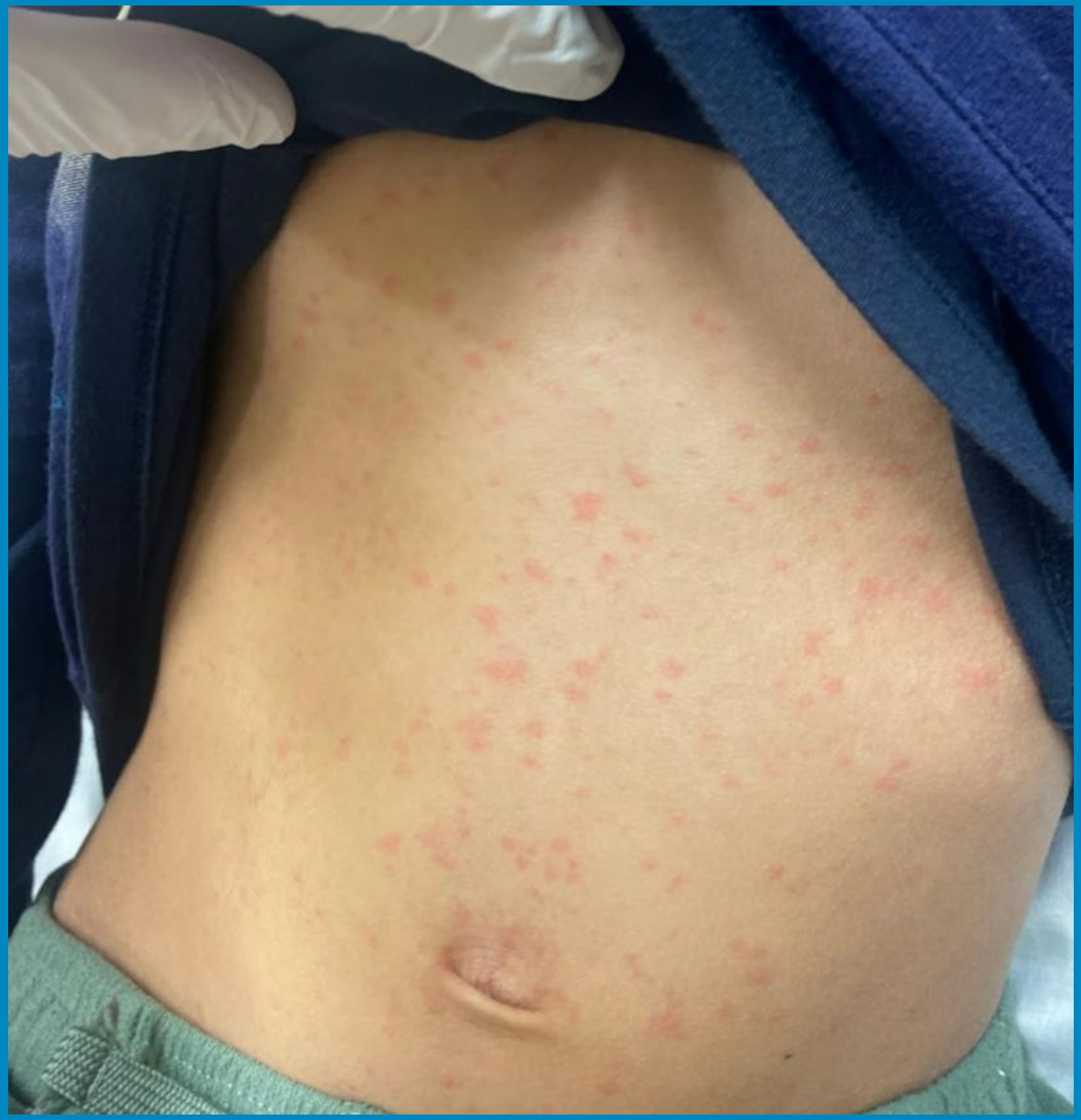
HEENT: congestion and rhinorrhea present, mucous membranes dry

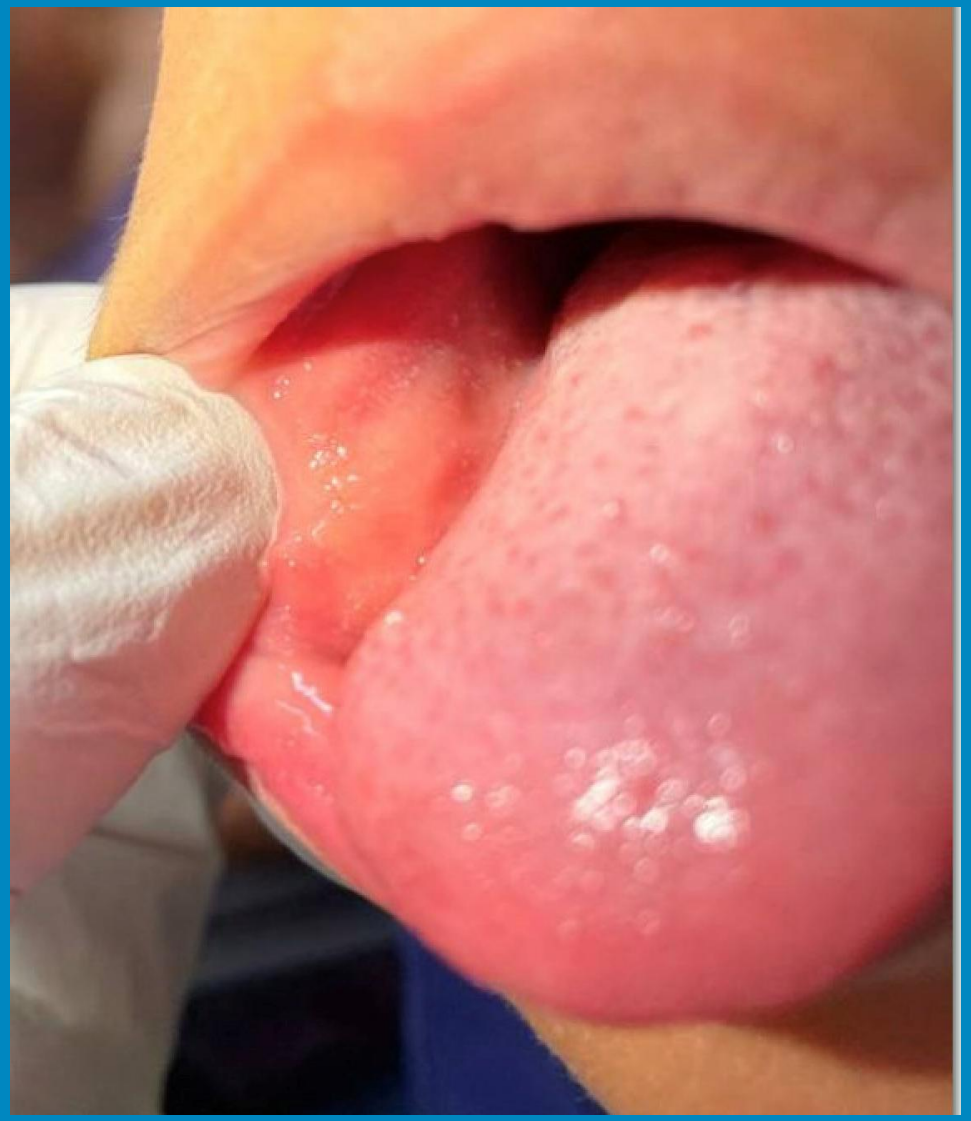
CV: regular rate and rhythm, no murmurs, rubs, or gallops

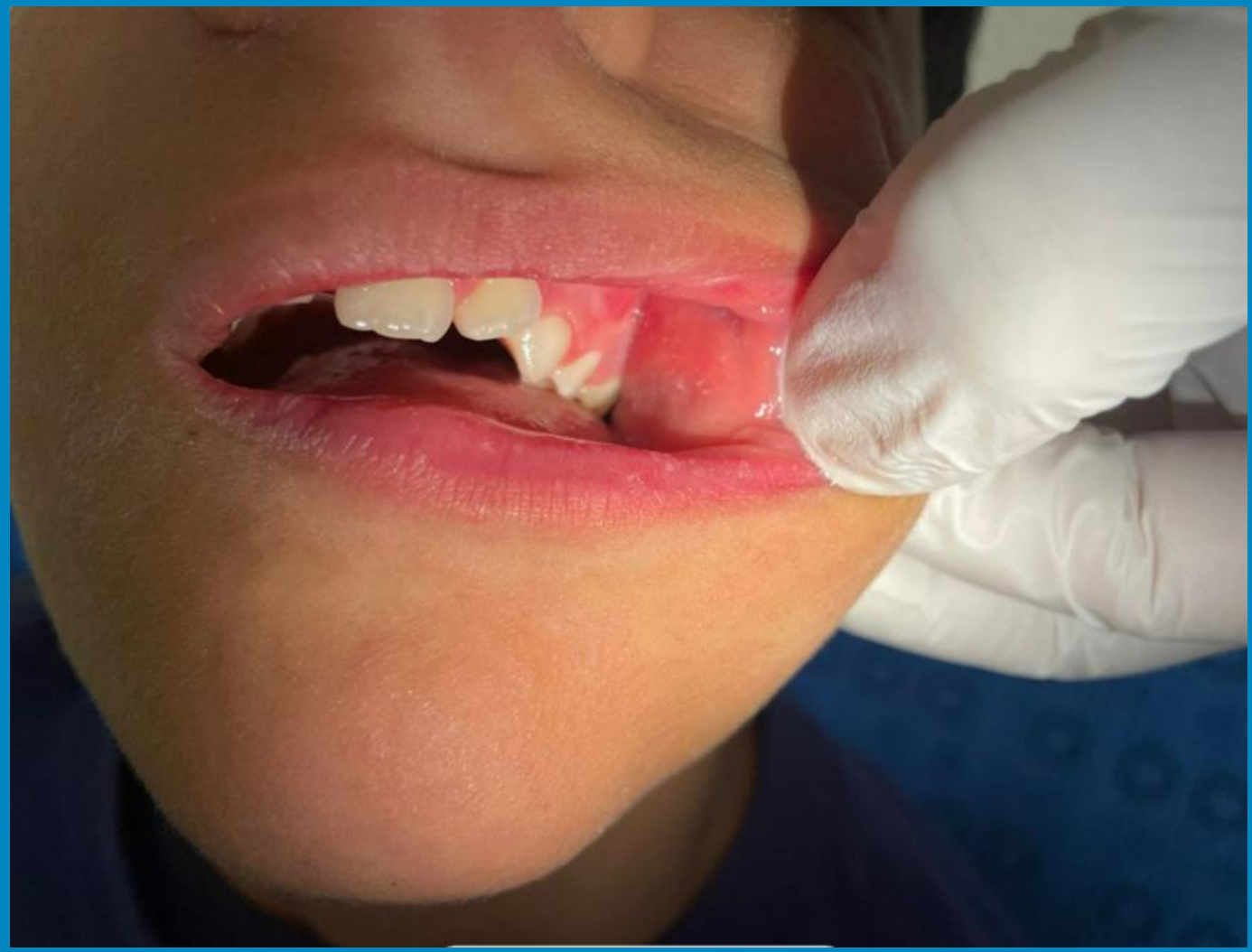
Pulmonary: clear to auscultation bilaterally, no wheezes, rales, or rhonchi

Extremities: no edema, morbilliform erythematous rash involving face, neck, trunk, and upper extremities









Next steps?

- Anything else you want to know?
  - Recent travel to Mexico two weeks ago
  - He is partially up to date on his childhood vaccines and has never received MMR
  - No direct exposure to anyone with measles
  - Everyone else in the family (including siblings) are well

Conduction an investigation

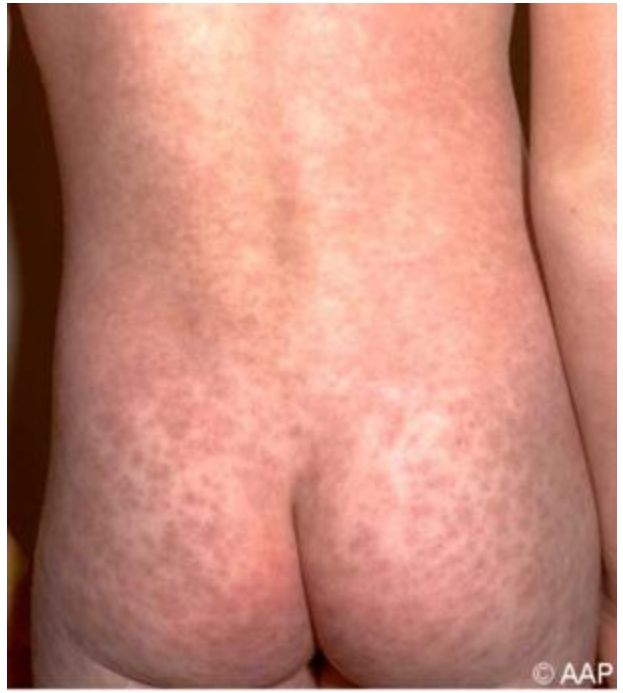
1) Prepare
2) **Confirm the diagnosis**
3) Determine existence of outbreak
4) Identify (case definition) and count cases
5) Tabulate data, person, place, and time
6) Immediate control measures
7) Develop and test hypothesis
8) Systemic study of outbreak
9) Implement and evaluate control and prevention measures
10) Communicate

<u>High impact pathogen</u>

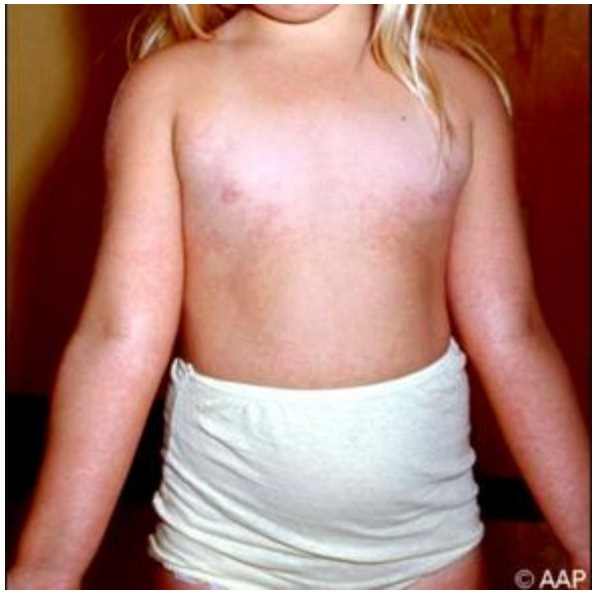
1) **Identify**
2) Isolate
3) Inform

https://www.cdc.gov/field-epi-manual/php/chapters/field-investigation.html

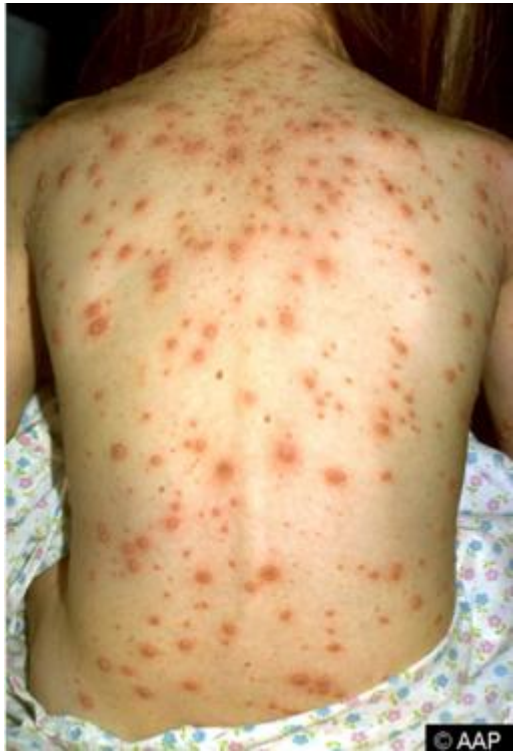
Fever and rash 2019- The viral exanthem



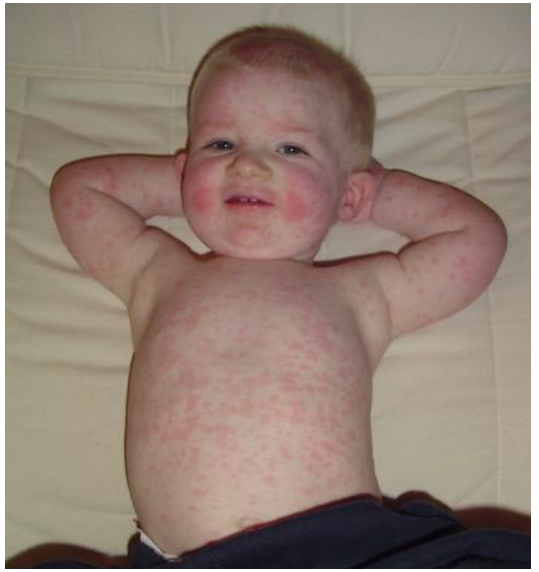
EBV after amoxicillin



Parvovirus B19



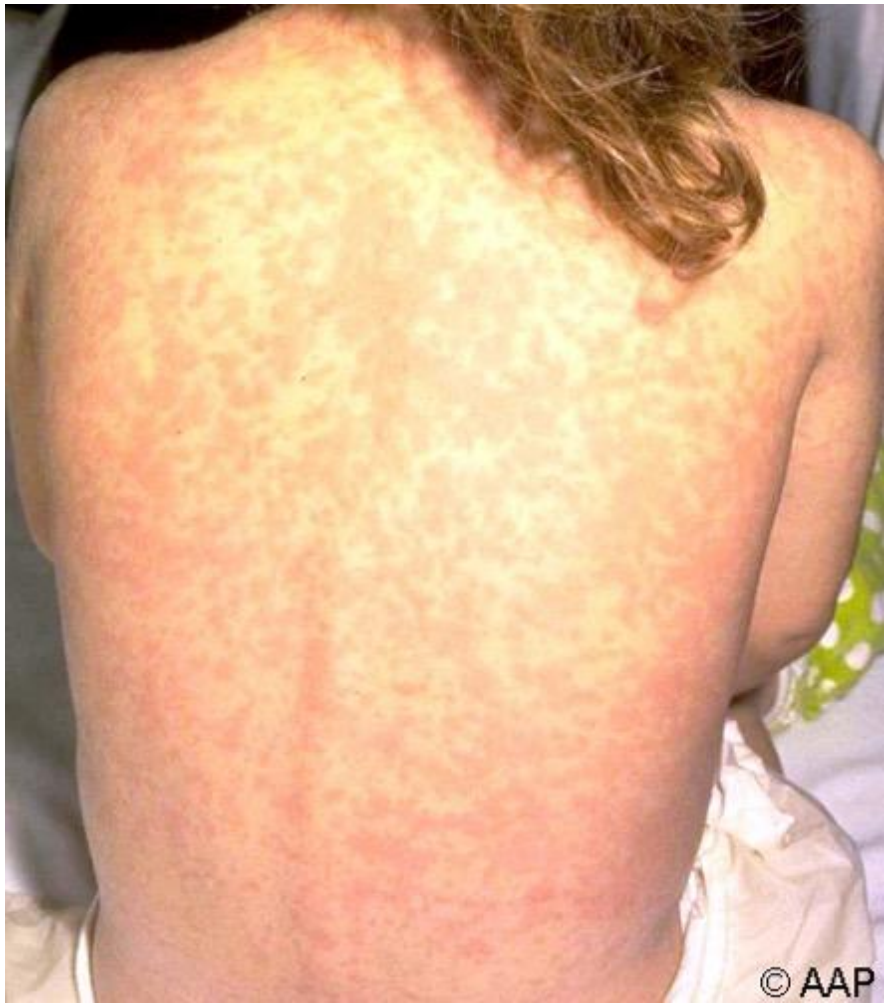
Varicella- chicken pox



Parvovirus B19

HHV-6 (roseola, sixth disease)
Enterovirus
Adenovirus
Antibiotic sensitivity reactions, allergies

What's old is new: Fever and rash 2025- expanding the differential dx



Red book 2018

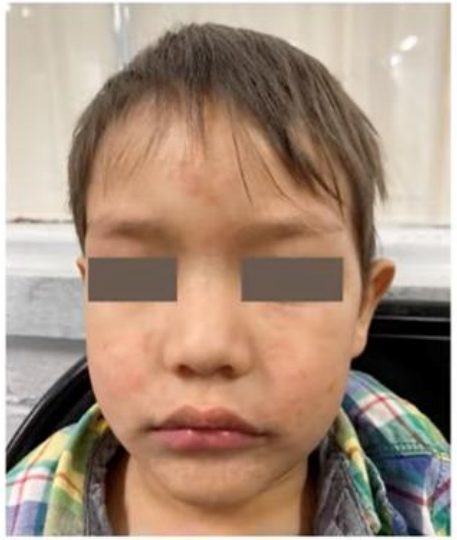
Giant microbes

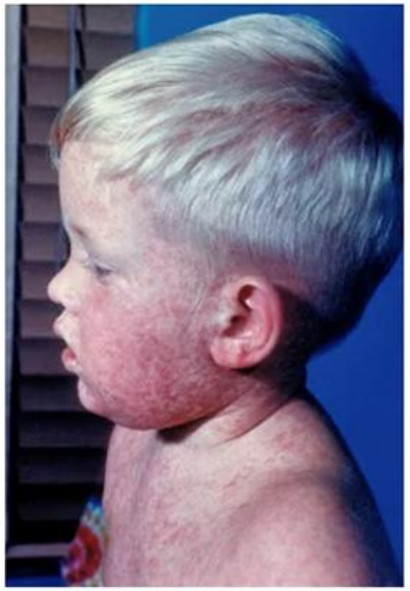
ED differential:

- Measles
- Kawasaki disease
- Parvo B19 (erythema infectiosum)
- Streptococcal pharyngitis
- Other viral exanthem (hand, foot, and mouth)

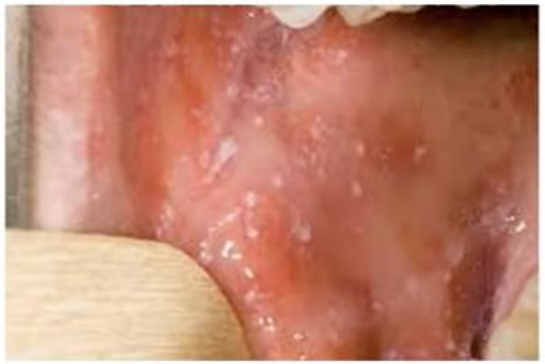
Measles Rash

- Typical presentation:
  - Starts on face, at hairline, or behind ears
  - Spreads downwards to neck, trunk, extremities
  - Maculopapular
    - Small raised or flat bumps
    - Spots may join together as the rash spreads
  - Not usually itchy
  - Koplik spots may be present on buccal mucosa





Measles rash



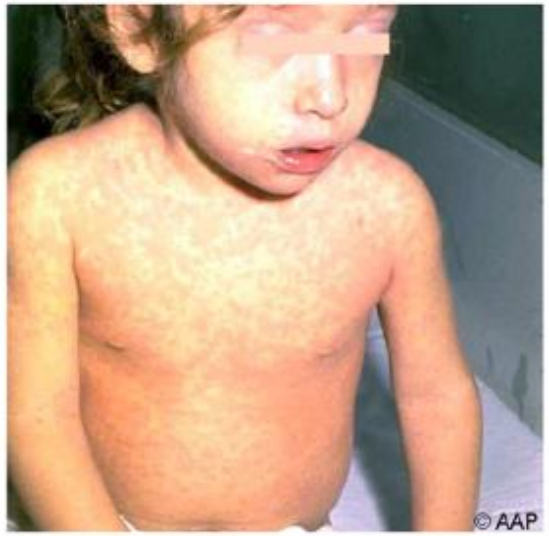
Koplik Spots

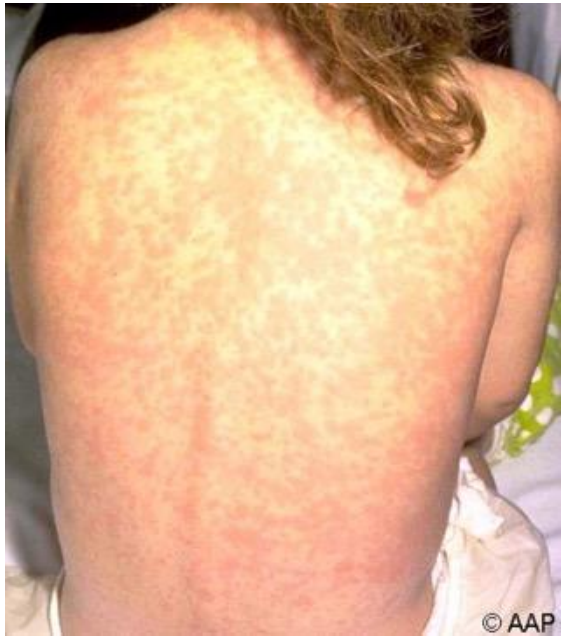
https://www.nhs.uk/conditions/measles

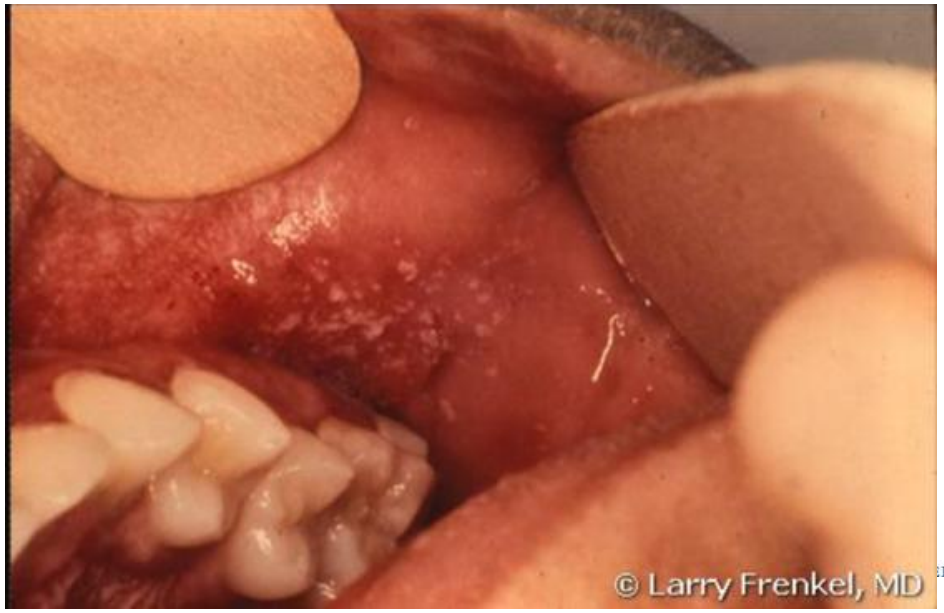
Measles symptoms typically include:

- ❑ High fever
- ❑ Runny nose
- ❑ Red, watery eyes
- ❑ Rash that breaks out 3-5 days after symptoms begin
- ❑ The 3 C': cough, coryza, conjunctivitis

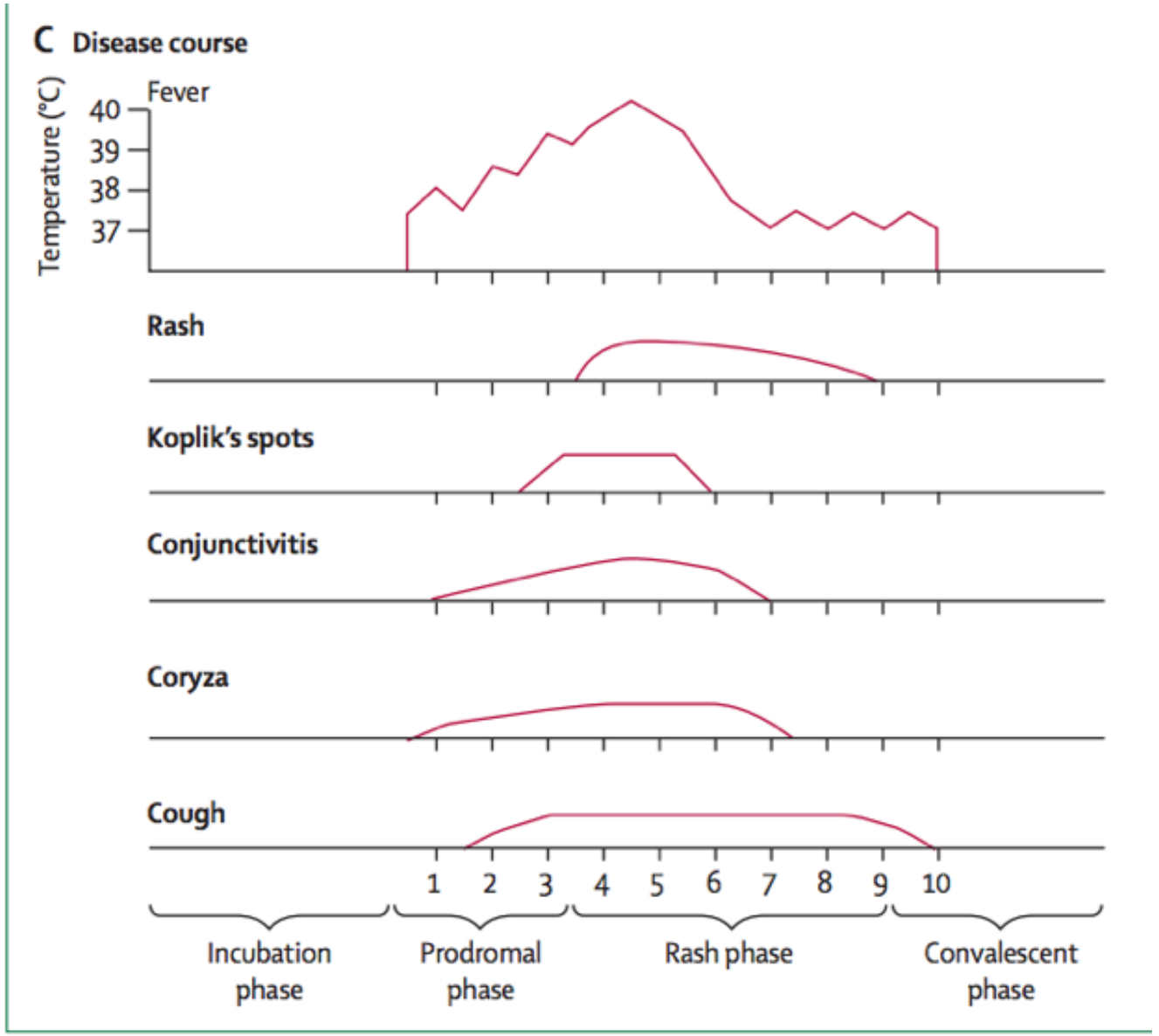
If high index of suspicion of measles, isolate and notify provider.*







Red book 2018



Establish the diagnosis

1) Must be a susceptible patient (there has been disease in previously vaccinated older patients)
2) Compatible clinical syndrome - 3 C's, rash
3) Laboratory confirmation of disease

Serology?

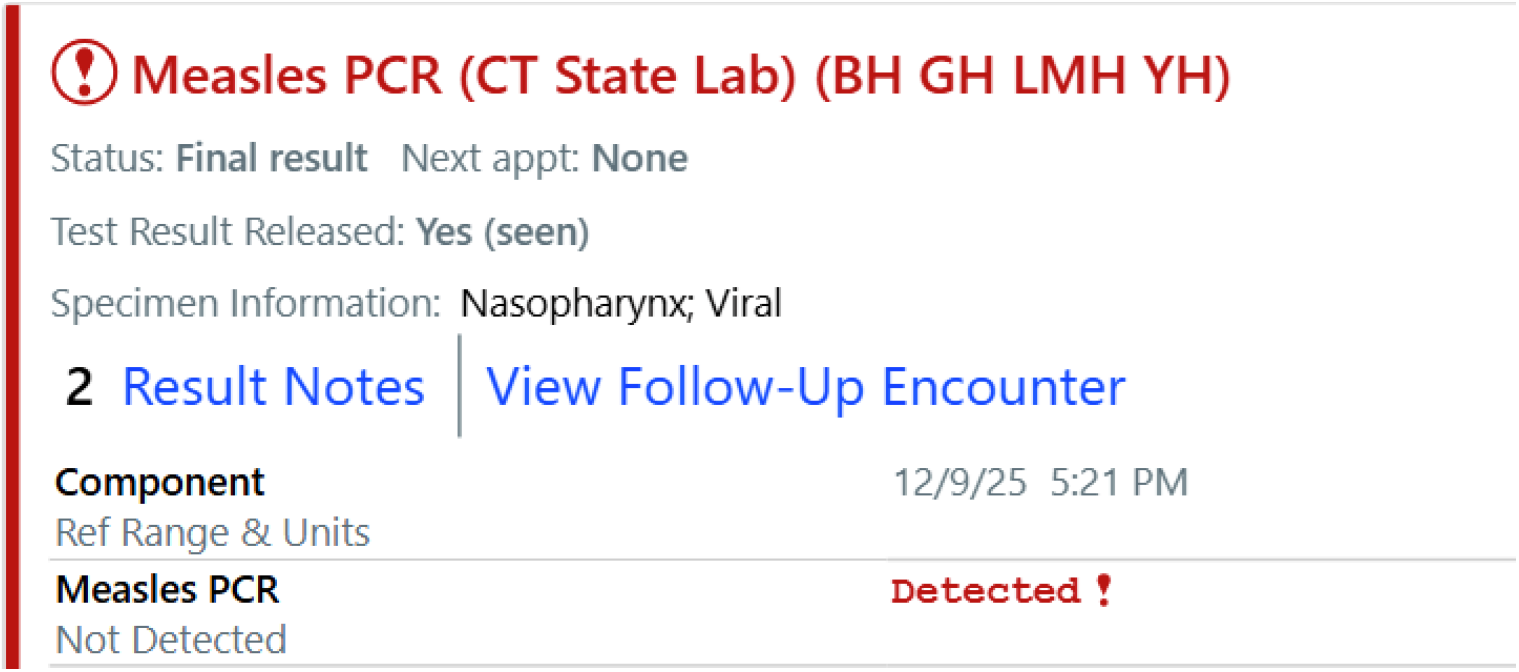
- Commercial IgM not reliable
- IgG for immunity
- Seroconversion can be helpful

How to test? Approval for state lab testing

Nasopharyngeal swab is DPH test of choice

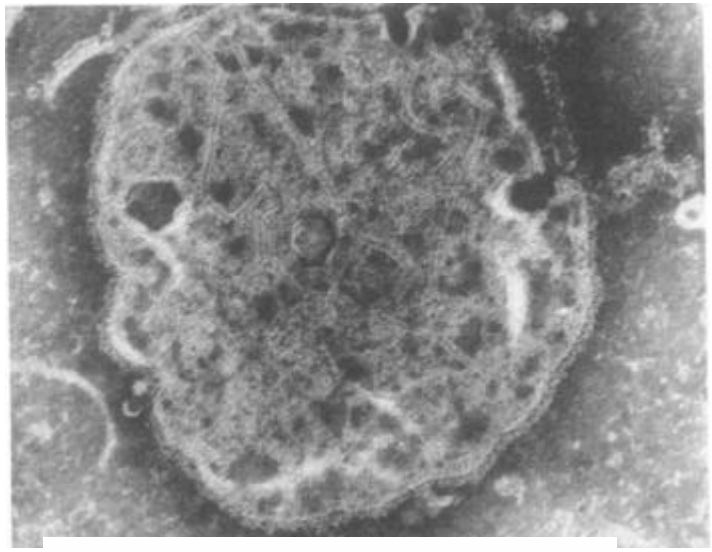
Investigation

- Patient is discharged home with instructions to isolate
- What now?
  - For the patient?

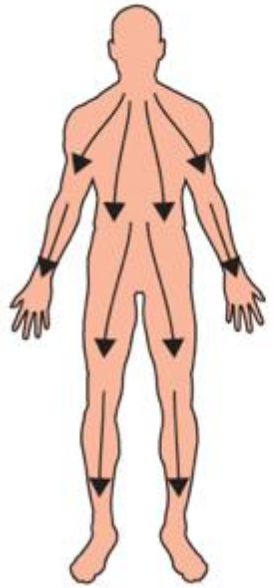


The virus

- Single stranded RNA paramyxoviridae family, Morbilliform genus
- **Only 1 serotype**, humans are the only host



JOURNAL OF VIROLOGY, Feb. 1969, p. 187–197



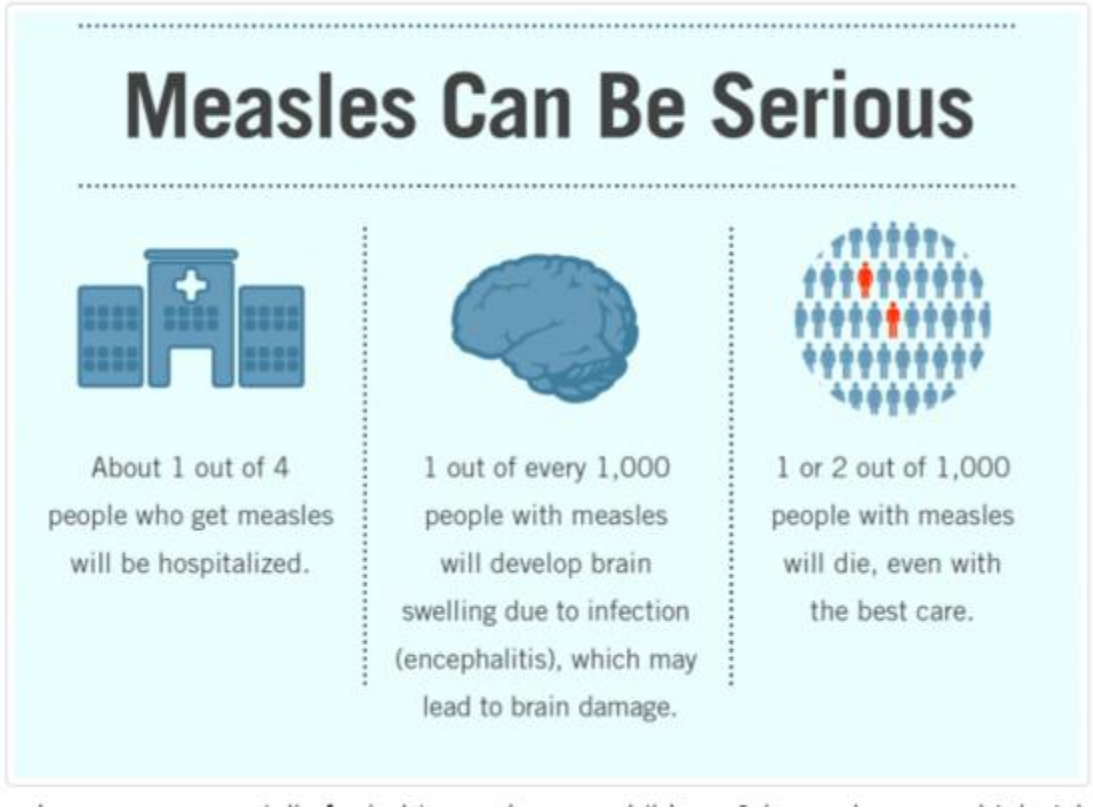
Measles virus spreads first to local lymphoid tissue and is then disseminated throughout the blood stream through infected lymphocytes, infecting cells in almost all organ systems

The incubation period for measles is 12·5 days on average (95% CI 11·8–13·2 days), with a range up to 23 days

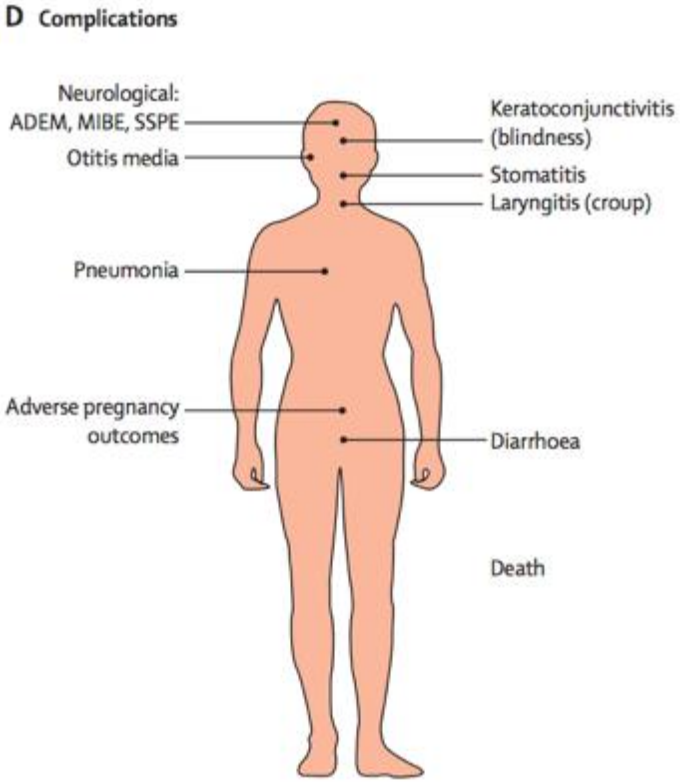
Lancet 2017; 390: 2490–502

- Infects lymphoid tissue and lymphocytes
- Spreads via blood stream

Complications of measles



CDC



Lancet 2017; 390: 2490–502

People at High Risk for Complications

People at high risk for severe illness and complications from measles include:

- Infants and children aged <5 years
- Adults aged >20 years
- Pregnant women
- People with compromised immune systems, such as from leukemia and HIV infection

Important in thinking about prevention in the outbreak setting

www.cdc.gov/measles/hcp/index.html

Subacute Sclerosing Panencephalitis (SSPE)

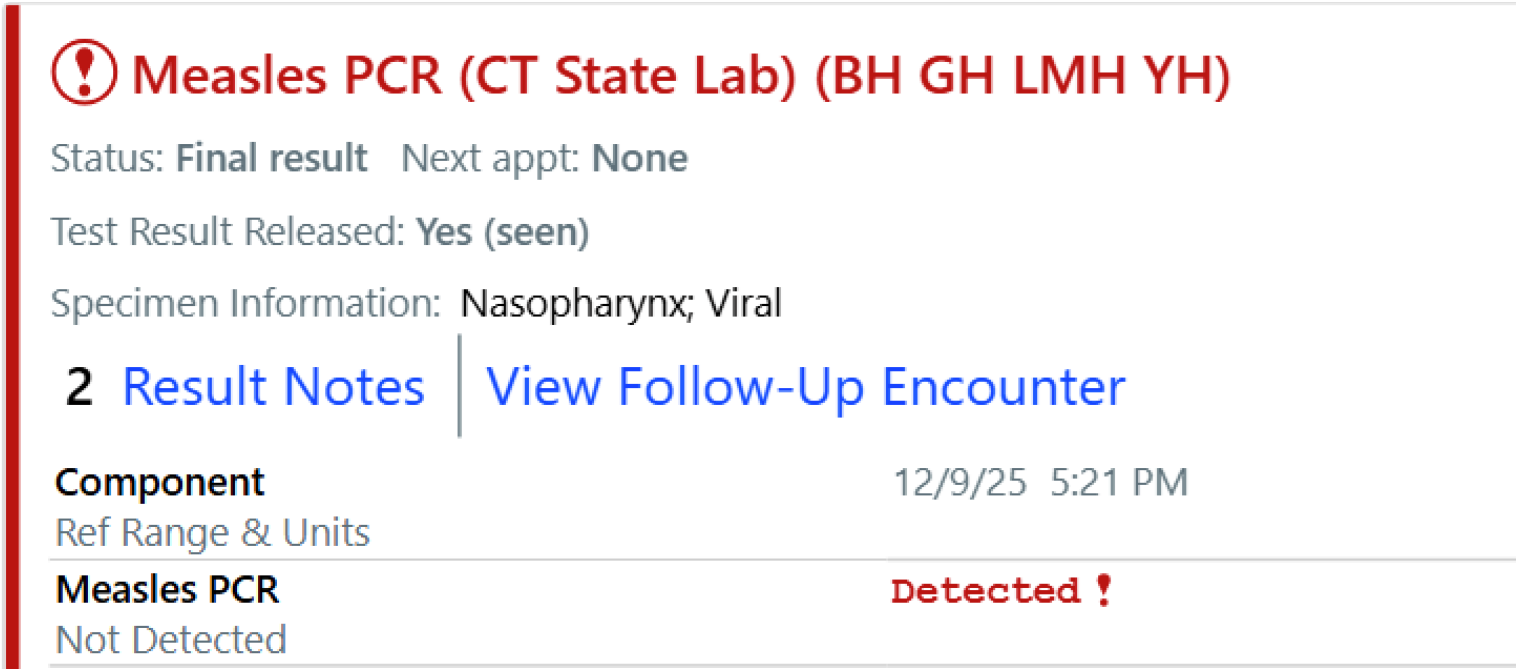
- Rare, but fatal progressive neurologic disease
  - Higher incidence in children who are infected with measles when <2 years old
- Onset on average 7 years after infection, but could present decades after
- Clinical symptoms
  - Initially mild, mental deterioration (memory loss, behavioral changes)
  - Progression to myoclonic seizures, motor disability, and eventually to a persistent vegetative state
  - Death typically occurs within 1–3 years of diagnosis

Measles Treatment

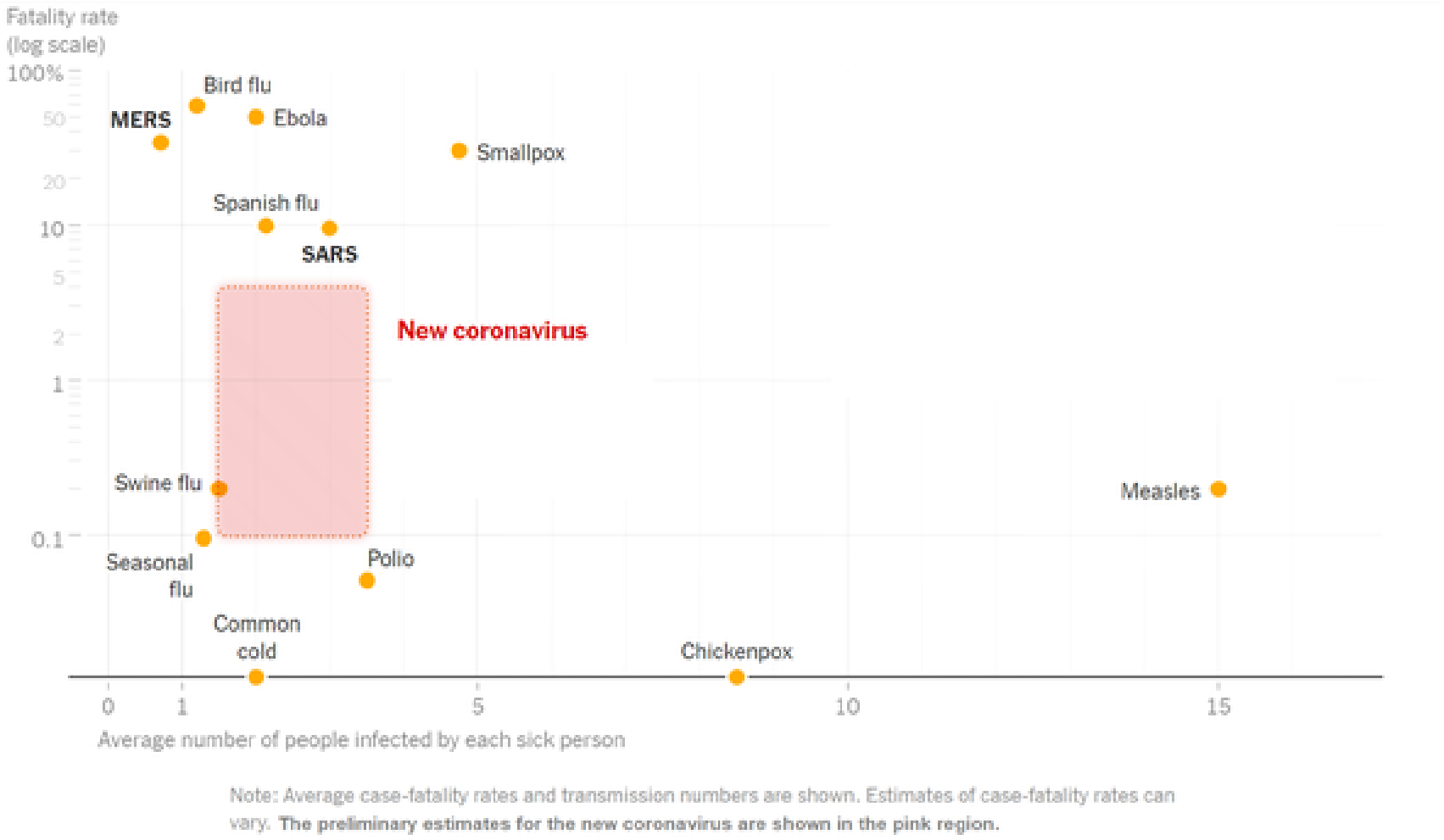
- There is no specific antiviral agent for measles treatment
- CDC recommends vitamin A supplementation for hospitalized children
  - Vitamin A dosing (once daily x2 days):
    - Infants <6 months: 50,000 international units
    - Infants 6 to 12 months: 100,000 international units
    - Children ≥12 months: 200,000 international units
- Measles virus is susceptible to ribavirin in vitro but data on clinical use and efficacy are extremely limited
  - Ribavirin could be considered, in consultation with an infectious disease expert, for patients with severe measles complications or immunocompromised patients

Investigation

- Patient is discharged home with instructions to isolate
- What now?
  - For the patient?
  - For healthcare workers and other patients?



Infectivity



Source: NYTimes

Measles Transmission at a Domestic Terminal Gate in an International Airport — United States, January 2014

Jared S. Vega, JD[1], Miguel Escobedo, MD[1], Cynthia R. Schulte[2], Jennifer B. Rosen, MD[3], Stephanie Schauer, PhD[4], Rachel Wiseman, MPH[5], Susan A. Lippold, MD[1], Joanna J. Regan, MD[1]
(Author affiliations at the end of text)

Patients 1 and 2 traveled on the same flight from the airport and were seated one row apart; both spent time at the departure gate before the flight. Patient 3, whose flight departed after the flight of patients 1 and 2, also reported spending time at this gate area during the time that patients 1 and 2 were present. Patient 4 passed through the same domestic gate around the time the other three patients were waiting to depart.

Required protection in the community

Table 1. Estimates of the critical percentage of susceptible persons that must be vaccinated to eradicate a given disease from a population

Disease	Critical percentage of susceptible persons that must be vaccinated to eradicate a disease (% of susceptible persons)
Measles	90-95
Pertussis	90-95
Fifth[a]	90-95
Chickenpox	85-90
Mumps	85-90
Rubella	82-87
Poliomyelitis	82-87
Diptheria	82-87
Scarlet fever	82-87
Smallpox	70-80

Pockets of populations where the level is lower

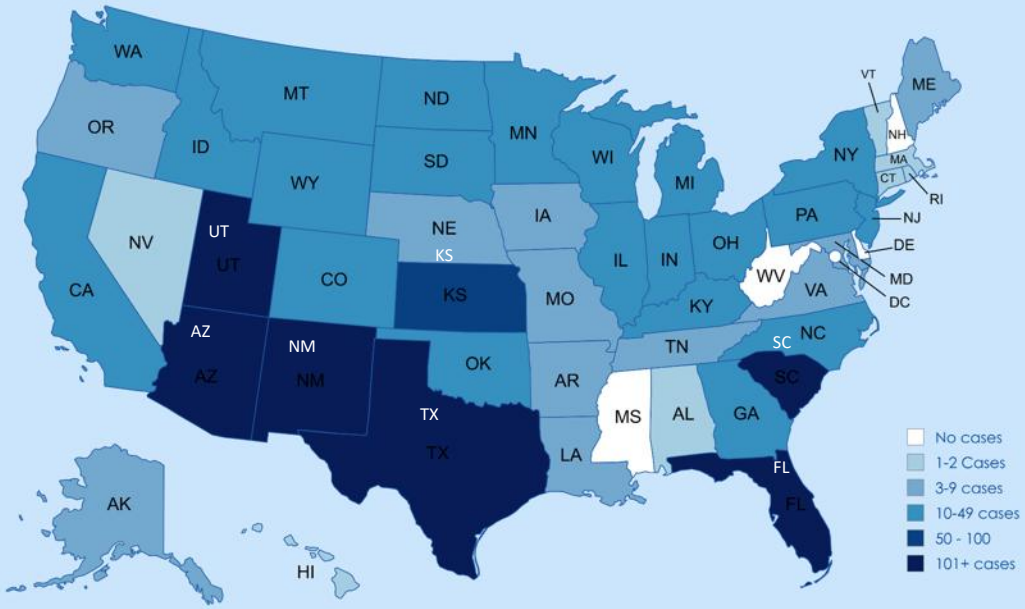
Publisher: CDC; Journal: Emerging Infectious Diseases Article Type: Research; Volume: 7; Issue: 6; Year: 2001; Article ID: 01-0607

MEASLES CASES – AS OF 19 APRIL 2026

2026 CASES
1784 CONFIRMED CASES

2025 CASES
2288 CONFIRMED + 4 PROBABLE CASES AND 3 DEATHS

2025 - 2026 CASES
4072 CONFIRMED + 4 PROBABLE CASES and 3 DEATHS



STATE	CASES					DEATHS
	NEW	2025+2026	CONFIRMED 2026	CONFIRMED 2025	PROBABLE 2025	2025
SOUTH CAROLINA	1	1001	668	333		
UTAH	6	603	406	197		
TEXAS	4	985	180	805		2
FLORIDA	1	153	145	8		
ARIZONA	7	300	79	221		
CALIFORNIA	4	66	40	26		
WASHINGTON	4	49	37	12		
NORTH DAKOTA	1	69	33	36		
NORTH CAROLINA	0	24	22	2		
OREGON	6	21	20	1		1
VIRGINIA	1	23	17	6		
NEW MEXICO	0	116	16	100		
MINNESOTA	1	42	16	26		
COLORADO	1	52	16	36		
PENNSYLVANIA	0	28	12	16		
OHIO	0	56	11	45		
IDAHO	0	23	9	14		
SOUTH DAKOTA	0	24	8	16		
MICHIGAN	0	38	8	30		
MAINE	0	5	5	0		
MONTANA	0	41	5	36		
NEW YORK	0	32	4	28		
NEW YORK CITY	0	24	4	20		
KENTUCKY	0	18	4	14	1	
ILLINOIS	0	18	4	14		
NEBRASKA	0	6	3	3		
GEORGIA	0	12	2	10		
MASSACHUSETTS	0	2	2	0		
WISCONSIN	0	38	2	36		
ALASKA	0	5	1	4		
MARYLAND	1	4	1	3		
MISSOURI	0	8	1	7		
OKLAHOMA	0	18	1	17	3	
RHODE ISLAND	1	2	1	1		
VERMONT	0	3	1	2		
ALABAMA	0	1	0	1		
ARKANSAS	0	8	0	8		
CONNECTICUT	0	1	0	1		
HAWAII	0	2	0	2		
INDIANA	0	11	0	11		
IOWA	0	9	0	9		
KANSAS	0	91	0	91		
LOUISIANA	0	3	0	3		
NEVADA	0	2	0	2		
NEW JERSEY	0	12	0	12		
TENNESSEE	0	8	0	8		
WYOMING	0	15	0	15		
TOTAL	38	4072	1784	2288	4	3

OUTBREAKS

- SMALL OUTBREAK (3-9)
- MEDIUM OUTBREAK (10 - 49)
- LARGE OUTBREAK (50 OR MORE)

An outbreak of measles is defined as three or more laboratory-confirmed cases that are temporally related and epidemiologically or virologically linked.

2026

Total: 1784

AGES
21% - Under 5
51.3% - 5-19 years of age
27.2% - 20+ years of age
.5%- Unknown

92% of all cases were unvaccinated or had unknown vaccination status, **4%** had 1 MMR dose, and **4%** had 2 MMR doses.

6% of all cases required hospitalization

2025

Total: 2288

AGES
26% - Under 5
44% - 5-19 years of age
30% - 20+ years of age
1% - Unknown

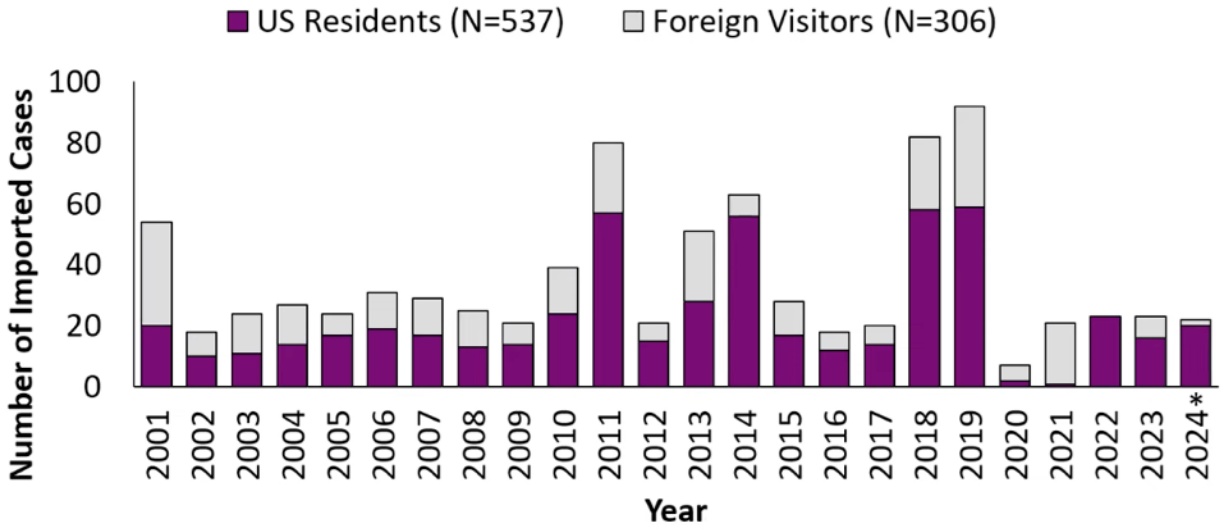
93% of all cases were unvaccinated or had unknown vaccination status, **3%** had 1 MMR dose, and **4%** had 2 MMR doses.

11% of all cases required hospitalization

Slide c/o YSPH

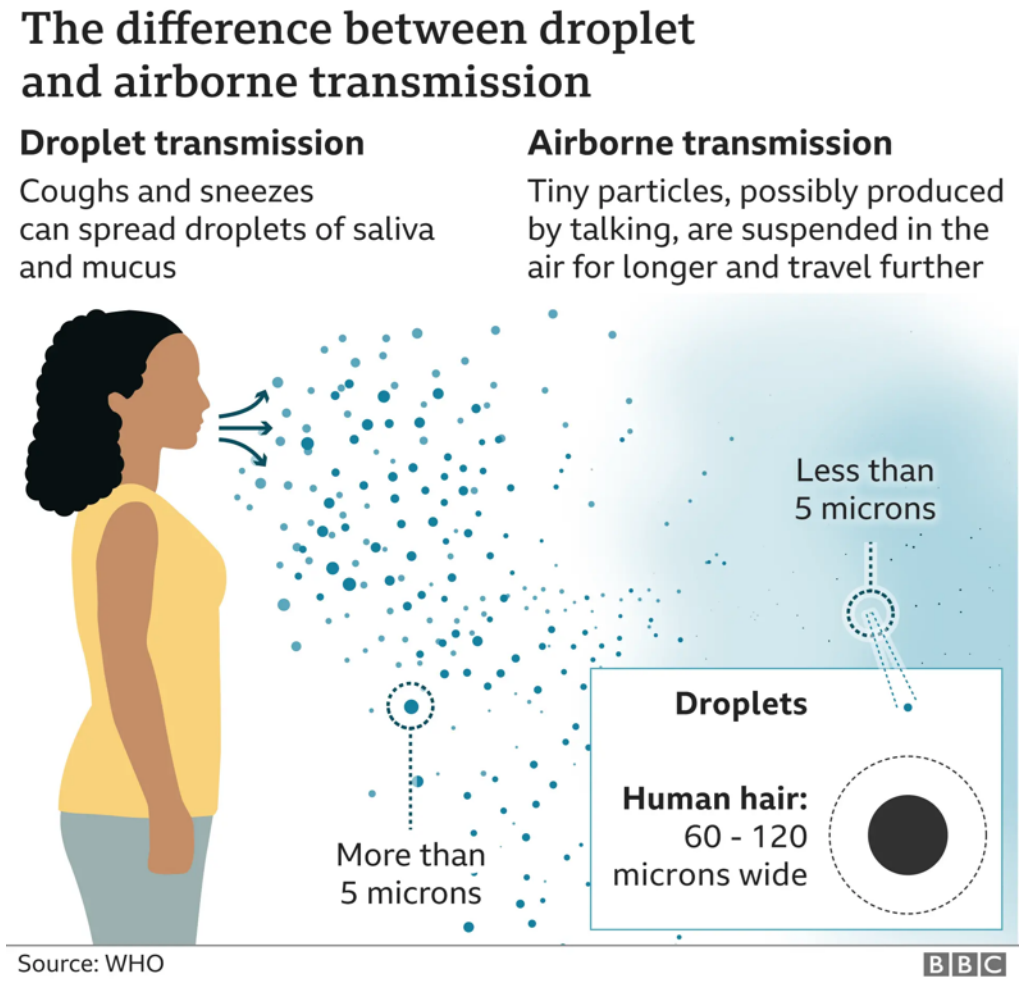
International importations, 2001–2024*

During 2001–2024, 64% of importations occurred among US residents



*2024 data shown here as of 3/28/2024. Data summarizing measles surveillance during 01/01/2020–3/28/2024 can be found here: https://www.cdc.gov/mmwr/volumes/73/wr/mm7314a1.htm

Droplet versus aerosol



Measles in healthcare settings

1) **Ensure all HCW have presumptive immunity to measles**
2) Minimize potential exposures
3) Adhere to standard AND airborne precautions
4) Manage measles exposures
5) Considerations for an outbreak
6) Train and educate HCP
7) Report within hospital and to public health authorities

Interim Infection Prevention and Control Recommendations for Measles in Healthcare Settings. CDC. 2025.

Who is immune?

Evidence of Immunity

Acceptable presumptive evidence of immunity against measles includes at least **one** of the following:

- written documentation of adequate vaccination:
  - one or more doses of a measles-containing vaccine administered on or after the first birthday for preschool-age children and adults not at high risk
  - two doses of measles-containing vaccine for school-age children and adults at high risk, including college students, healthcare personnel, and international travelers
- laboratory evidence of immunity
- laboratory confirmation of measles
- birth before 1957

MMR Vaccine Contraindications

- Severe immunocompromising conditions (e.g., hematologic malignancy, receipt of chemotherapy, long-term immunosuppressive therapy)
  - HIV if CD4 % < 15% or absolute CD4 <200
- Family history suggestive of a congenital immunocompromising condition, unless assessed to be immunocompetent by a clinician or laboratory testing
- History of severe allergic reaction to MMR or to an MMR vaccine component
- Pregnancy

https://www.cdc.gov/measles/hcp/vaccine-considerations/index.html

MMR Vaccine Adverse Events

- MMR vaccine is generally very well tolerated
- Common side effects include:
  - Fever (<15%)
  - Brief rash (5%)
  - Lymphadenopathy (5% of children, 20% of adults)
- Rare serious adverse events include:
  - Anaphylaxis (2–14 events per million doses)
  - Febrile seizures (1 event per 3–4,000 doses)
  - Low platelet count (1 event per 40,000 doses; may be higher risk if known ITP)

MMR Can Cause a Self-limited Rash

- MMR can cause a short-lived febrile rash syndrome that is not contagious to others
- Differentiating measles from an MMR reaction in the setting of an outbreak can be challenging, especially if MMR was given to prevent measles after an exposure

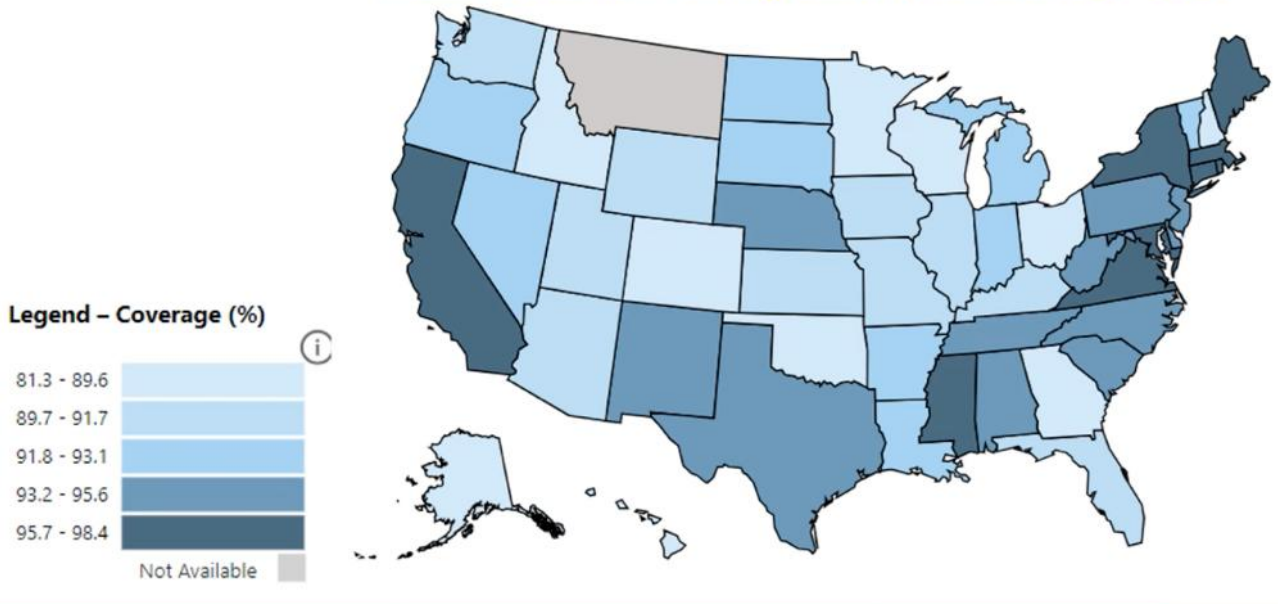
MMR reaction (not contagious)

Non-medical vaccine exemptions are increasing

National and State Level 2-dose MMR Coverage

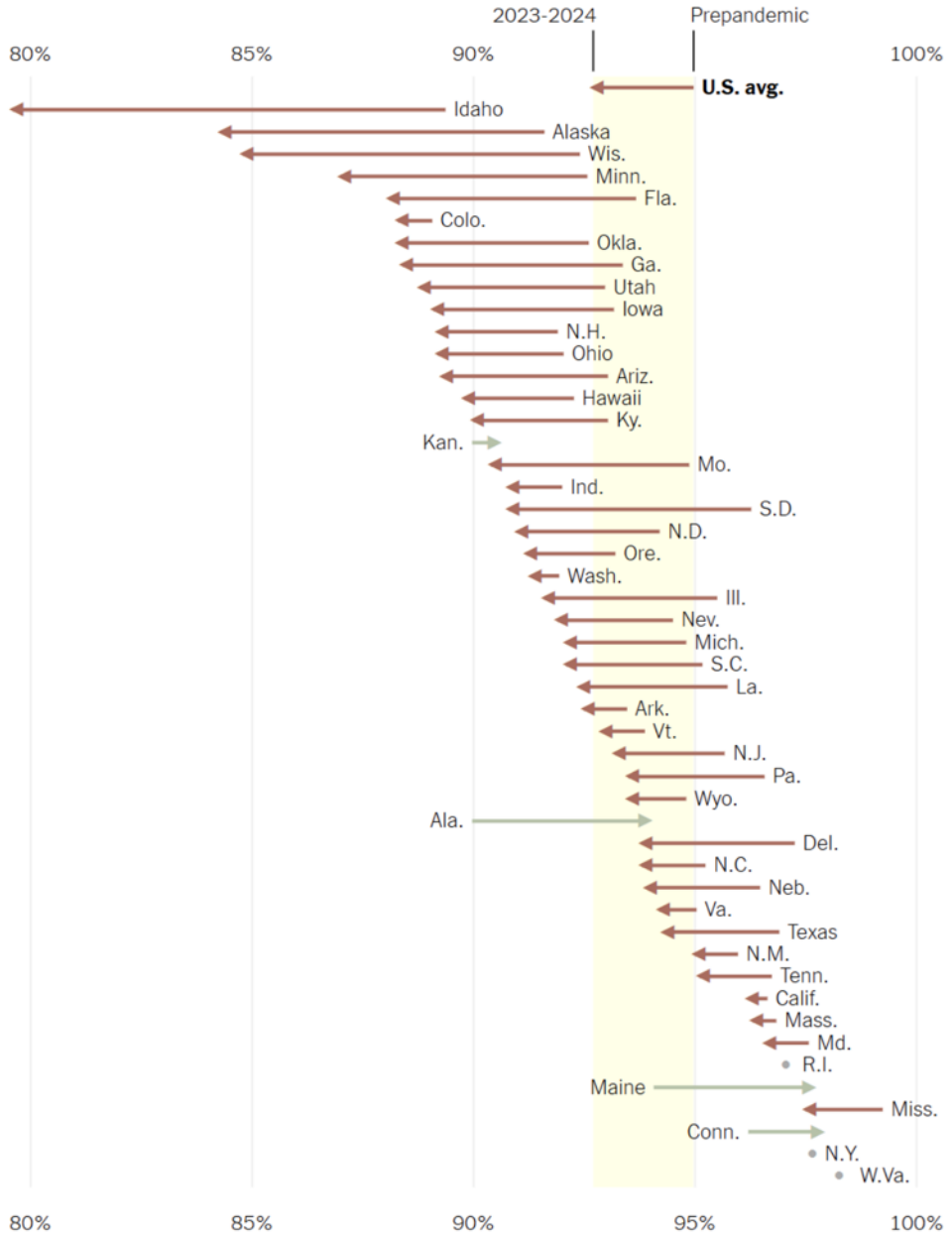
	2019-2020	2020-2021	2021-2022	2022-2023
MMR (2 doses)	95.2	93.9	93.0	93.1

MMR Vaccination among Kindergartners 2022 - 2023



https://www.cdc.gov/schoolvaxview/data/

Change in kindergarten measles vaccination rates



Prepandemic is the average of 2017-18, 2018-19 and 2019-20 data, though not all years were available for all states. Alabama, Florida, Georgia, Iowa, Mississippi, New Hampshire, New Jersey and Delaware (in 2024) report the rate of students who have completed all required vaccines, not just the measles series. Source: Centers for Disease Control and Prevention

Measles in healthcare settings

1) Ensure all HCW have presumptive immunity to measles
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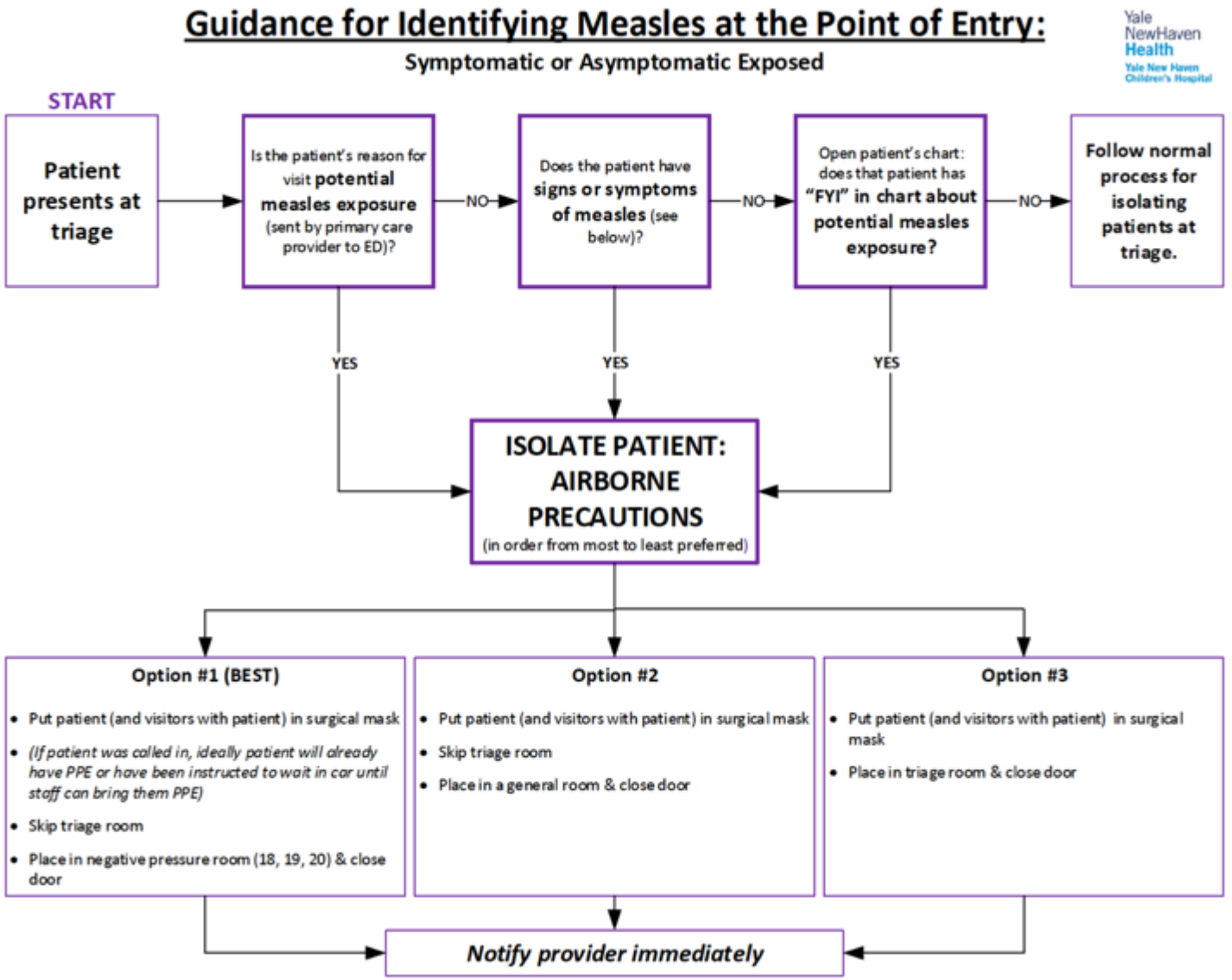
Interim Infection Prevention and Control Recommendations for Measles in Healthcare Settings. CDC. 2025.

Minimize exposures

- Notify healthcare facility in advance
- PUI should don mask
- Separate from other patients as soon as possible



Measles in healthcare settings

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Interim Infection Prevention and Control Recommendations for Measles in Healthcare Settings. CDC. 2025.

Precautions

- AIIR – exhaust to outside or HEPA

ACH § ¶	Time (mins.) required for removal 99% efficiency	Time (mins.) required for removal 99.9% efficiency
2	138	207
4	69	104
6+	46	69
8	35	52
10+	28	41
12+	23	35
15+	18	28
20	14	21
50	6	8

The number of air changes per hour and time and efficiency.

Measles in healthcare settings

1) Ensure all HCW have presumptive immunity to measles
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Interim Infection Prevention and Control Recommendations for Measles in Healthcare Settings. CDC. 2025.

Measles exposures

HCW exposed

- Asymptomatic WITH immunity: status quo

- Asymptomatic WITHOUT immunity: PEP, quarantine 5 – 21 days after exposure regardless of PEP

- Infected with measles: isolate x 4 days after rash appears

Patients/family exposed

- airborne day 5 – 21 after exposure

- PEP

- Immunoglobulin may extend incubation period to 28 days

< 6 month old (non-immune due to age)

Time since initial exposure:

≤ 6 days:	> 6 days:
Give intramuscular immunoglobulin (IMIG) (dosing)	PEP not indicated (too late)
Home quarantine for 28 days after last exposure	Home quarantine for 21 days after last exposure

6-11 months old (non-immune due to age)

Time since initial exposure:

≤ 72 hours (3 days):	4-6 days:	> 6 days:
Give MMR vaccine (preferred over IG)	Give intramuscular immunoglobulin (IMIG) (dosing)	PEP not indicated (too late)
No quarantine needed if MMR PEP given	Home quarantine for 28 days after last exposure	Home quarantine for 21 days last after exposure

≥12 months and non-immune

Time since initial exposure:

≤ 72 hours (3 days):	≥ 4 days:
Give MMR vaccine	PEP not indicated (too late)
No quarantine needed if MMR PEP given	Home quarantine for 21 days after last exposure, then give MMR vaccine to protect from future exposures

Measles in healthcare settings

1) Ensure all HCW have presumptive immunity to measles
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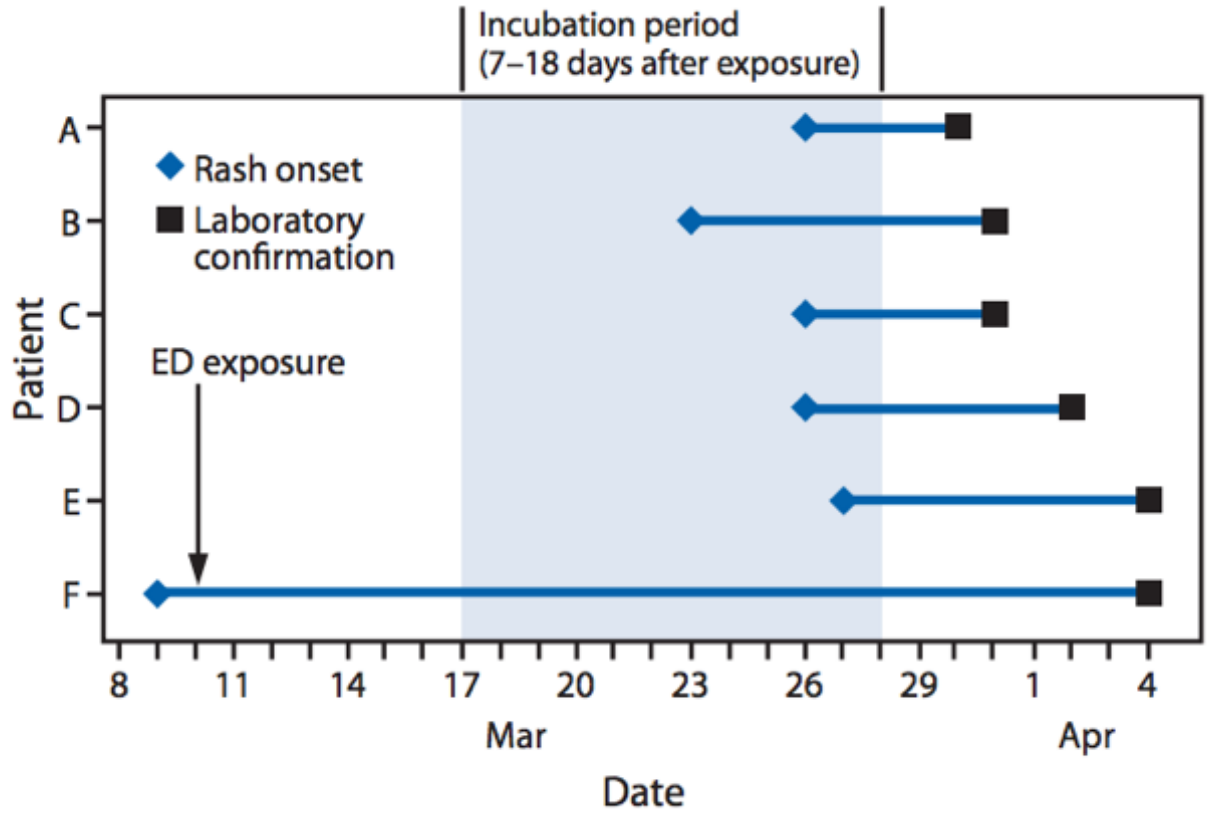
Interim Infection Prevention and Control Recommendations for Measles in Healthcare Settings. CDC. 2025.

Tempo of illness from exposure to diagnosis

FIGURE. Time from hospital emergency department (ED) exposure and rash onset until laboratory confirmation of measles among six patients — Pennsylvania, March–April 2009



MMWR

Yale SCHOOL OF MEDICINE | Yale NewHaven Health Yale New Haven Hospital

Measles in healthcare settings

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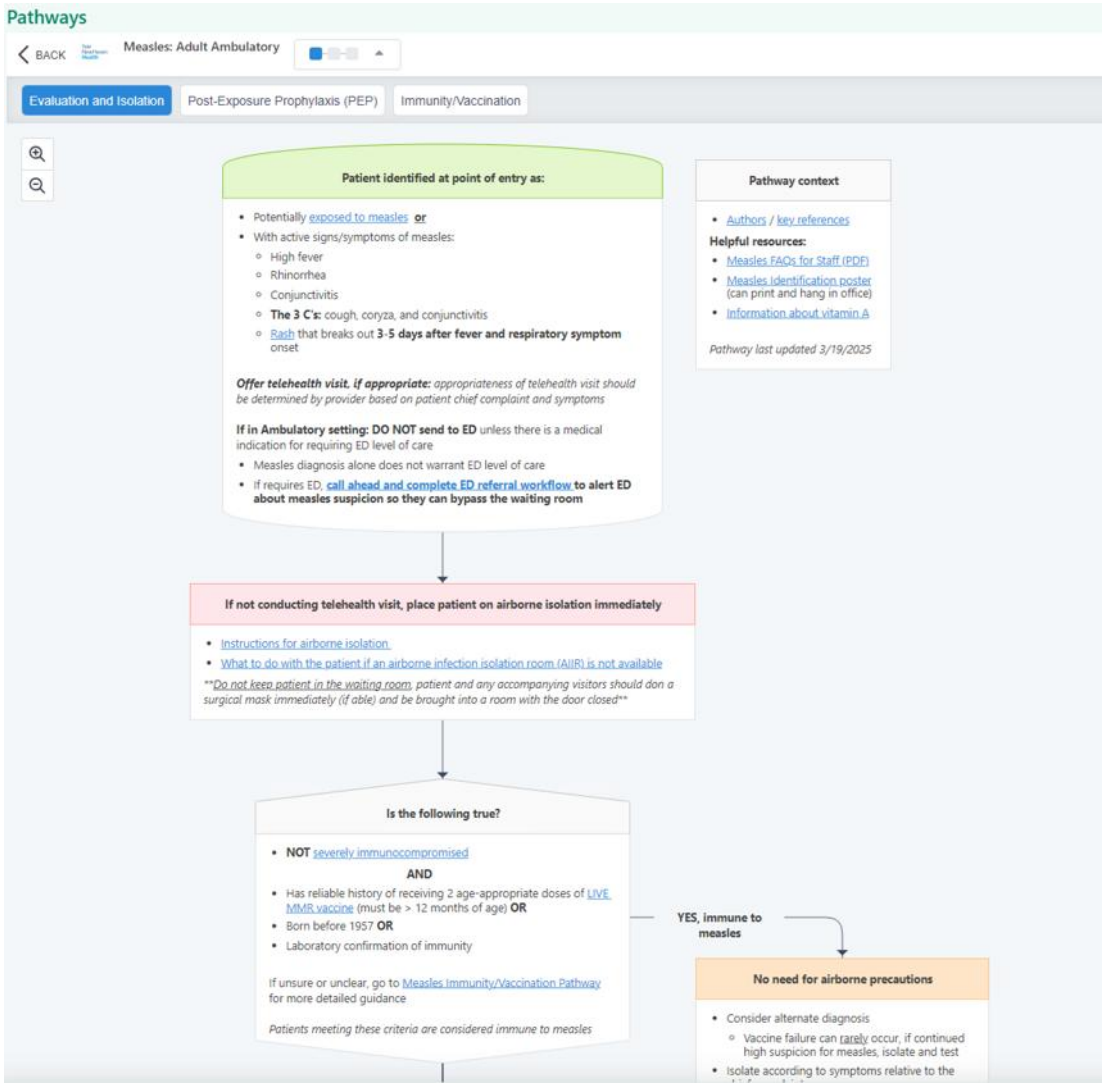


Yale SCHOOL OF MEDICINE

Yale NewHaven Health
Yale New Haven Hospital

Questions?

Common FAQs

If my patient is a 7 mo old and traveling within the United States should they get a MMR vaccine early?

- No, the only current indications for early vaccination is international travel or as recommended by a state DPH during an outbreak.
- If traveling to a domestic area where there is active transmission, early vaccination can be considered.

Vaccine <1 yr does not count toward the vaccine series

Common FAQs

I was born in 1965. I know I received a measles vaccine but I do not have written records of vaccination. Should I get an MMR vaccine?

People who previously received a dose of measles vaccine in 1963–1967 and are unsure which type of vaccine it was, or are sure it was inactivated measles vaccine, should be revaccinated with either one (if low-risk) or two (if high-risk) doses of MMR vaccine. If the vaccine given was the live virus vaccine, the dose is considered valid and does not need to be repeated.

Common FAQs

Are there situations when more than 2 doses of MMR are recommended?

There are two circumstances when a third dose of MMR is recommended. ACIP recommends that women of childbearing age who have received 2 doses of rubella-containing vaccine and have rubella serum IgG levels that are not clearly positive should receive 1 additional dose of MMR vaccine (maximum of 3 doses). Further testing for serologic evidence of rubella immunity is not recommended. MMR should not be administered to a pregnant woman.

In 2018, ACIP published guidance for MMR vaccination of people at increased risk for acquiring mumps during an outbreak. People previously vaccinated with 2 doses of a mumps virus–containing vaccine who are identified by public health authorities as being part of a group or population at increased risk for acquiring mumps because of an outbreak should receive a third dose of a mumps virus–containing vaccine (MMR or MMRV) to improve protection against mumps disease and related complications.

Common FAQs

A college student doesn't have vaccine records, but their titer shows they are not immune to a combination of measles, rubella, and/or mumps. What vaccine should the student receive?

Single antigen vaccine is no longer available in the U.S.; the student should get the combined MMR vaccine. If a college student or other person at increased risk of exposure cannot produce written documentation of either immunization or disease, and titers are negative, they should receive two doses of MMR.

Common FAQs

A patient born in 1970 has a history of measles disease and is also immunosuppressed due to multiple myeloma. The patient wants to travel to Africa, but is concerned about the measles exposure risk. Should the patient receive the MMR vaccine?

A history of having had measles is not sufficient evidence of measles immunity. A positive serologic test for measles-specific IgG will confirm that the person is immune and is not at risk of infection regardless of the multiple myeloma. Multiple myeloma is a hematologic cancer and is considered immunosuppressive so MMR vaccine is contraindicated in this person.

Common FAQs

I have a 45-year-old patient who is traveling to Haiti for a mission trip. She doesn't recall ever getting an MMR booster (she didn't go to college and never worked in health care). She was rubella immune when pregnant 20 years ago. Her measles titer is negative. Would you recommend an MMR booster?

ACIP recommends 2 doses of MMR given at least 4 weeks apart for any adult born in 1957 or later who plans to travel internationally. There is no harm in giving MMR vaccine to a person who may already be immune to one or more of the vaccine viruses.

Common FAQs

Is there any harm in giving an extra dose of MMR to a child of age seven years whose record is lost and the mother is not sure about the last dose of MMR?

In general, although it is not ideal, receiving extra doses of vaccine poses no medical problem.

Vaccination providers frequently encounter people who do not have adequate documentation of vaccinations. Providers should only accept written, dated records as evidence of vaccination. With the exception of influenza vaccine and pneumococcal polysaccharide vaccine, self-reported doses of vaccine without written documentation should not be accepted. An attempt to locate missing records should be made whenever possible by contacting previous healthcare providers, reviewing state or local immunization information systems, and searching for a personally held record.

If records cannot be located or will definitely not be available anywhere because of the patient's circumstances, children without adequate documentation should be considered susceptible and should receive age-appropriate vaccination. Serologic testing for immunity is an alternative to vaccination for certain antigens (e.g., measles, rubella, hepatitis A, diphtheria, and tetanus).

Common FAQs

Is there any evidence that MMR or thimerosal causes autism?

No. This issue has been studied extensively, including a thorough review by the independent Institute of Medicine (IOM). The IOM issued a report in 2004 that concluded there is no evidence supporting an association between MMR vaccine or thimerosal-containing vaccines and the development of autism. For more information about MMR vaccine safety, see the measles chapter of CDC's Epidemiology and Prevention of Vaccine-Preventable Diseases (known as the "Pink Book"), at www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-13-measles.html#cdc_report_pub_study_section_10-vaccine-safety. For more information on thimerosal and vaccines in general, visit www.cdc.gov/vaccine-safety/about/thimerosal.html.

Questions?

Thank you!

APIC NEW ENGLAND

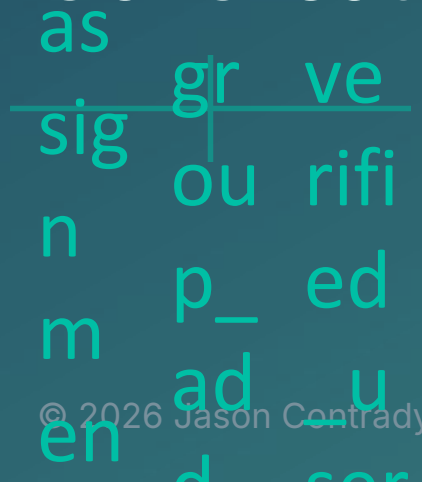
Biography: Jason Contrady, MBA, PMP, LSSGB, NREMT

Jason is a Senior Project Manager at Dartmouth Health. He has over a decade of experience leading diverse teams, implementing large-scale projects, and driving quality improvements across different industries. Currently, he guides system-wide strategic integration initiatives to improve quality, safety, and patient care. Much of Jason's 15-year career was spent in supply chain planning, operations, and software in wholesale distribution and retail while spearheading emergency response and federal grants as a public servant. An advocate for continuous learning and innovation, Jason is passionate about equipping others with practical tools to succeed. He thrives on exploring complex systems, distilling technical concepts, and transforming ideas into reality. Jason holds a Project Management Professional (PMP) certification, an MBA from Colby- Sawyer College, a BS in Finance and Supply Chain from Northeastern University and is Lean Six Sigma Green Belt certified through the Dartmouth Health Value Institute Learning Center. He is an active National Registry EMT, Firefighter I, Deputy Fire Chief, and Emergency Management Director in Surry, New Hampshire.

APIC NEW ENGLAND

Project Management Fundamentals For Infection Prevention

From Policy to Practice:
Co-Creating an Infection Prevention Rollout Plan



What Is a Project?

A temporary endeavour undertaken to create a unique product, service, or result.[1]

Current Baseline

Project Work

- Planning & coordination
- Communication & training
- Problem-solving

Desired Future State

A project has a defined goal, a beginning, and an end.

1. Project Management Institute. (2021). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (7th ed.). Project Management Institute.

There Is a Profession for Managing Projects

assignment
Project Management

Managing a temporary initiative to create a unique product or service.

Focus: "One effort"
Execution, scope, budget.

PMP®, CAPM®

account_tree
Program Management

Managing a group of related projects to obtain strategic benefits.

Focus: "Related efforts"
Strategic alignment.

PgMP®

dashboard
Portfolio Management

Centralized management to achieve high-level strategic objectives.

Focus: "Right work"
Value & resource allocation.

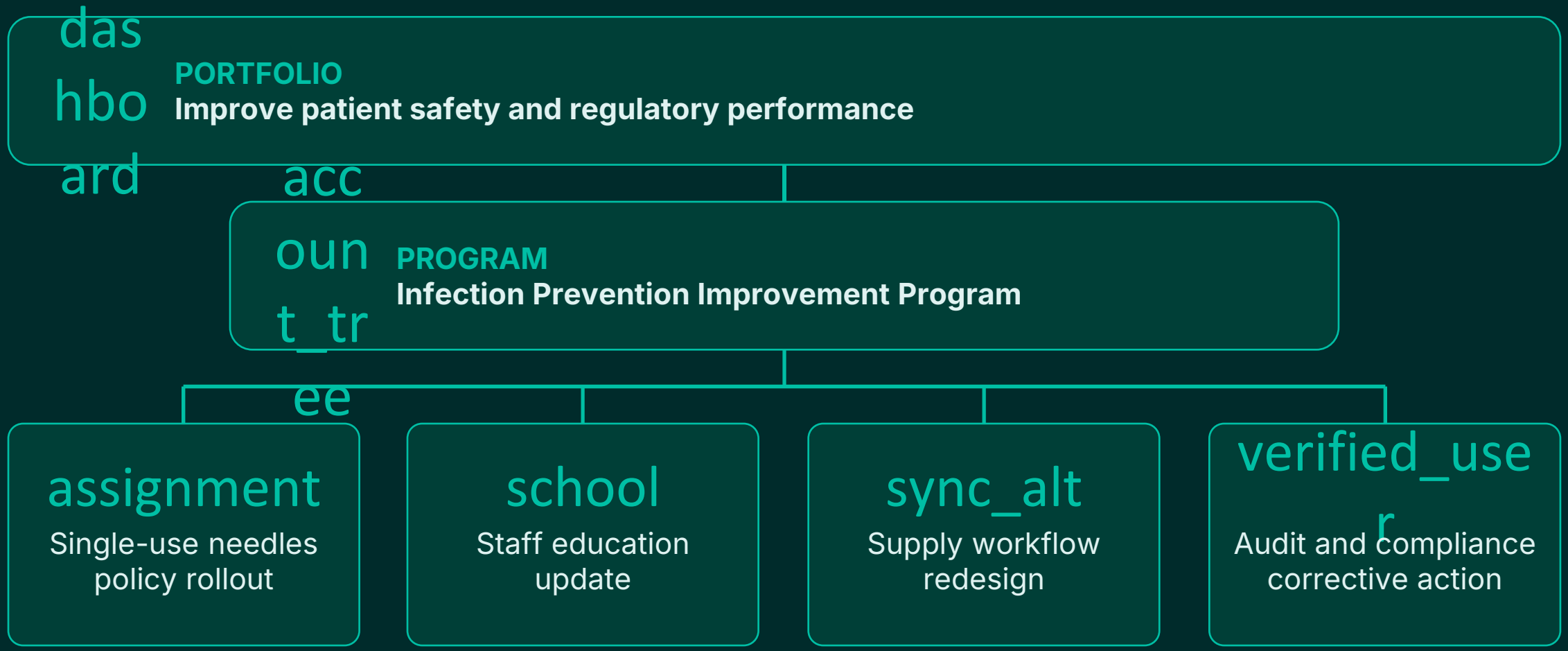
PfMP®

Project Management skills aid effectiveness, even without professional certification.

Standards governed by PMI and other global bodies.

PMI

How This Looks in Healthcare



What We'll Do Today

assignment

Plan

Build a basic rollout plan.

sync_alt

Experience

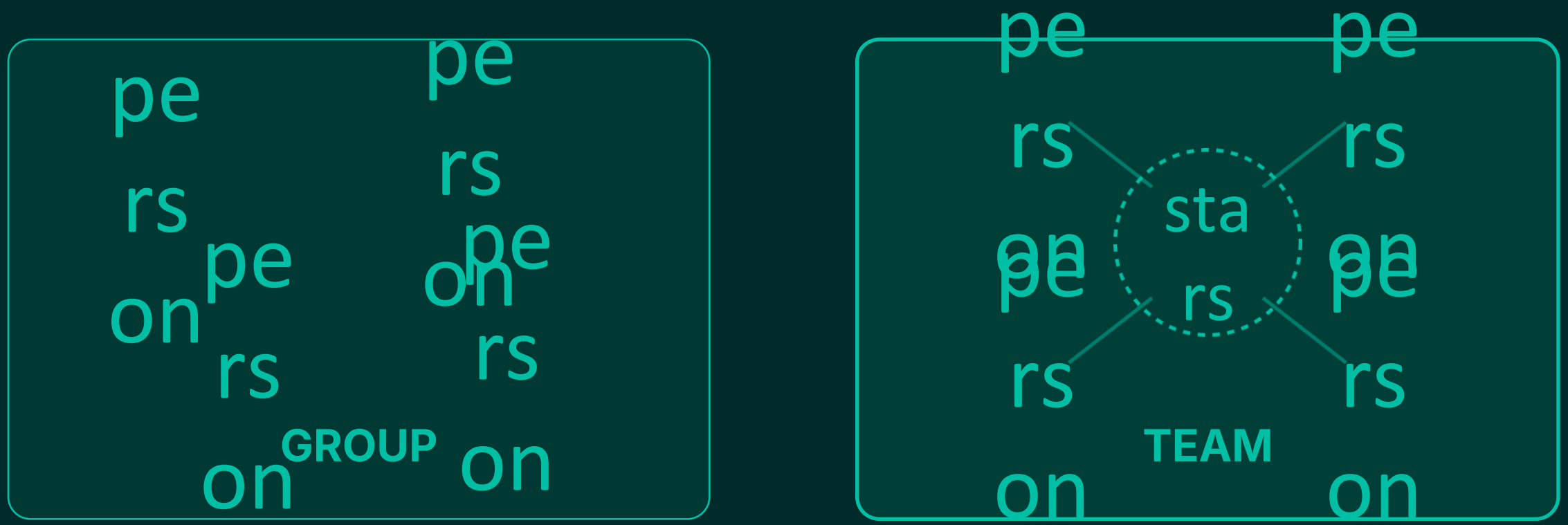
Experience change.

visibility

Observe

See why change management matters.

A Group Becomes a Team Through Shared Work



Projects turn groups into teams by organizing people around a common outcome.

Scenario: MGM Health

MGM Health is implementing a new single-use needles policy across inpatient and ambulatory clinical spaces.

location_city

The Setting

- 300-Bed Community Hospital
- 1 Ambulatory Surgery Center (ASC)
- 4 Outpatient Clinics

gavel

The Policy

Mandatory Single-Use Needles in all clinical spaces.

timer

Your Task

Draft your Plan.

"Assume a smooth sail. What does a perfect rollout look like?"

Build Your Plan

groups

Work with your table

description

Use the templates

psychology

Aim for practical decisions

done_all

You do not need perfect answers

Tools and Templates

assignment
Charter (mini)

group_add
Stakeholder Plan

grid_view
RAM
Responsibility Assignment Matrix

campaign
Communication Plan

fact_check
Milestone Timeline

Build a practical rollout plan for MGM Health.

Tool 1: Charter (mini)

assignment

Objective

[Define the primary goal of the rollout]

In Scope

- *Included departments*
- *Specific deliverables*
- *Budget items*

Out of Scope

- *Future phases*
- *Excluded facilities*
- *Non-clinical areas*

Tool 2: Stakeholders

Who is affected?

- Nurses & Physicians
- Educators & Leadership
- Supply Chain
- Ambulatory Staff

Likely reaction

Resistance — Neutral — Champion

What might they gain or lose?

GAINS

Improved Safety, Standardized Workflow, Better Patient Outcomes

LOSSES / RISKS

Time (Training), Muscle Memory, Initial Efficiency Drop

Deep Dive: The Stakeholder Map

group_ad
d

Strategies for stakeholder groups

Action Item: Draft Mitigation Strategies for each group. How do you turn a challenge into a partnership?

Tool 3: Responsibility Assignment Matrix (RAM/RACI)

grid_view

Activity	Project Lead	Clinical Educator	Supply Manager	Executive Sponsor
Education	A	R		
Supply readiness	A		R	
Policy communication	R			A
Audit follow-up	A	C		

R Responsible **A** Accountable **C** Consulted **I** Informed

There can be only ONE 'A' (Accountable) per activity row.

Tool 4: Communication Plan

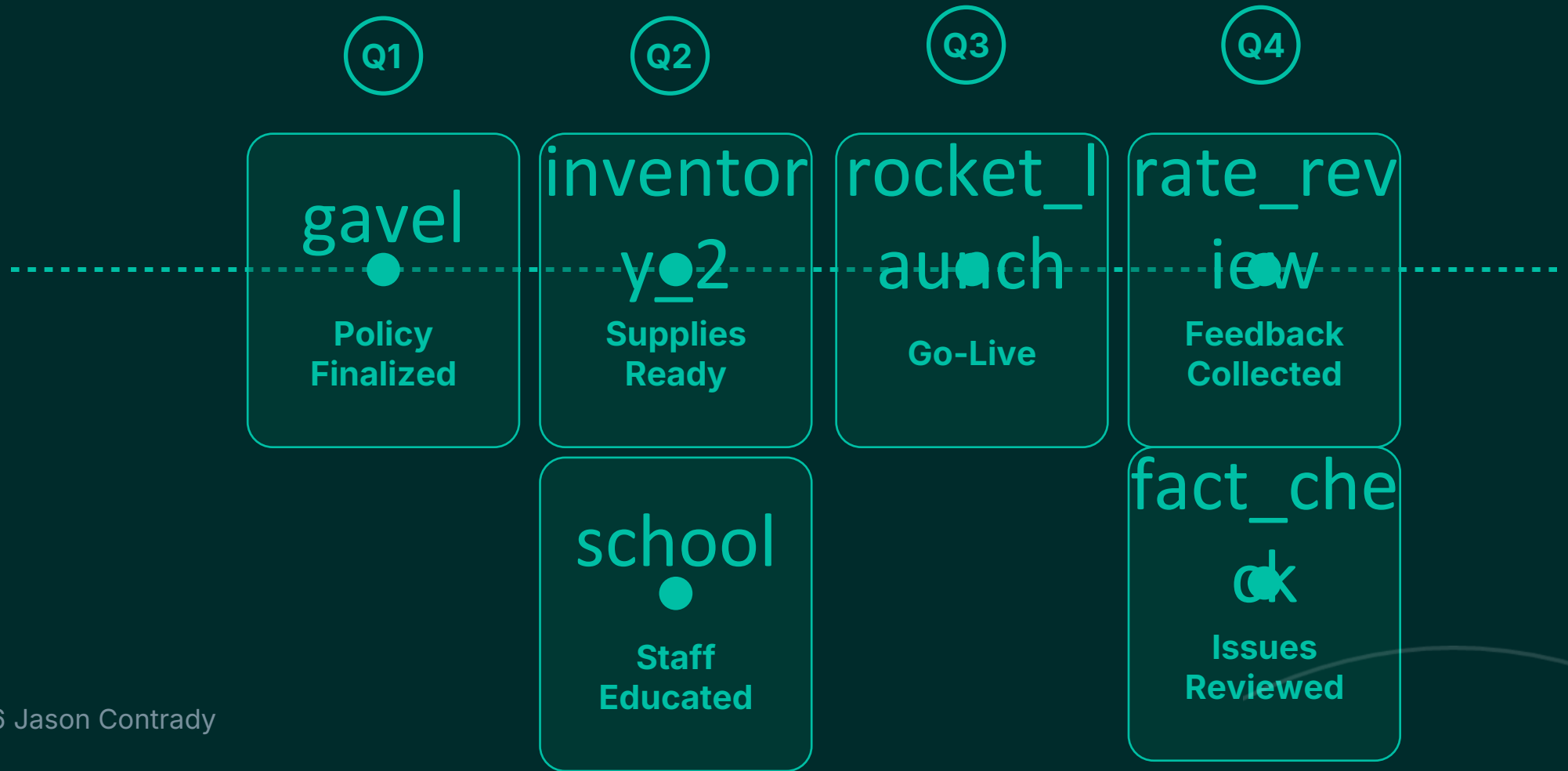
campaig
n

Audience	Message	Channel	Concern to Address
Frontline Clinicians	Safety & Workflow	groups Daily Huddle	*Impact on patient time and muscle memory*
Department Leads	Resource Support	forum Leader Briefing	*Budget and staffing for training phases*
All Employees	Why it Matters	mail Email/Intranet	*Consistency across the health system*

Ensure messages are consistent, frequent, and address specific "losses" identified earlier.

Tool 5: Milestone Timeline

fact_chec
k



At Your Table: How to Work the Exercise

Assign quick roles and build a practical starter plan.

Assign 4 Roles

Scribe — captures the group's decisions on the worksheet

Timekeeper — keeps the table moving through each step

Spokesperson — guides discussion and speaks for the Team

Sponsor — ensures the Team delivers the objective

Your Goal by the End

- A one-sentence implementation objective
- 2–3 key stakeholders and likely concerns
- Basic role ownership
- 2–3 communication actions
- A short milestone sequence

Keep it practical and high level. Build a usable outline, not a perfect plan.

Objective: MGM Health Policy

timer 10 min

Implement a new single-use needles policy across inpatient and ambulatory clinical spaces.

assignment
Charter (mini)

group_add
Stakeholder Plan

grid_view
RAM
Responsibility Assignment Matrix

campaign
Communication Plan

fact_check
Milestone Timeline

Setting

300-Bed Community Hospital | 1 Ambulatory Surgery Center (ASC) | 4 Outpatient Clinics

Build a practical rollout plan for MGM Health.

New Direction

timer **5 min**

Stop. Put your pens down.

Be more collaborative
Exchange your draft with a neighboring table

Representative
Send one liaison to discuss the transition

Authority
A sponsor from another team must sign-off on your documents

Pause: What Just Happened?

history

What changed?

groups

How did your table react?

psychology

What helped you adapt?

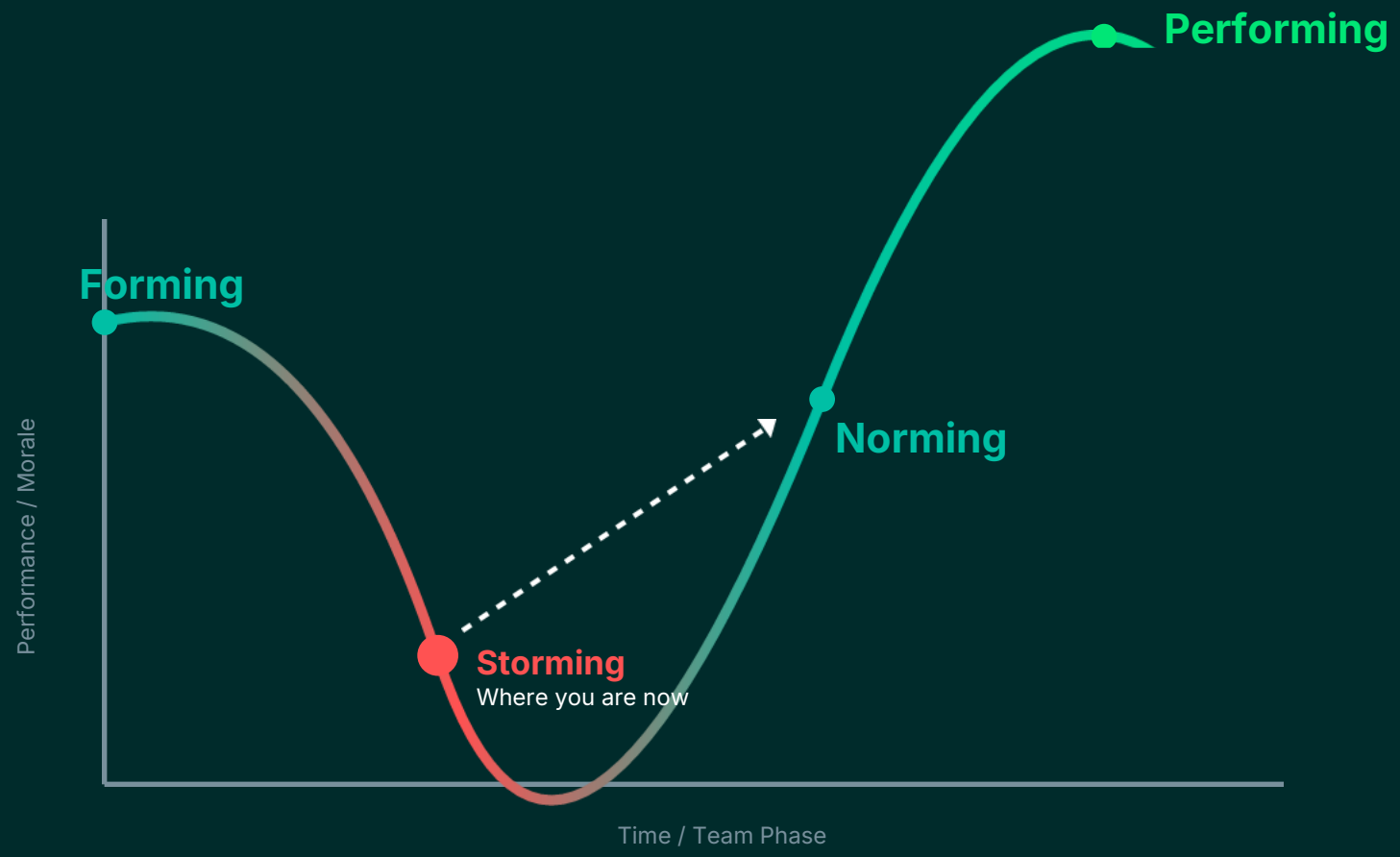
The Tuckman Curve in Real-Time

Forming: Where did we start? (Optimism)

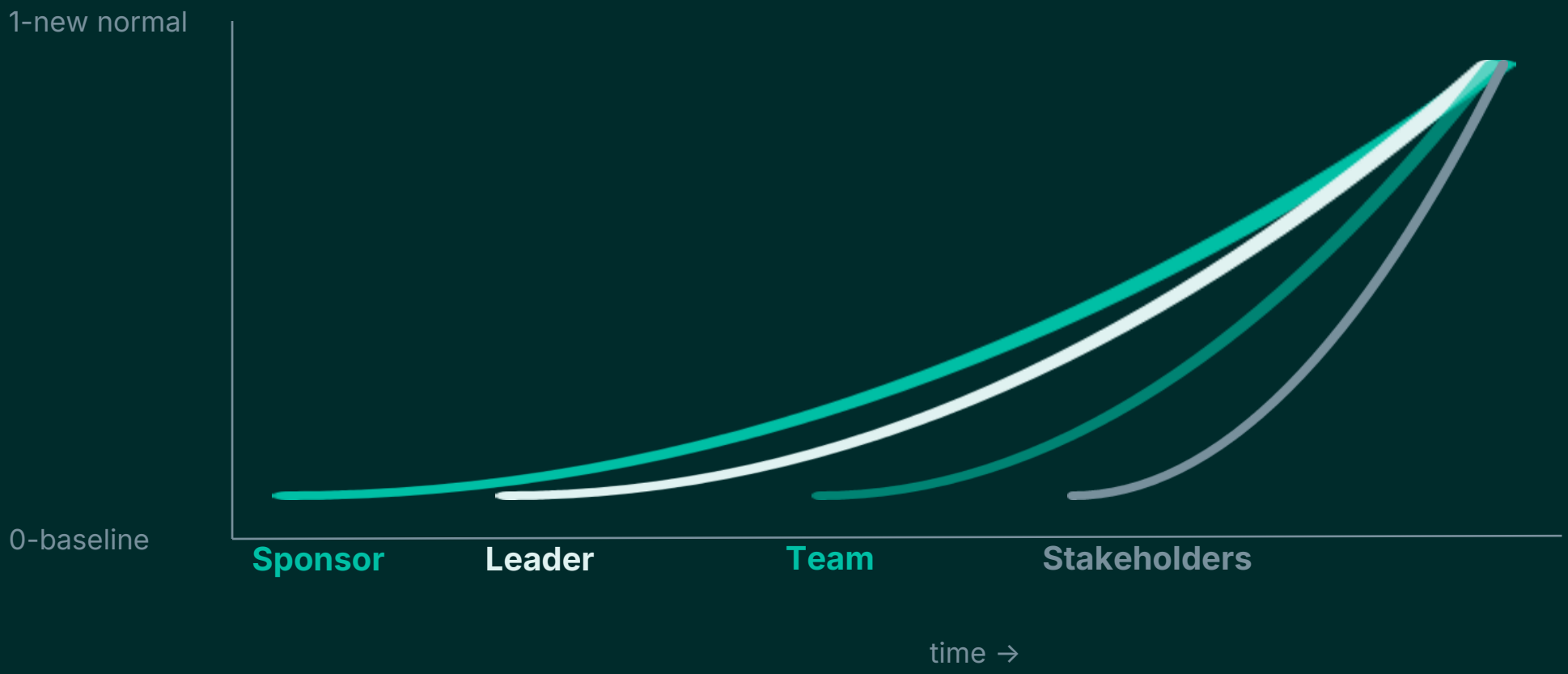
Storming: Where are you now? (Frustration, Anxiety)

Norming: Where did we come from? (Collaboration, Problem Solving)

Performing: The destination. (Mastery, Resilience)



The Change Arc



Why Change Management Matters

Technical Rollout Plan

- Defined Tasks & Roles
- Phased Timeline
- System Integration

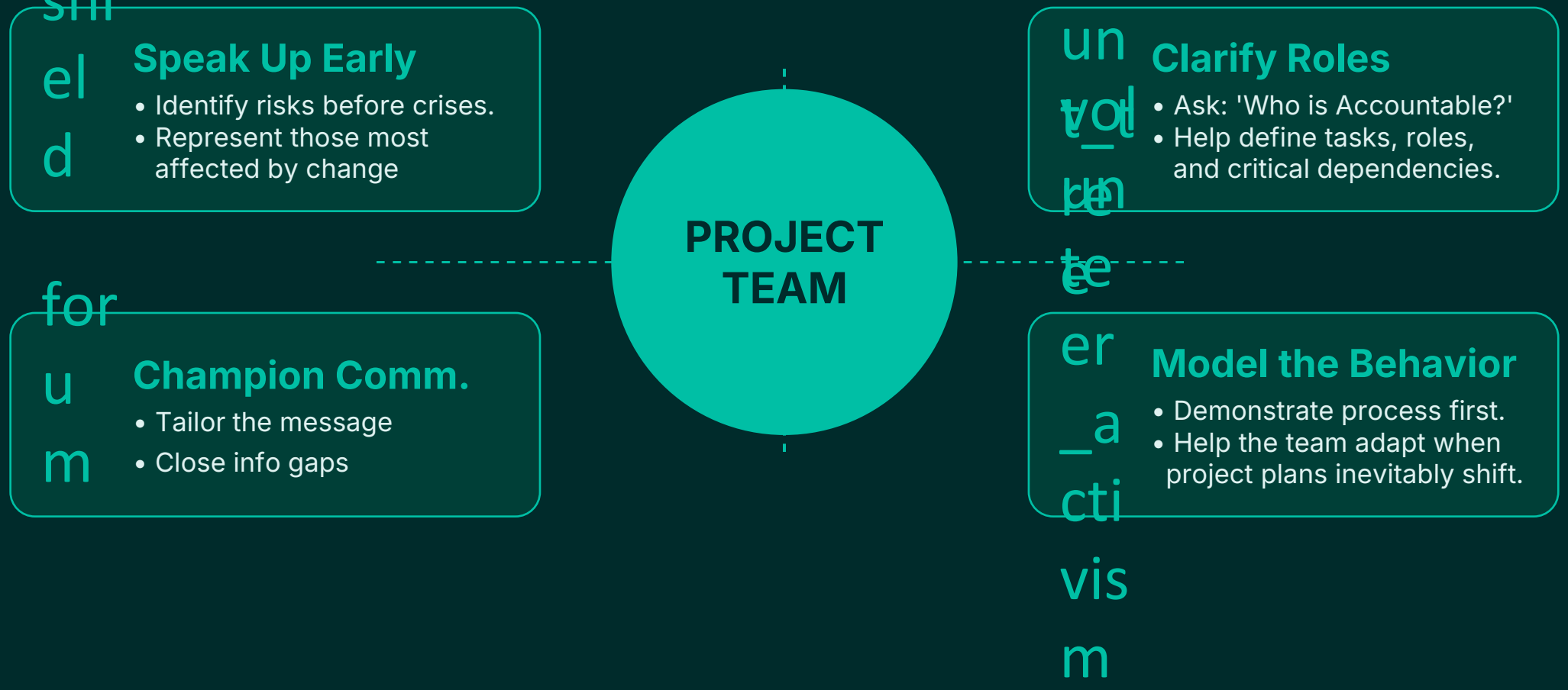
Adoption

- Transparent Communication
- Trust & Psychological Safety
- Support & Behavioral Change

Implementation succeeds when people adopt the change, not just when tasks are completed.

You Don't Need to be the PM to Drive Change

Every team member is a Change Agent.



Project Checklist

Charter (mini)

- Defines objective, scope, and success measures.
- Answers: What are we trying to accomplish?

RAM (RACI Matrix)

- Clarifies who is responsible and accountable.
- Defines ownership for key implementation tasks.

Milestone Timeline

- Outlines sequence of key checkpoints.
- Tracks readiness items and go-live actions.

Stakeholder Plan

- Maps groups, interests, and influence levels.
- Identifies likely support or resistance.

Communication Plan

- Targets messages, senders, and channels.
- Ensures audiences hear what they need to hear.

Change Management

- Accelerator through change uncertainty.
- Builds support loops for behavioral adoption.

Key Takeaways

Expect the Dip
The "Storming" phase is inevitable. Prepare for it.

Tools are Vehicles
Charts and matrices are useless without people.

Manage the Feeling
Your primary role is to guide your team from frustration to collaboration.

Change is not a step in the project. It is the project.

Q&A Discussion

Questions, reflections, and practical applications.

mail jason.contrady@pm.me

Thank You!

APIC NEW ENGLAND

Biography: Lisa Giannakopoulos, RN, BSN

Lisa is a registered nurse with over 20 years of experience, with 3 of those years focused on Infection Prevention. She has led multiple quality improvement initiatives and has received 3 honorable achievement awards for enhancing patient safety at UCONN. She currently serves as the co-chair of the Water Management Committee at UCONN.

APIC NEW ENGLAND

LEGIONELLA… The Silent Killer

Lisa Giannakopoulos, BSN, RN
UCONN Health

Figure 1. ([What is legionella], n.d.)

No disclosures

OBJECTIVES

- Review the history of legionella
- Discuss characteristics, transmission, treatment and prevention strategies
- Identify industry standards and regulations of Water Management Programs.
- Review case reporting, investigation, and controls measures
- Discuss the role of the Infection Preventionist in water management & legionella prevention
- Review the history of legionella in the United States and CT
- Examine the seasonal pattern of legionella
- Discuss the global burden and recent outbreaks

Figure 1. [Legionnaires' disease], (2021)

Figure 1 ([Legionella disease], n.d.)

The Bellevue-Stratford Hotel

All images (The Lost Hotels, 2026)

1976 Legionnaires' disease outbreak

Figure 2 (Wolfman-Arent, 2021)

-when cold air kills

Figure 1 (Leonard, 2025)

*Figure 3(*Hingston,2016)

Within days of returning home, some of the veterans developed pneumonia and fatal respiratory infections.

Figure 1 (Gordon, 2015)

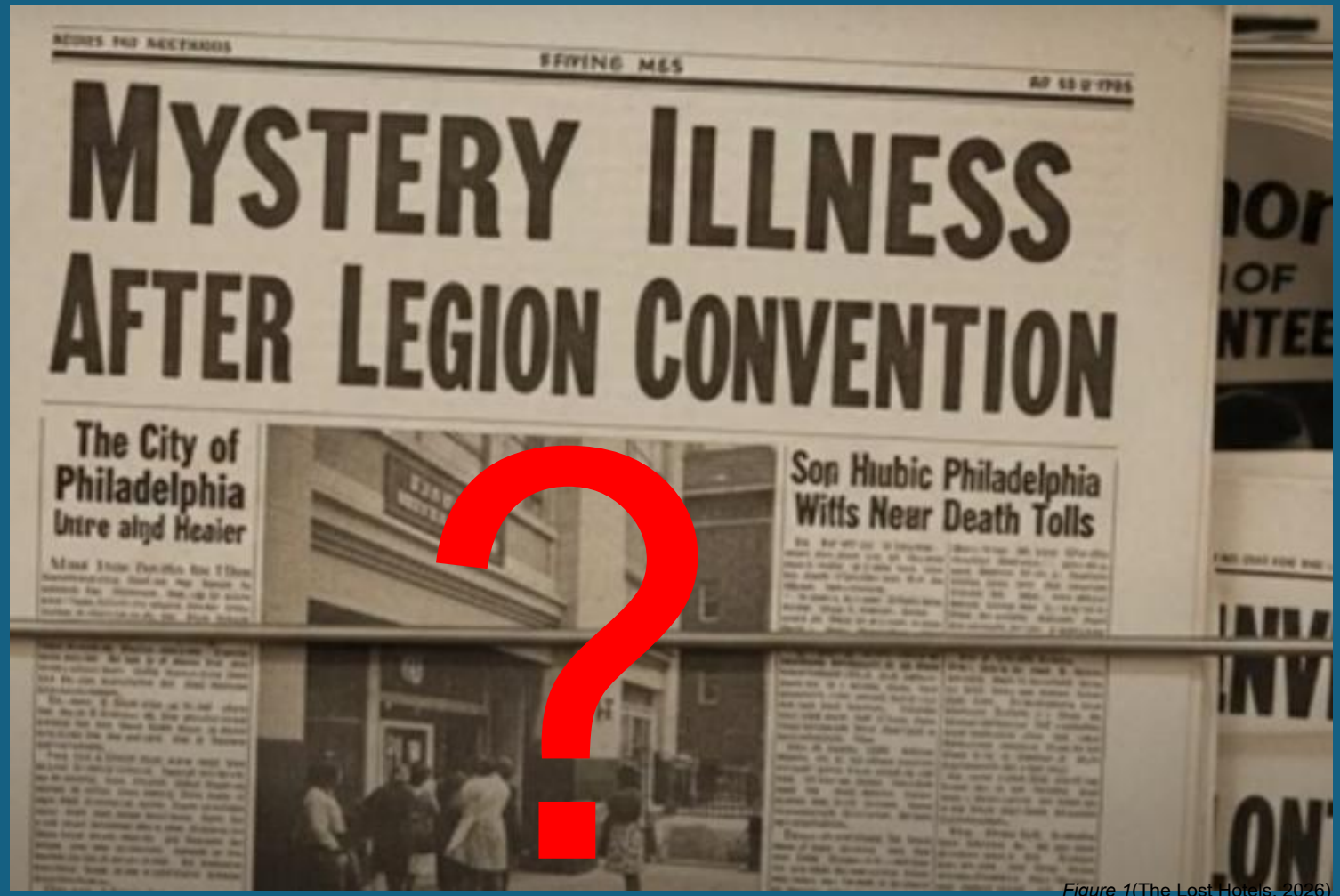
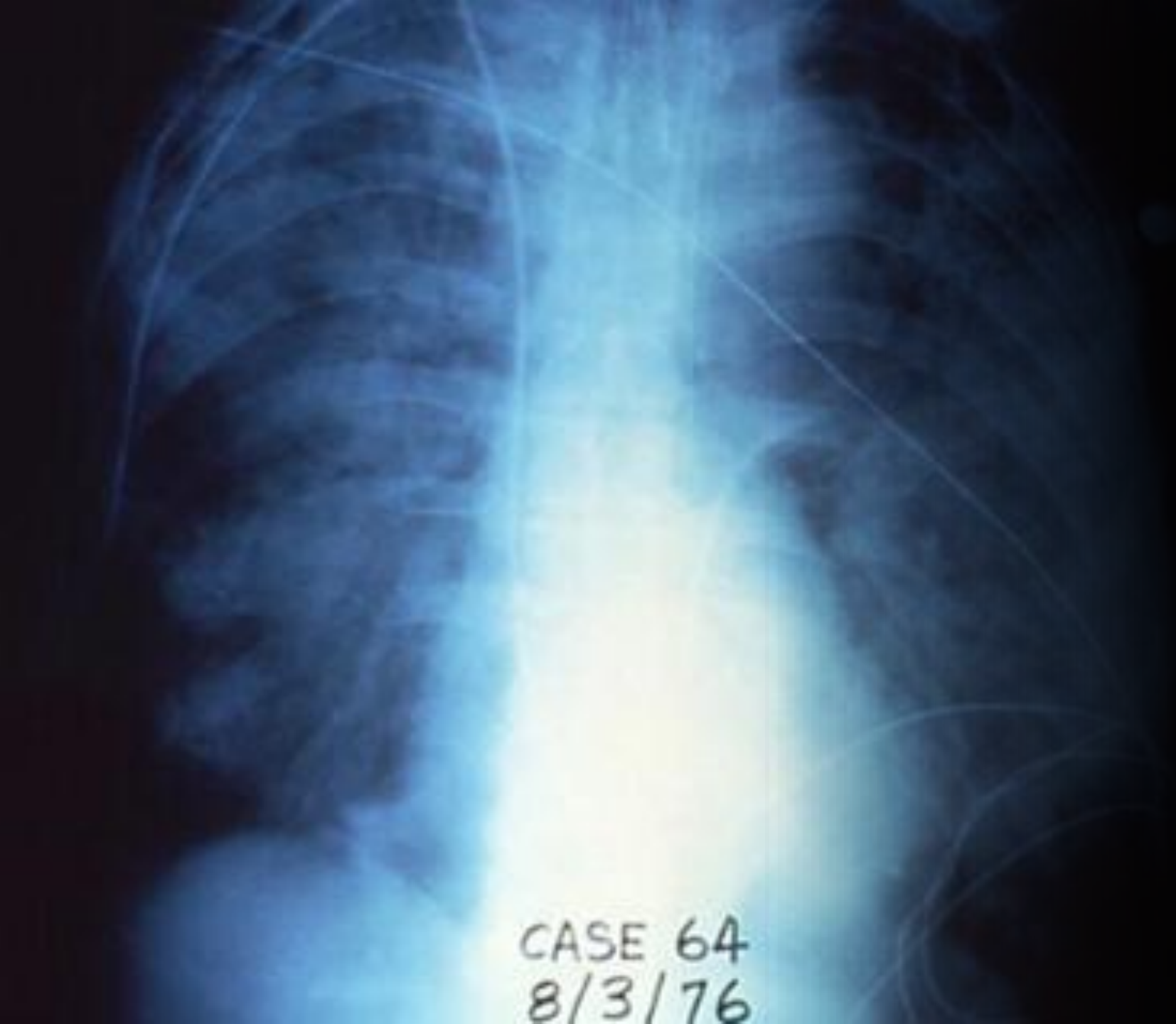


Figure 1(The Lost Hotels, 2026)

Casualties

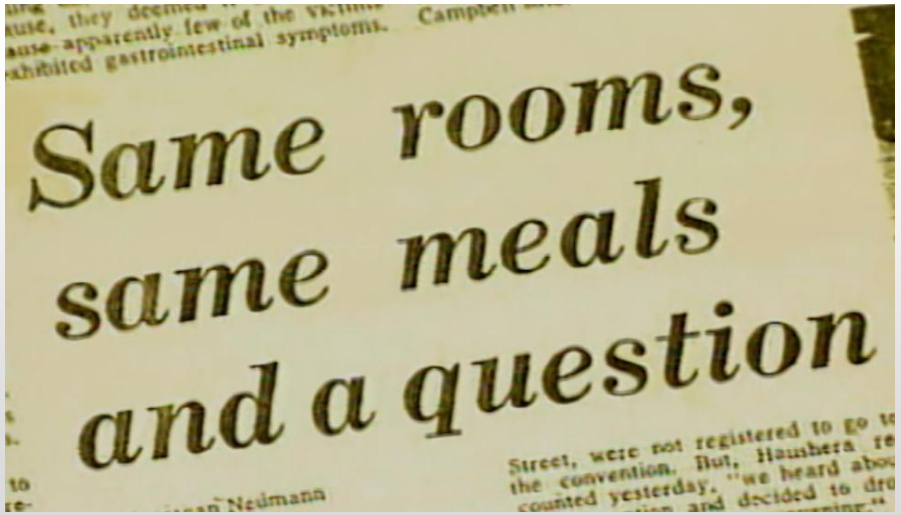
Figure 1 (Altman 2001)

Figure 2 (The Philadelphia Legionnaires' Outbreak, 2023)



The pneumonia-like symptoms were nearly the same in every case—muscle aches, headaches, severe coughs, diarrhea, chest pains and fevers as high as 107 degrees.

Figure 1 ([Legionnaires' Disease Xray January 01, 1976] ,



All Images from: (LaGarde,1996)

Investigative Team

- Epidemiologists
- State health workers
- Laboratories
- Medical staff in hospitals
- Investigators

Figure 1 (Geothermal, 2020)

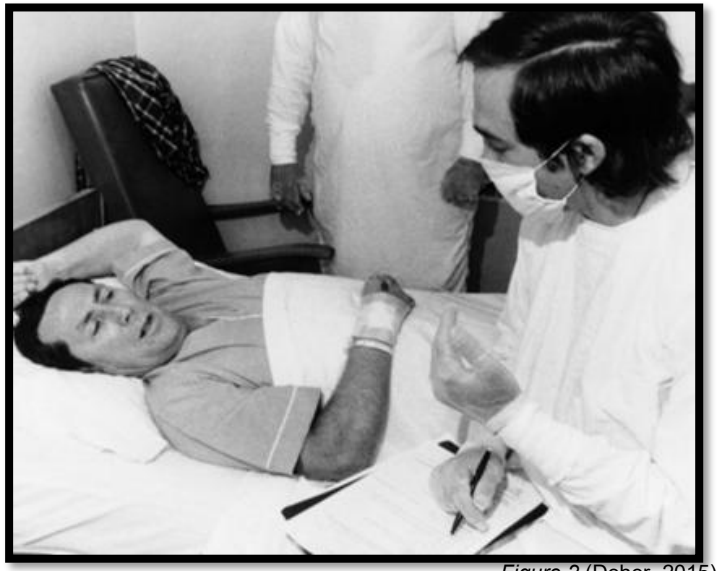


Figure 2 (Deher, 2015)

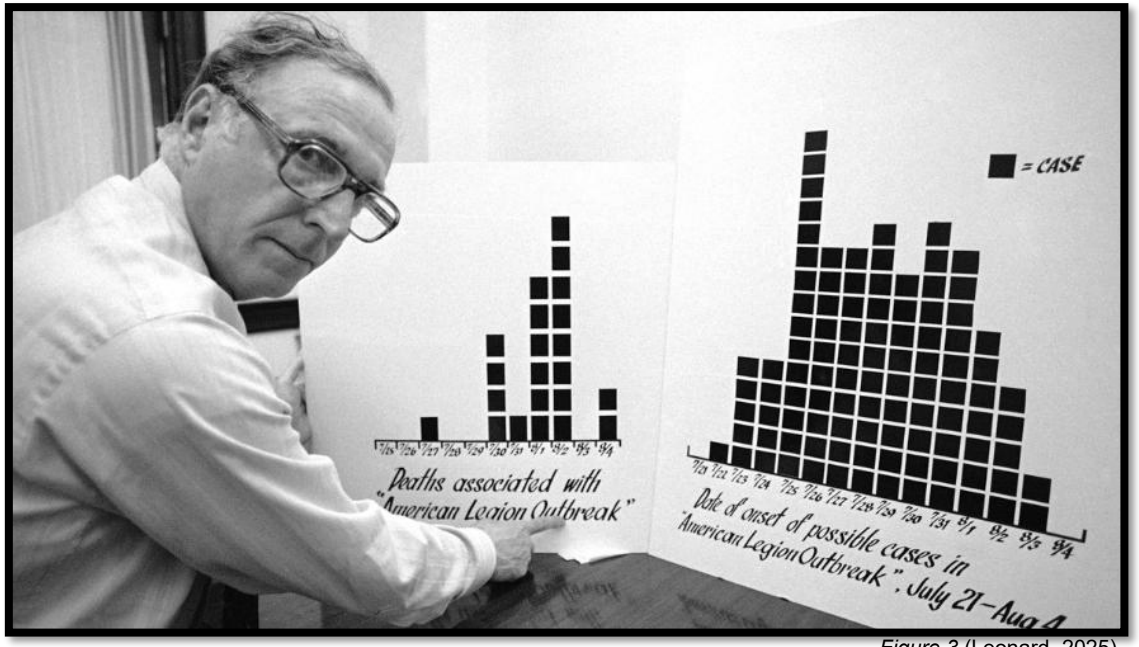


Figure 3 (Leonard, 2025)

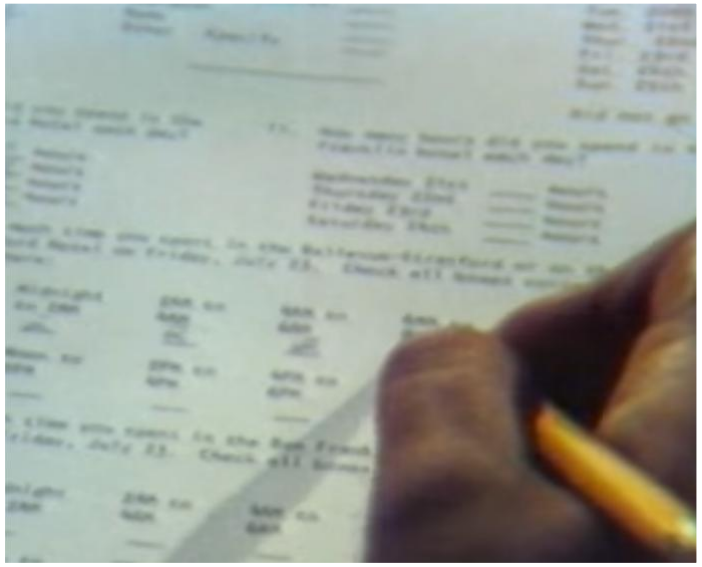


Figure 1 (LaGarde,1996)

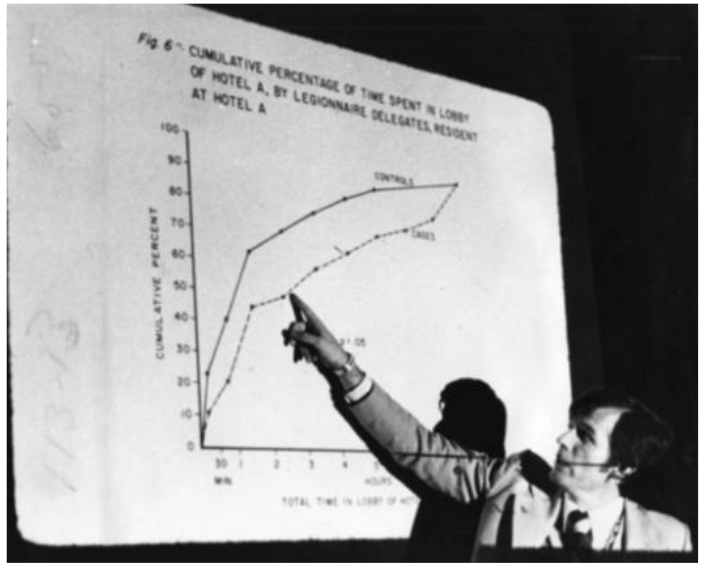
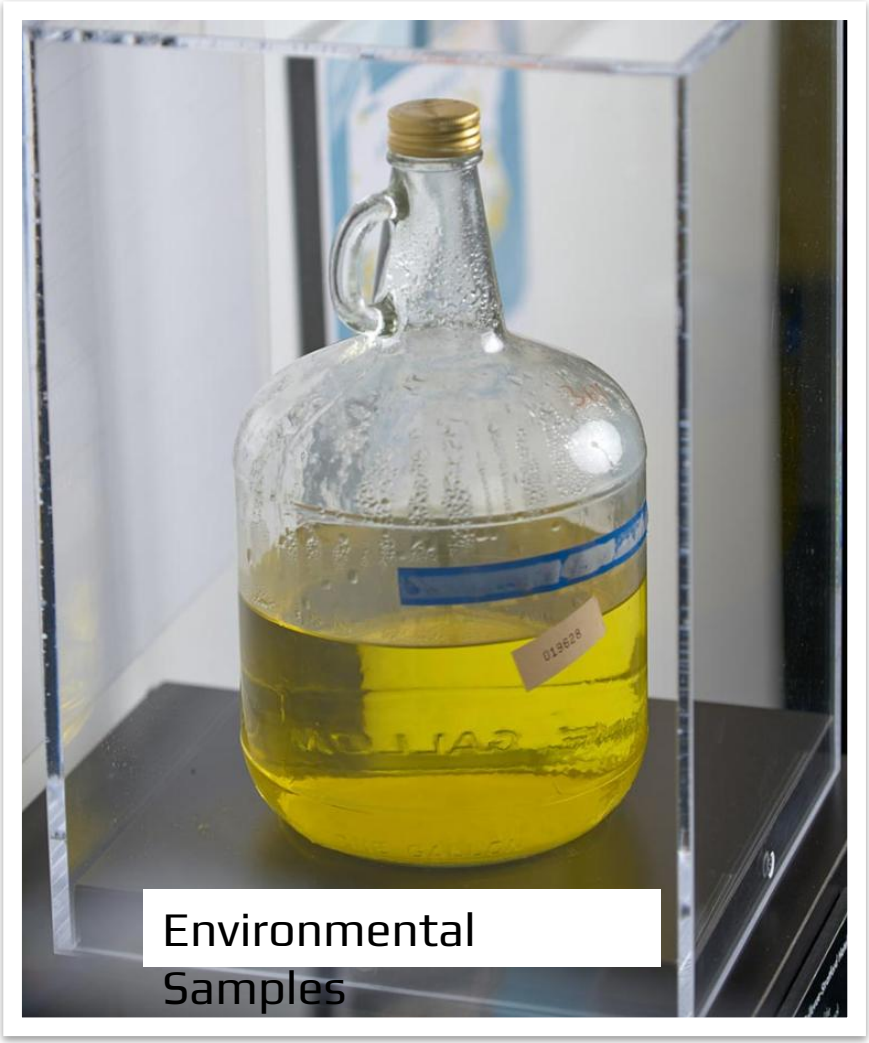


Figure 2 ([Graph at the Legionnaire's Disease Symposium], n.d)

Data Collection


Environmental Samples

David J Sencer CDC Museum: Legionnaires Exhibit

All images: (Center for Disease Control and Prevention, 202

Figure 1 (Norman, 2025)

San Francisco Chronicle

The Largest Daily Circulation in Northern California

112th Year No. 173 ★★★★ WEDNESDAY, AUGUST 4, 1976 777-1111 20 CENTS

Fear Among the Legionnaires

Williamsport, Pa.

Richard W. Snyder has been feeling his forehead all day.

His best friend, William J. Hartman, 65, was in critical condition at Williamsport Hospital with the mysterious illness that has stricken American Legion members all over Pennsylvania.

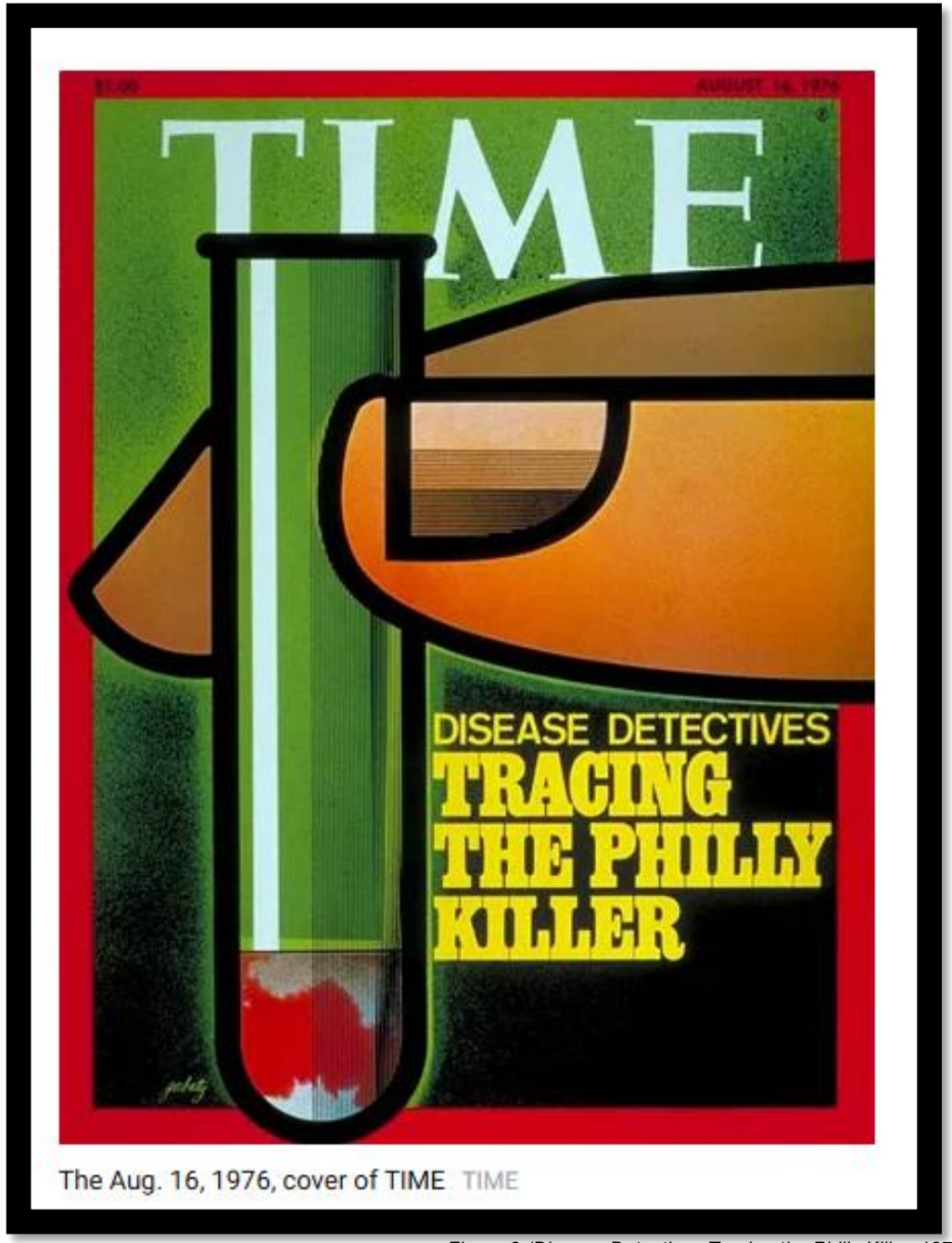
Another friend, Charles Bathurst, 40, was fine Monday night when Snyder called him. Bathurst entered the hospital yesterday afternoon, with the same fever and headache that has marked the illness in other legionnaires who

Back Page Col. 1

Legion Mystery

Disease Toll Rising— Doctors Still Baffled

Figure 2 (O' Rourke, 2016)



The Aug. 16, 1976, cover of TIME TIME

Figure 3 (Disease Detectives Tracing the Philly Killer, 1976)

MEDIA FRENZY!

All images: (Wolfman-Arent, 2021)

THE CLOSURE OF GROUND ZERO

All images (The Lost Hotels, 2026)

The Bellevue-Stratford Hotel

Theories & Speculation

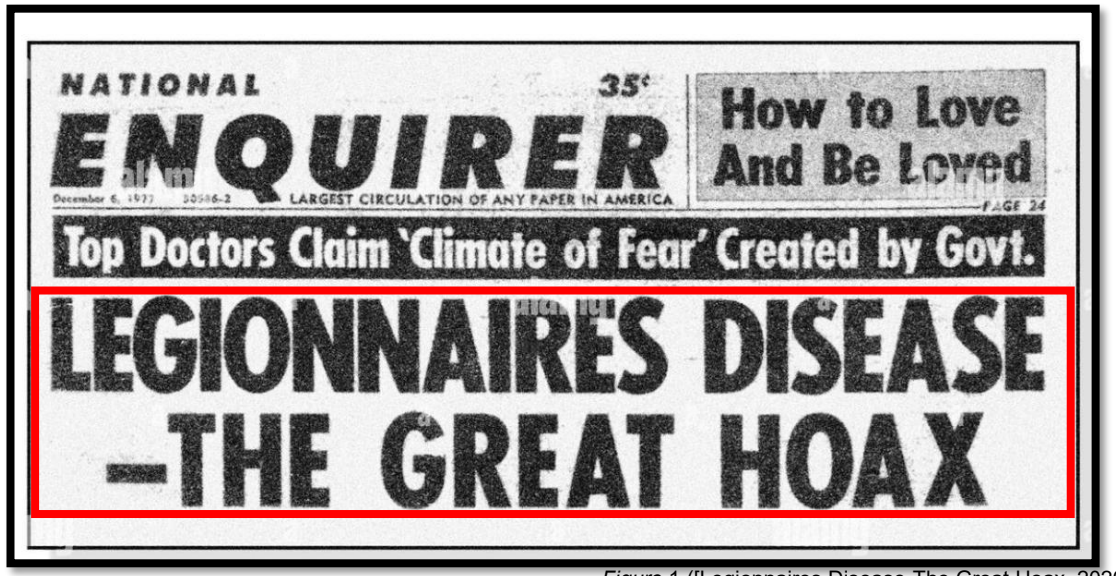

NATIONAL
ENQUIRER
35¢
LARGEST CIRCULATION OF ANY PAPER IN AMERICA
How to Love And Be Loved
Top Doctors Claim 'Climate of Fear' Created by Govt.
LEGIONNAIRES DISEASE —THE GREAT HOAX

Figure 1 ([Legionnaires Disease-The Great Hoax, 2020)

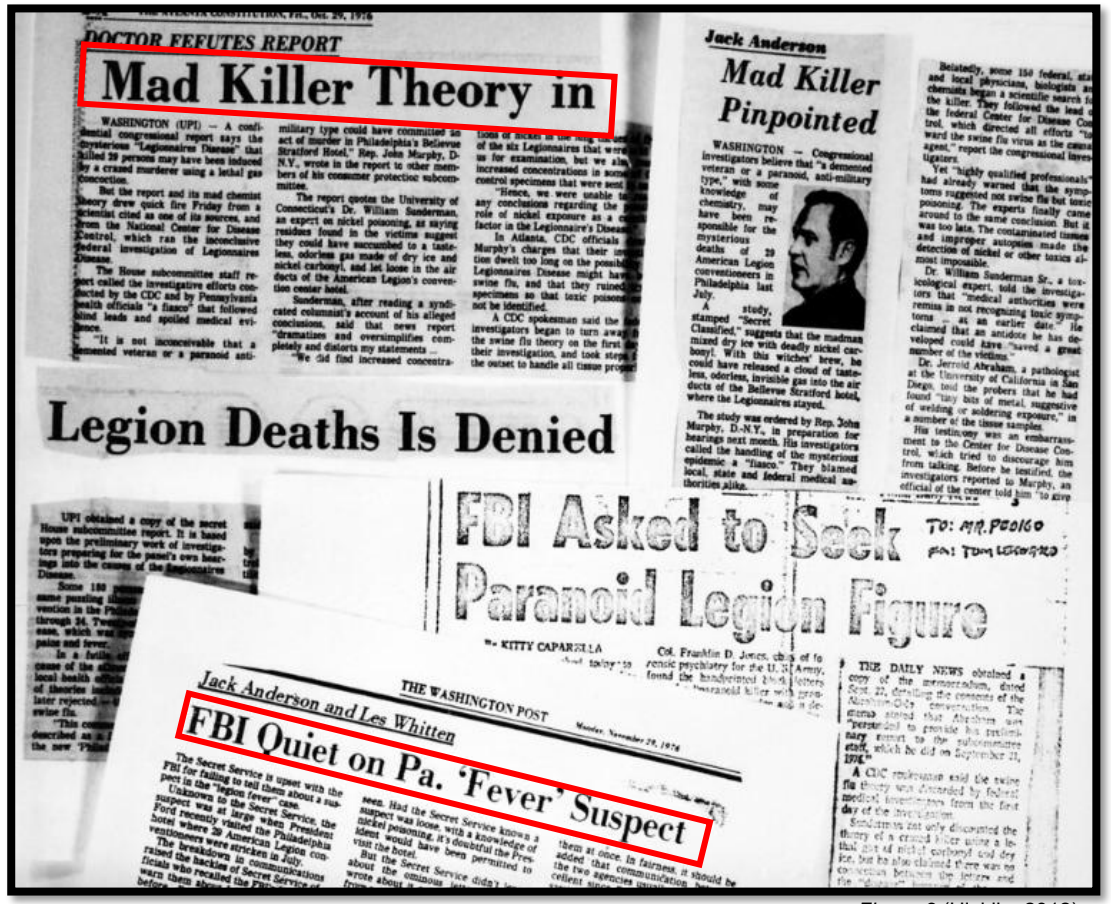

DOCTOR REFUTES REPORT
Mad Killer Theory in
Legion Deaths Is Denied
Jack Anderson
Mad Killer Pinpointed
FBI Asked to Seek Paranoid Legion Figure
Jack Anderson and Les Whitten
FBI Quiet on Pa. 'Fever' Suspect

Figure 2 (Hicklin, 2012)

```
     A                      D           E                A         D
Some say it was radiation,  some said: acid on the microphone
    A                              D                E
And some say it was a combination   of things that turned their heart
    D                                        E
But whatever it was, it drove them to their knees
E7                      |: A . . .  D . . .  E . . . | . . . .  :|
Oh, that Legionnaire's disease


I wish I had a dollar for everyone that died within that year
Got 'em grabbed by the collar, and plenty a maiden shed a tear
Now beneath my heart, it sure put on a squeeze,
Oh, that Legionnaire's disease
It was Legionnaire's disease

Granddad fought in a revolutionary war, father in the War of 1812
Uncle fought down in Vietnam and then he fought a war all by himself
But whatever it was, it hit him like a tree
Oh, that Legionnaire's disease
It was Legionnaire's disease
It was Legionnaire's disease
It was Legionnaire's disease
```

Figure 1 (Dylan, 1978)

Bing Videos

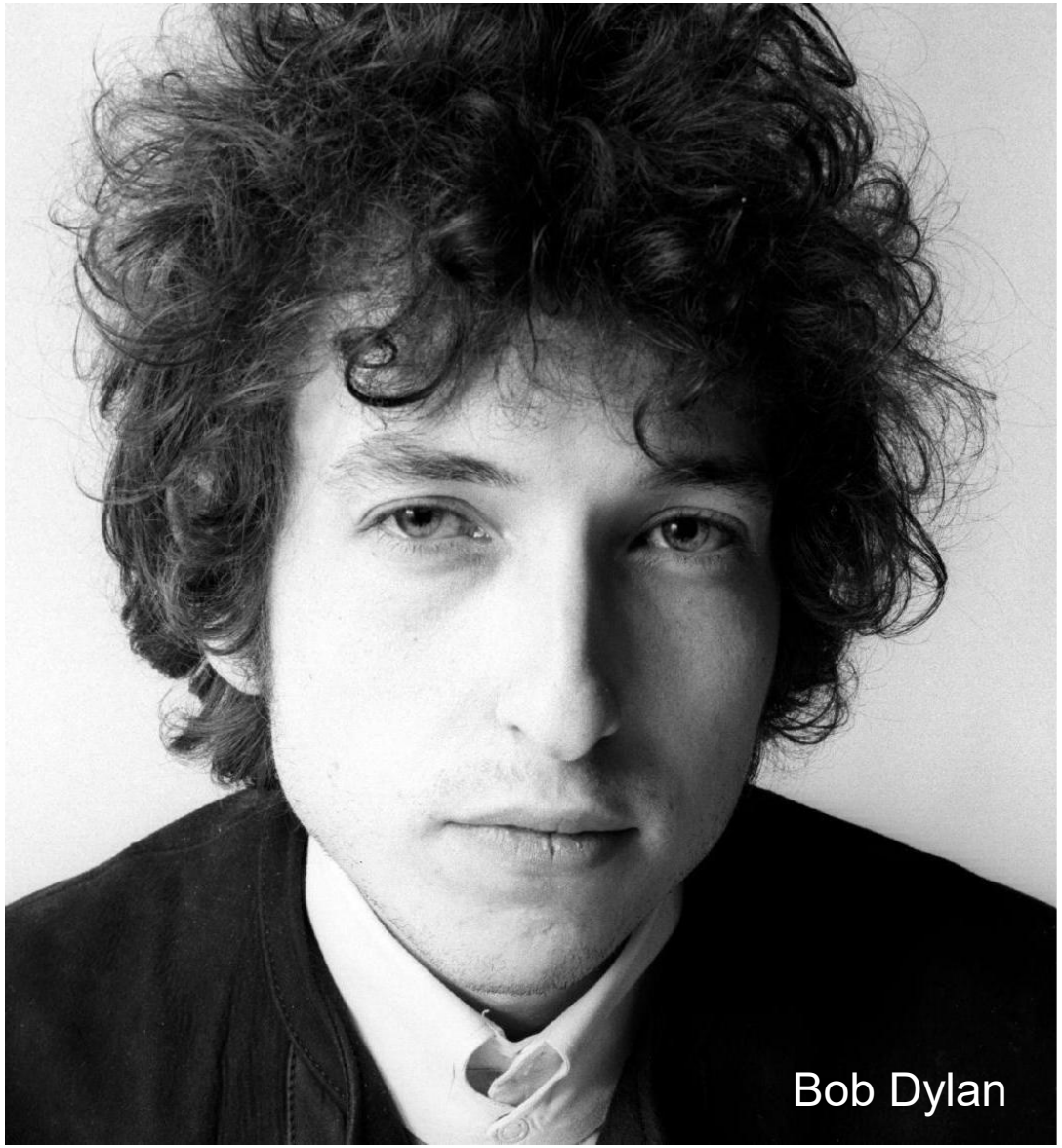


Figure 2 (Davison, M., Fishel, P, 2023)

A Race Against Time

The Pittsburgh Press

3:30 STOCKS Down 2.04

FRIDAY, AUGUST 6, 1976

25 DEAD; LEGION ILLNESS EBBS

May Remain A Mystery, Scientists Say

Convention Choice Ends In Death

Figure 1
(Rossiter,1976)

San Francisco Chronicle

Fear Among the Legionnaires

Legion Mystery

Disease Toll Rising—Doctors Still Baffled

Air Crash Kills Winner In Primary

20 Dead, Many Sick

Convoy From Tal Zaatar

91 Palestine Wounded Saved

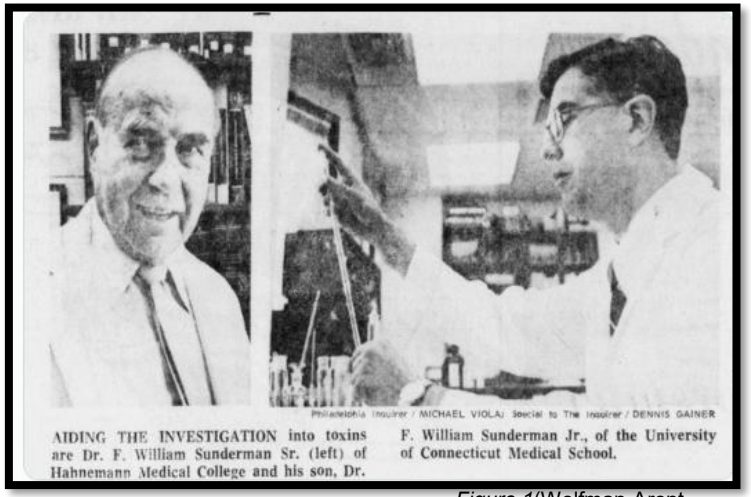
Antitrust Probe of Automakers

2 Dead in Shooting — Millionaire Held

Thieves Cart Off 3 Tons of Coins

Index

Figure 2 ([The baffling birth of Legionnaires' disease. Chronicle Covers],1976.)



Philadelphia Inquirer / MICHAEL VIOLA Special to The Inquirer / DENNIS GAINER

AIDING THE INVESTIGATION into toxins are Dr. F. William Sunderman Sr. (left) of Hahnemann Medical College and his son, Dr. F. William Sunderman Jr., of the University of Connecticut Medical School.

Figure 1(Wolfman-Arent, 2021)

*Figure 2 (*LaGarde, 1996)

Above-Normal Nickel Found in Legionnaires

Farmington, Conn. — (AP) — Scientists today found higher than normal nickel levels in tissue from victims of the mysterious legionnaires' disease.

They cautioned against premature conclusions in that high levels of nickel also were found in tissue from other humans.

The researchers are looking into the possibility that the Legion illness was caused by poisoning from nickel carbonyl.

After an American Legion convention July 21-24 in Philadelphia, 27 persons died and 128 others became ill, and their symptoms were similar to those of nickel carbonyl poisoning.

Dr. F. William Sunderman, who heads the University of Connecticut research team, said today nickel carbonyl is "one of the most toxic gases known." But he said he didn't know where it would have come from at the

Sunderman said he has asked for more tissue samples and added it would take several days to reach a conclusion. He said the tissue from the victims and the normal tissue were sent in the same container to Connecticut, raising the possibility of contamination.

When the tests are done, results will be sent from the UConn Health Center to the Center for Disease Control in Atlanta, Ga.

Doctors at the health center examined tissues from the lungs, brains and other organs of the victims. The symptoms of the 155 persons stricken with the illness "are very, very close to the classic description of nickel carbonyl poisoning," Sunderman said.

Allegheny County Coroner Cyril Wecht said yesterday in Pittsburgh that concentrations of crystals found in the kidneys of two victims indicate

Figure 3 (Wolfman-Arent, 2021)

Search Is Focused on Toxins

Contract settled; trash pickups to be resumed

Disease has peaked, doctor says

*Figure 4 (*LaGarde, 1996)

17 Metals Dropped In Tests for Cause Of Legion Disease

By LAWRENCE K. ALTMAN
Special to The New York Times

HARRISBURG, Pa., Aug. 12 —The Center for Disease Control in Atlanta said today that 17 metals had been excluded as possible causes of the mysterious legionnaires' disease that has killed 27 persons in Pennsylvania.

Figure 5 (Altman 1996)

CDC Microbiologist Joseph McDade

“It’s like looking for a contact lens on a basketball court with your eyes four inches above the ground,”

-New York Times interview with John McDade

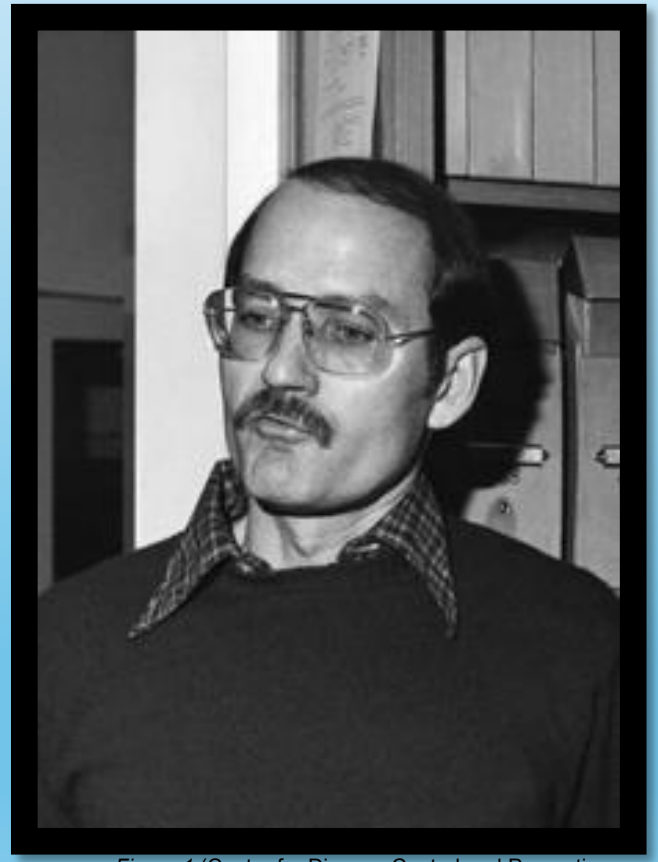


Figure 1 (Center for Disease Control and Prevention, n.d.)

Figure 2 (Bouscher, 2023)

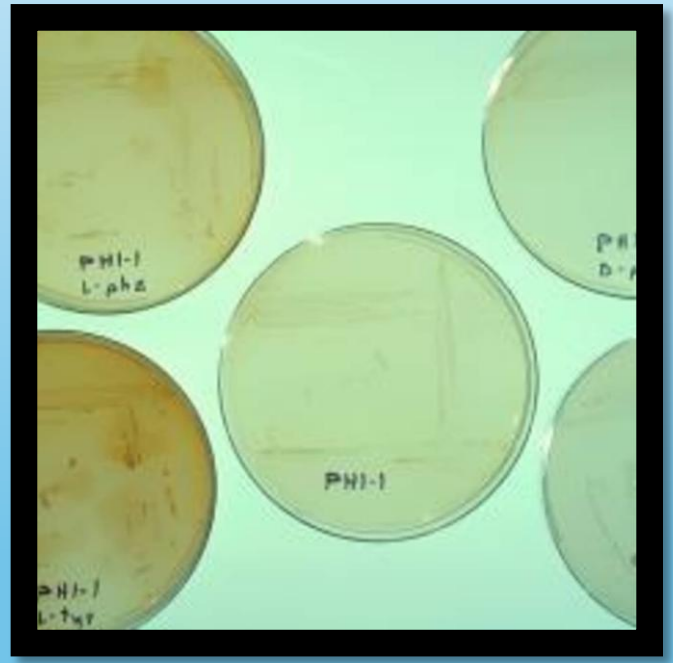


Figure 3 (Klein, 2006)

Figure 1 ([Christmas tree 1978], 1978)

THE TURNING POINT: Christmas

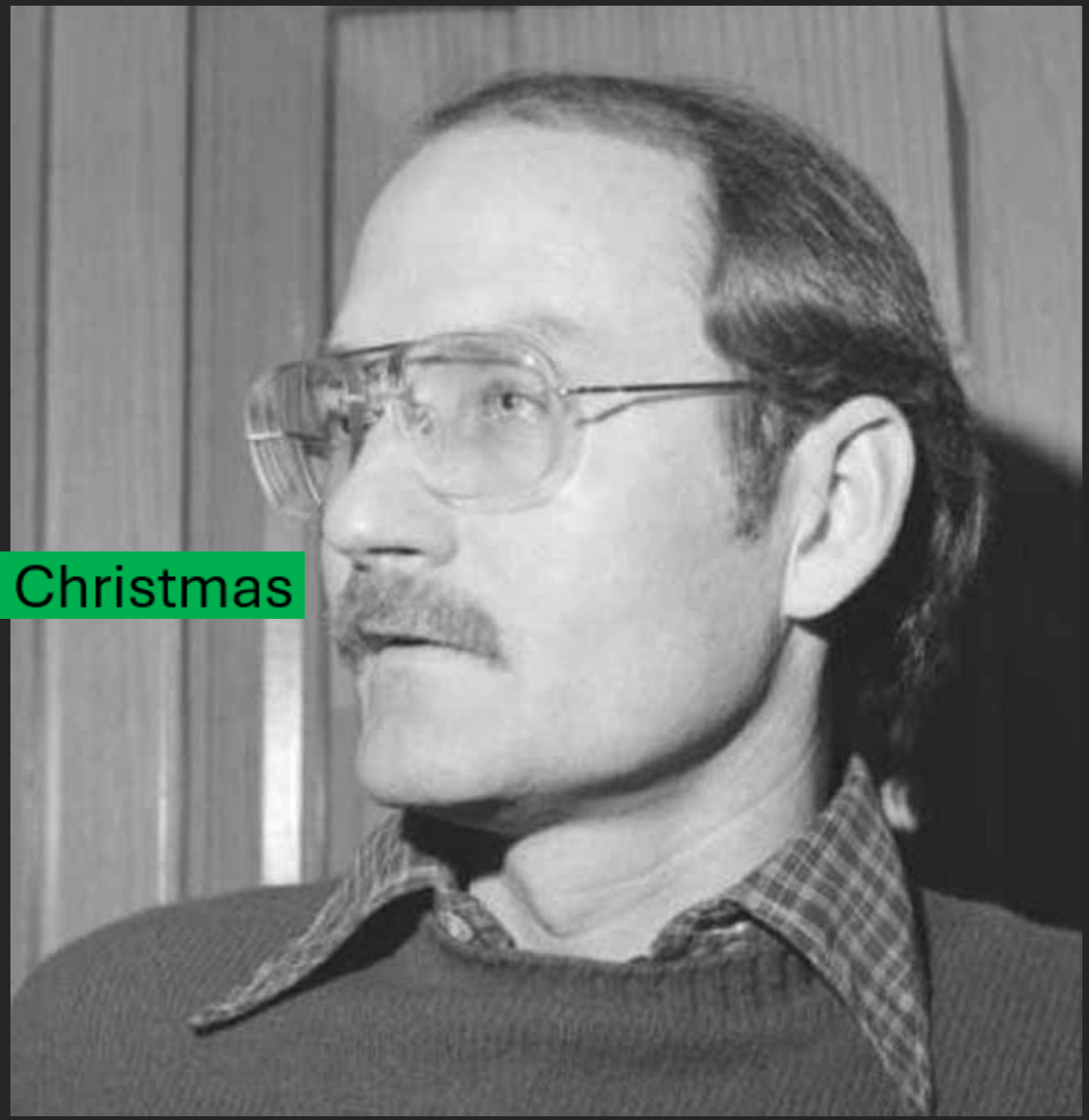
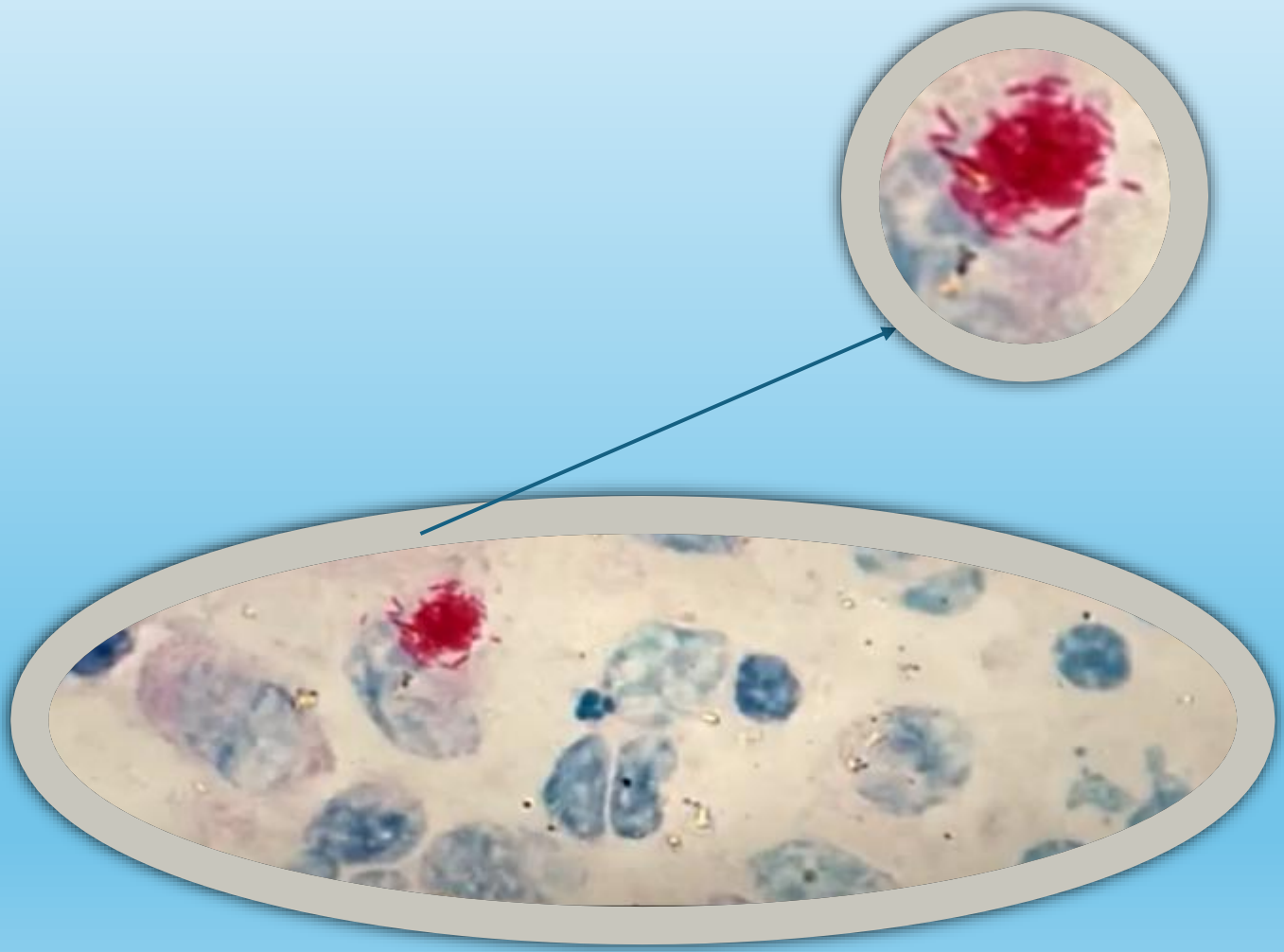
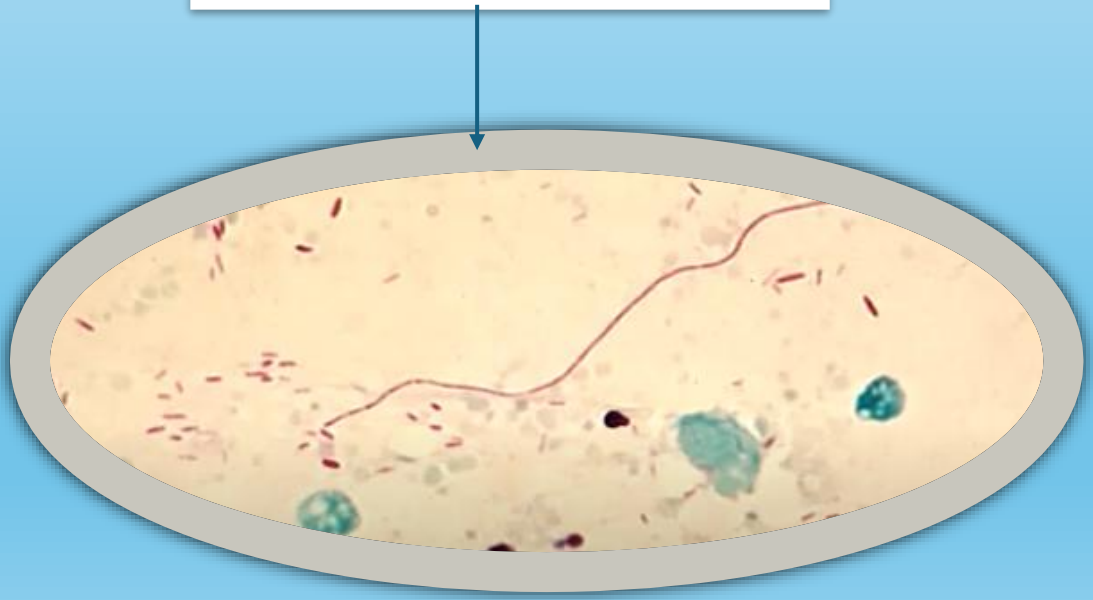


Figure 2 (Gordan, 2016)

The discovery: January 18, 1977





All images: (Bouscher, 2023)

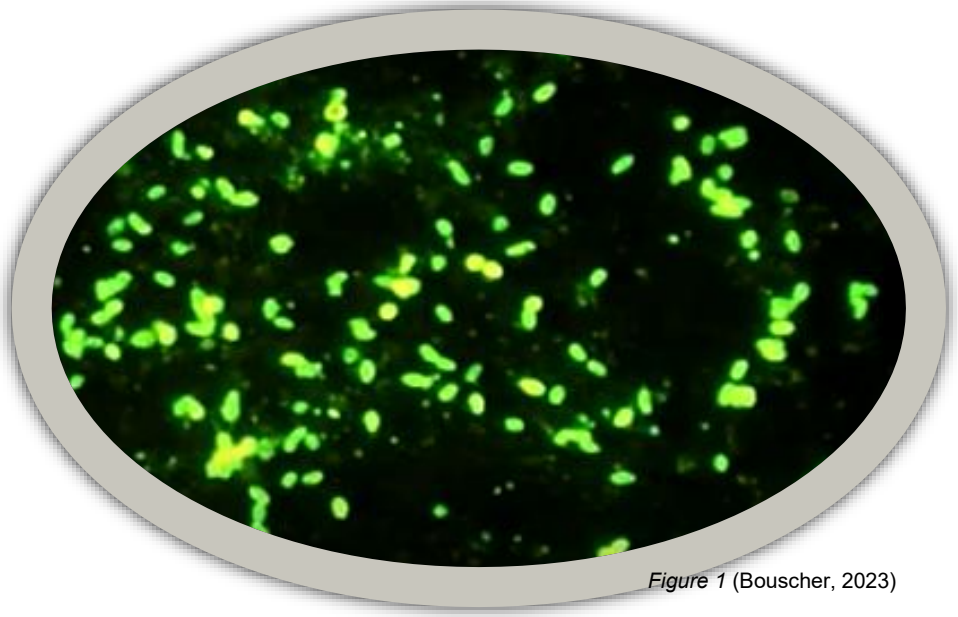


Figure 1 (Bouscher, 2023)

Figure 2 (LaGarde,1996)

"As we broke the code and found out that they were falling into this particular pattern, I can still remember the hair raising up on the back of my neck."

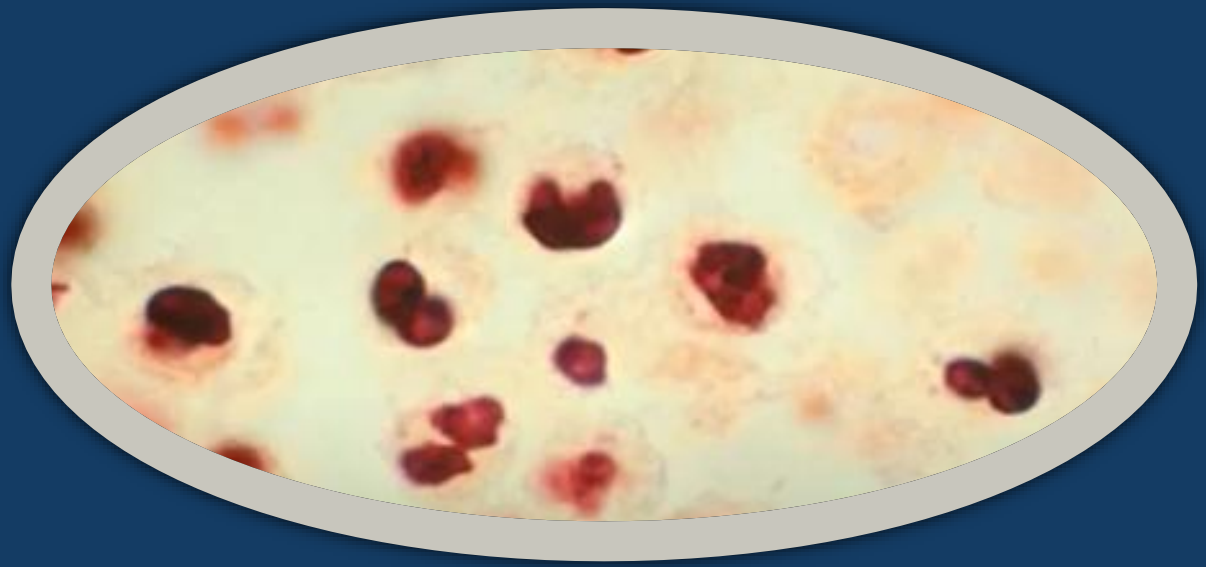
FORMER CDC MICROBIOLOGIST JOSEPH MCDADE

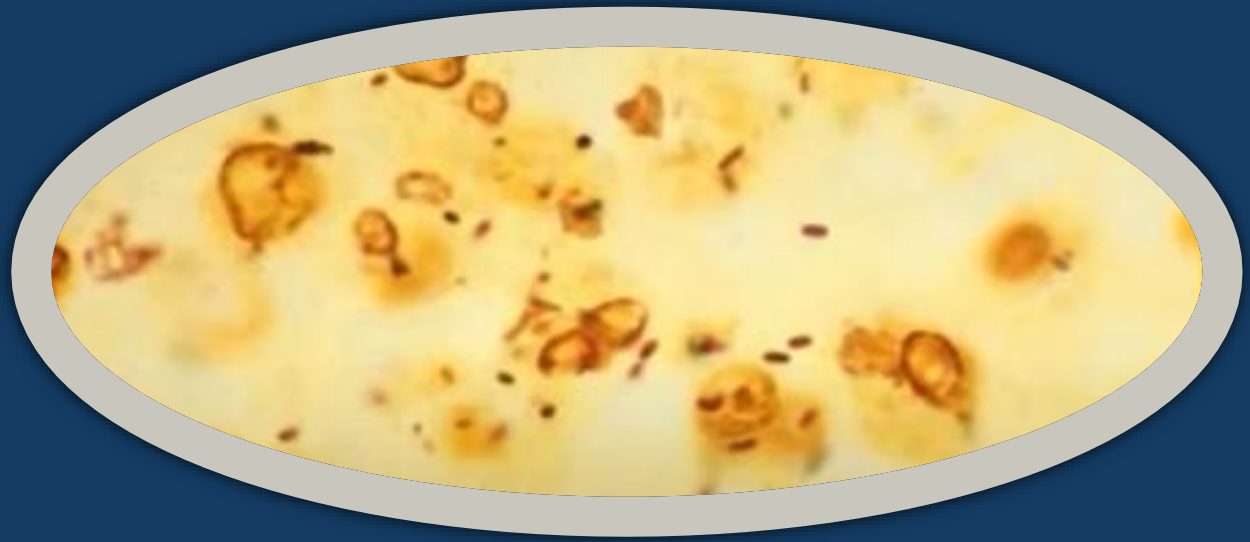
Figure 3 (LaGarde,1996)

Feeley Gorman Agar

Figure 1 (Bouscher, 2023)

HOW WAS LEGIONELLA MISSED?





All images: (Bouscher, 2023)


The Philadelphia Inquirer

Legion Disease Cause Found; How It Spread Still Unknown

It's getting warmer --sort of

Unusual organism isolated

Figure 1 (LaGarde, 1996)


Legion disease cause is found

Figure 3 (LaGarde, 1996)

Figure 2 ([Erythromycin], n.d)

Figure 1 (Washington Post, 2019)

Figure 2 ([Pontiac Michigan], n.d)

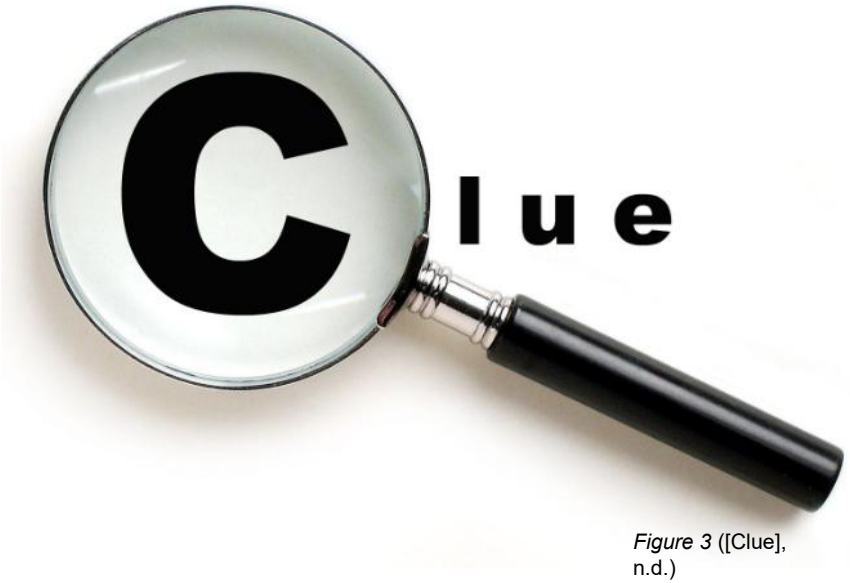


Figure 3 ([Clue], n.d.)

ST. ELIZABETHS MENTAL HOSPITAL 1965 & PONTIAC FEVER MICHIGAN 1968

Legionella linked to cooling tower

The legionella bacterium was found to be breeding in the cooling tower of the hotel's air-conditioning system.

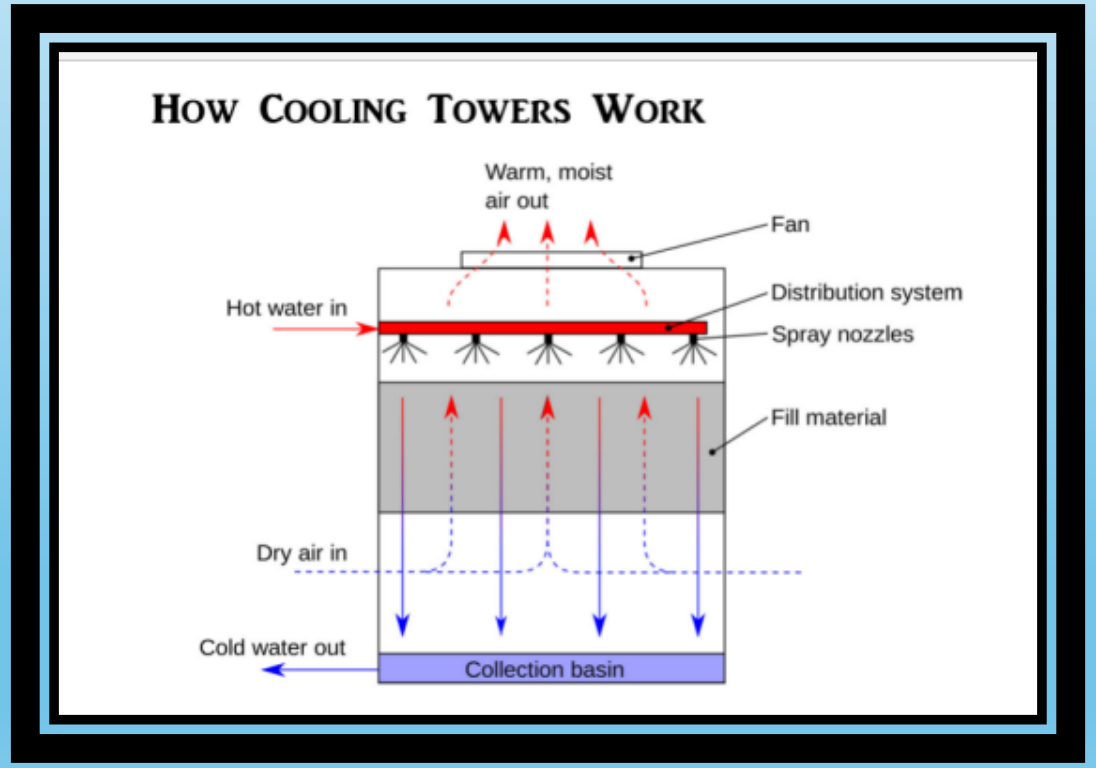


Figure 1 ([How cooling towers work], n.d.)

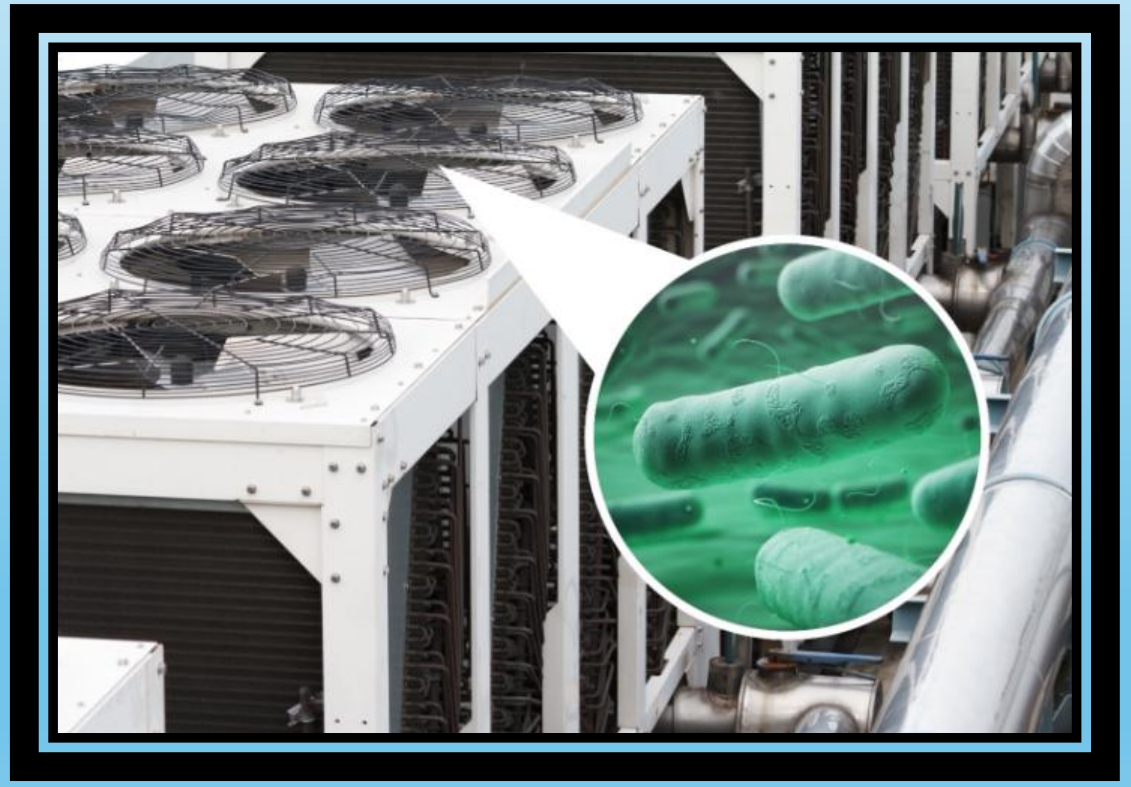


Figure 2 (Arsenault, 2017)

Burlington VT Hospital Outbreak 1977

Figure 1 ([Burlington VT hospital 1977], n.d.)

Bloomington Indiana Outbreak 1978

- Campus of Indian University: 36,000 students centered around Indiana memorial union that houses students & clubs & hotel for visitors
- March 1978-Aug 1978
- 39 cases of legionella
- 3 deaths
- CDC investigated water tower and found legionella

Figure 1 ([Campus of Indiana University Memorial Union] , n.d.)

Memphis TN Hospital Outbreak 1978

- Baptist Hospital
- 44 cases, 0 deaths
- 2 samples water from air conditioning cooling tower were positive legionella

Figure 1 ([Baptist Memorial Hospital Memphis TN] n.d.)

Figure 1 ([Oxford Churchill Hospital] n.d.)

Oxford outbreak 1979

- Churchill hospital in Oxford
- Kidney transplant unit
- 2 cases of legionella, 6 months apart staying in the same room
- Legionella found in the shower head, from the facet head and the side arms of the shower head.

Legionella species are Gram-negative bacilli.

Figure 1 ([Legionella on petri dish] , 2013)

Figure 2 ([Lake].n.d)

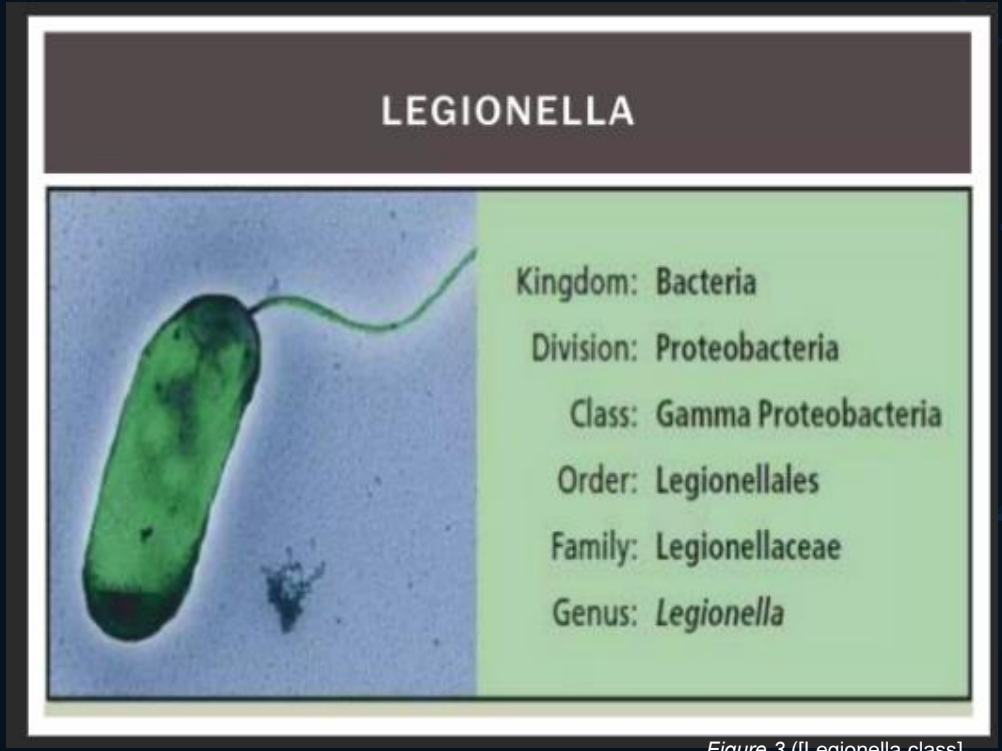


Figure 3 ([Legionella class] n.d)

Legionnaires disease (legionellosis)

a lung infection caused by the bacterium Legionella

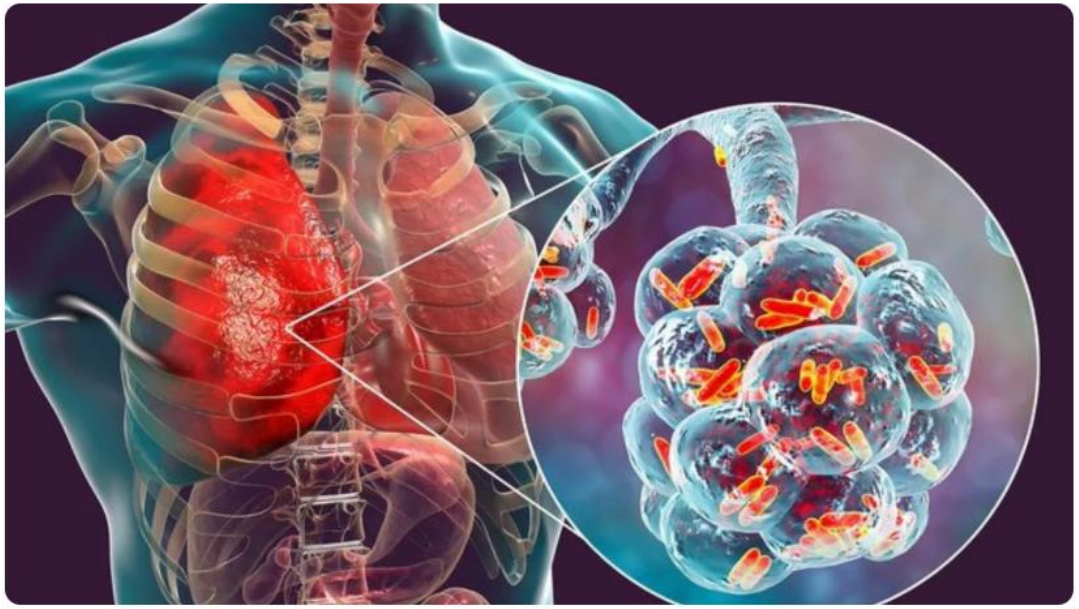


Figure 1[(Legionella lung infection] n.d.)

The NEW ENGLAND JOURNAL of MEDICINE

CURRENT ISSUE | SPECIALTIES | TOPICS

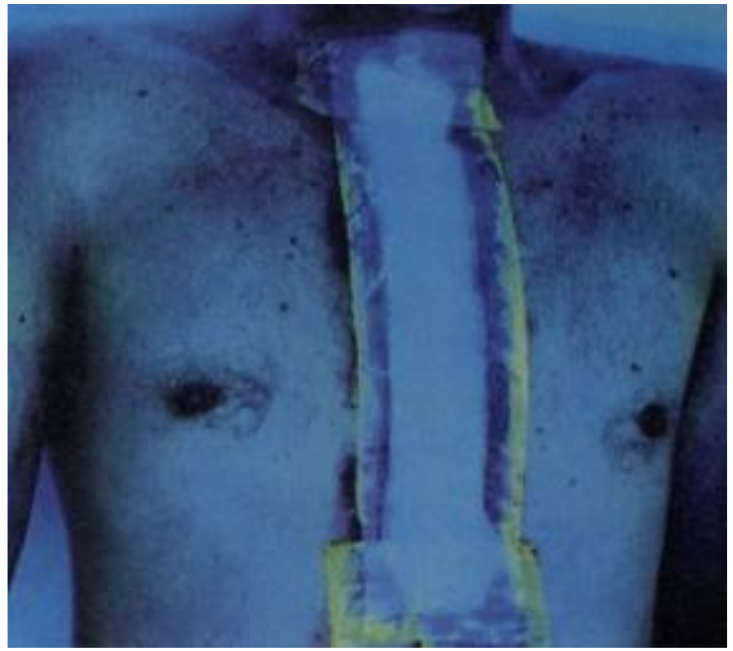
ORIGINAL ARTICLE | BRIEF REPORT

A Cluster of Legionella Sternal-Wound Infections Due to Postoperative Topical Exposure to Contaminated Tap Water

Authors: Philip W. Lowry, M.D., Rosalind J. Blankenship, R.N., Wilma Gridley, R.N., Nancy J. Troup, and Lucy S. Tompkins, M.D., Ph.D. Author Info & Affiliations

Published January 10, 1991 | N Engl J Med 1991;324:109-113 | DOI: 10.1056/NEJM199101103240207

VOL. 324 NO. 2



Figures 2 &3 (Lowry et al, 1991)

Symptoms

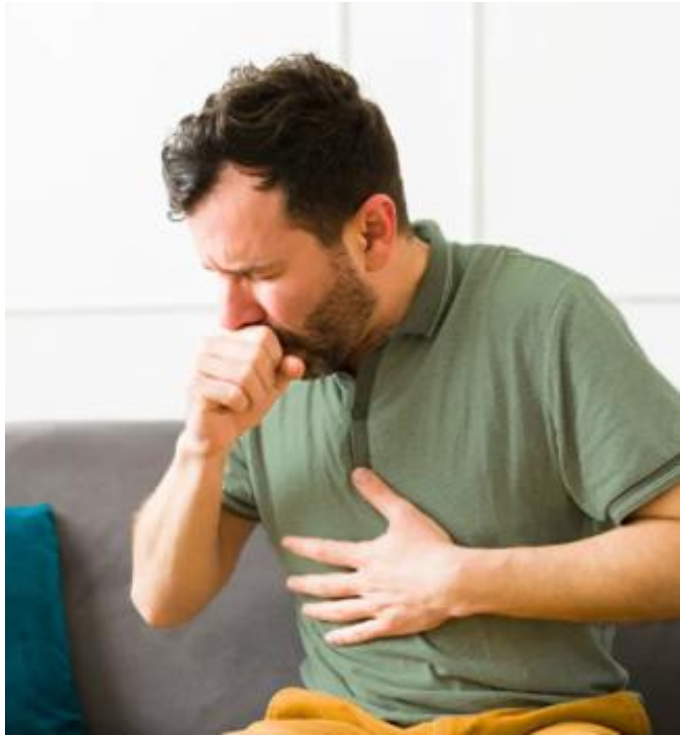


Figure 1 ([Coughing].n.d.)

- Cough
- Shortness of breath
- Muscle aches
- Headache
- Fever

Risk Factors

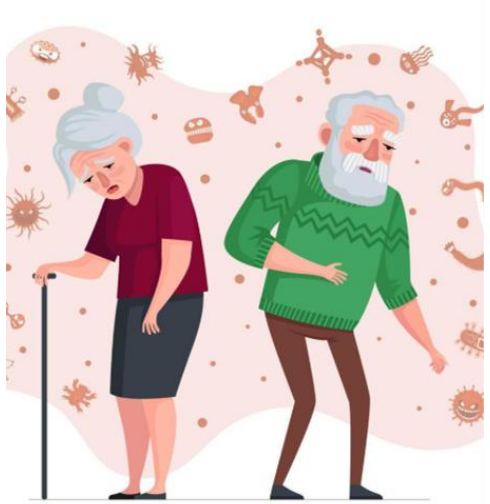


Figure 2 ([Sick elderly], n.d.)

- Elderly (50 years and older)
- Smokers (current or former)
- Specific health issues/conditions:
  - Cancer
  - Chronic lung disease
  - Diabetes
  - Kidney & liver failure
  - Weak immune system

Modes of transmission

- Breathing in mist & water containing *Legionella*
- Swallowing water into the lungs, and aspiration of drinking water/ice chips containing *Legionella*

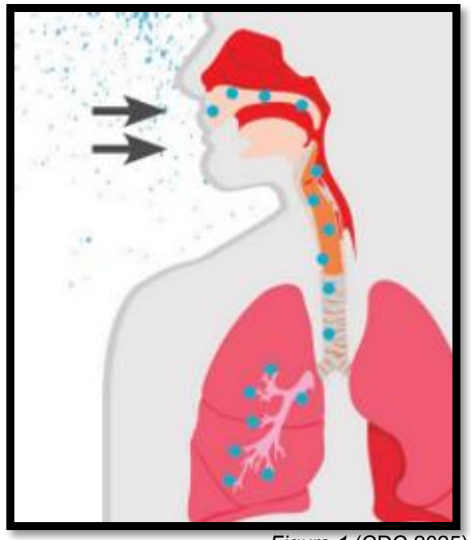


Figure 1 (CDC,2025)

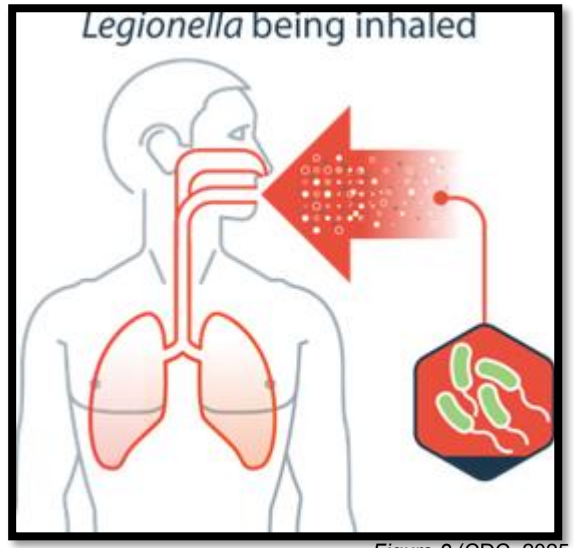


Figure 2 (CDC, 2025.)

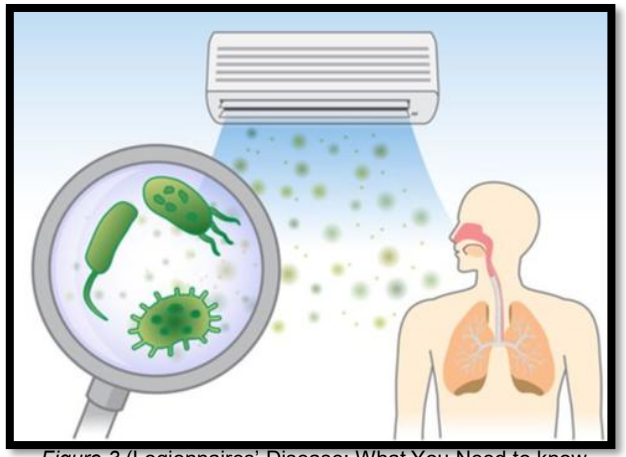


Figure 3 (Legionnaires' Disease: What You Need to know, 2018)

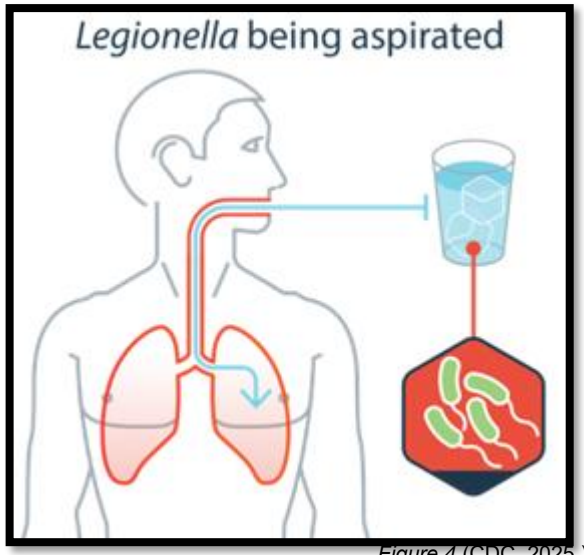


Figure 4 (CDC, 2025.)

Sources of infection

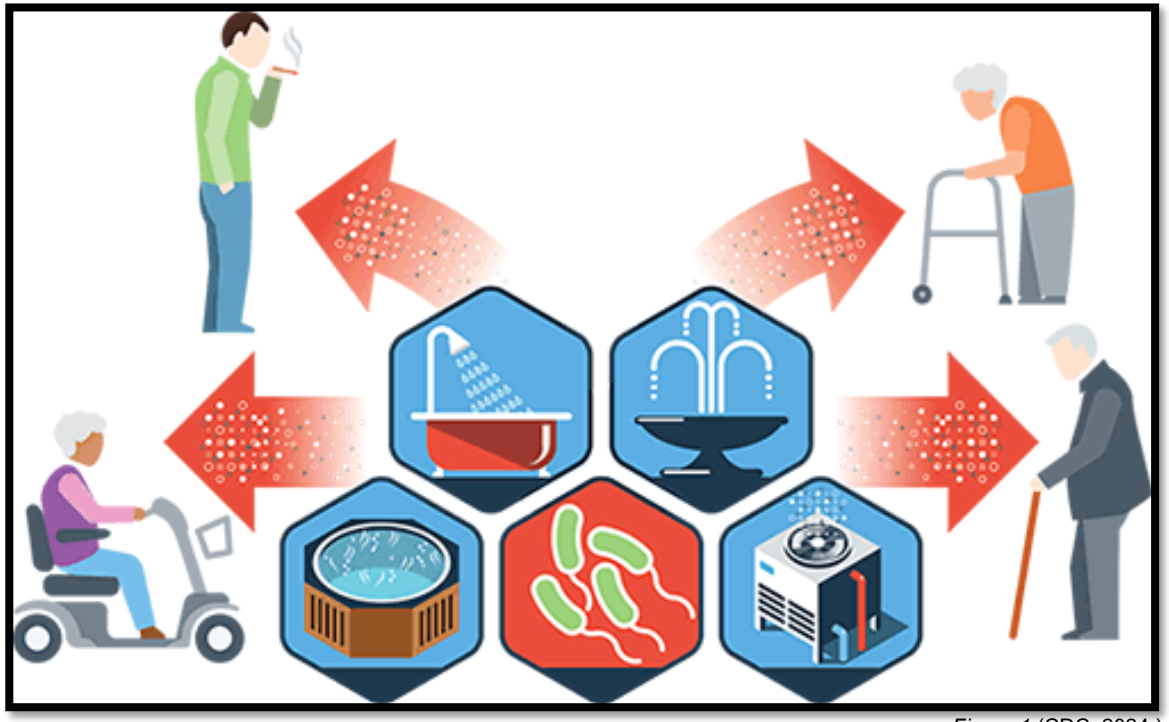


Figure 1 (CDC, 2024.)

- Respiratory equipment
- Car washes
- Misting devices
- Street cleaning machines
- Soil
- Showerheads and sink faucets
- Hot tubs
- Decorative fountains and water features
- Plumbing systems
- Contaminated water or ice
- Cooling towers
- Hot water heaters
- Humidifiers
- Hospital dishwashers

Diagnosing

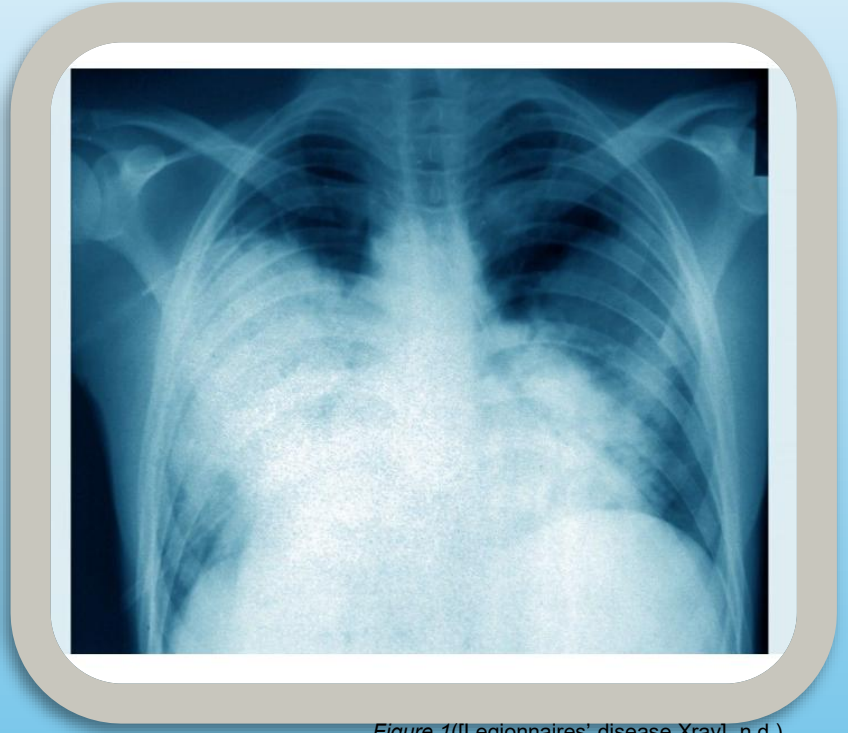


Figure 1([Legionnaires' disease Xray], n.d.)

This frontal chest radiograph shows acute bilateral pneumonia (legionnaires' disease caused by *Legionella pneumophila*

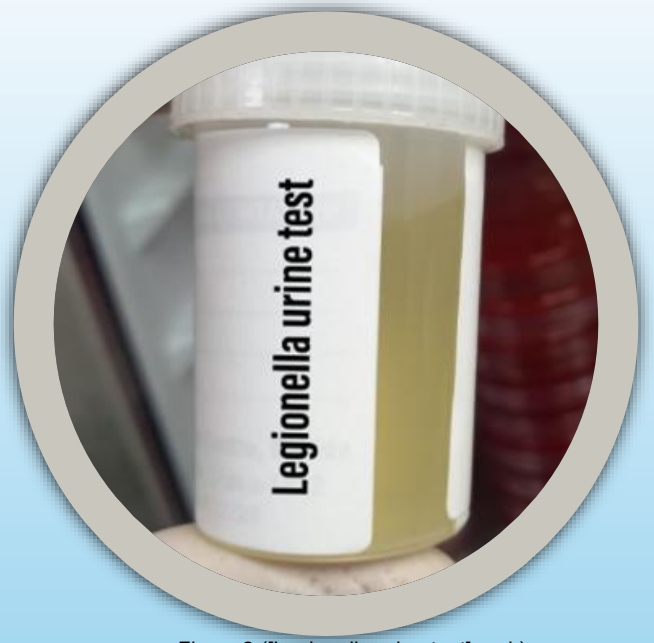


Figure 2 ([Legionella urine test], n.d.)

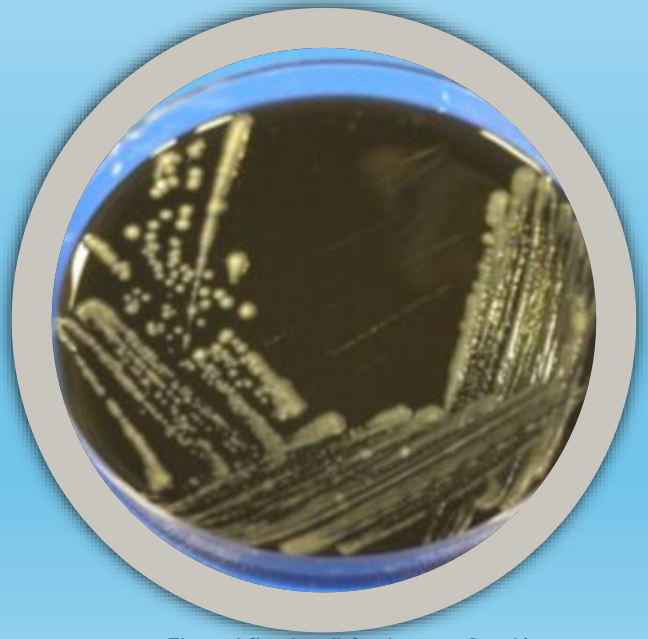


Figure 3 [Legionella] culture test], n.d.)

Figure 4 ([Legionella blood test], n.d)

Figure 5 ([Legionella PCR], n.d)

Is Legionnaires' disease contagious?

Legionnaires' disease is NOT contagious.

NO!

Unlike many types of pneumonia, Legionnaires' disease is NOT transmitted directly from person to person.

Patients with confirmed or suspected Legionella infection do not require isolation or contact precautions

Treatment & Prognosis

- Antibiotics: Azithromycin, Clarithromycin, or Levofloxacin.
- For individuals who contract the disease in health care settings, the case-fatality rate is as high as 25%.
- 1 out of 10 people who get Legionnaires' disease will die from the infection.

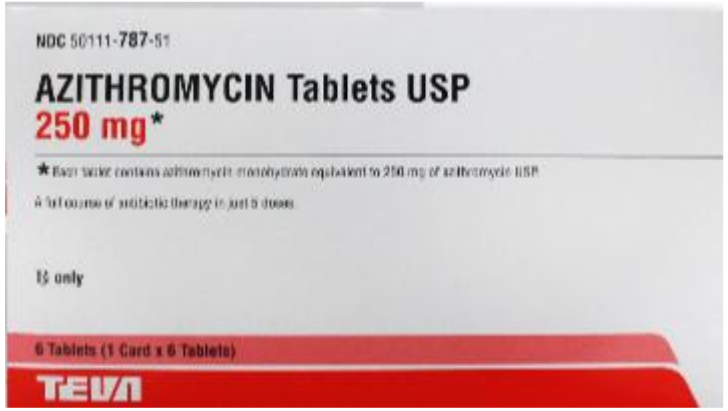


Figure 1 ([Azithromycin], n.d.)

Figure 2 ([Levaquin], n.d)

Focus on plumbing and biofilm

Figure 1 ([Biofilm in pipe],n.d.)

CONCERNS:

- Age of piping
- Scale build up
- Biofilm buildup
- Dead legs
- Water stagnation

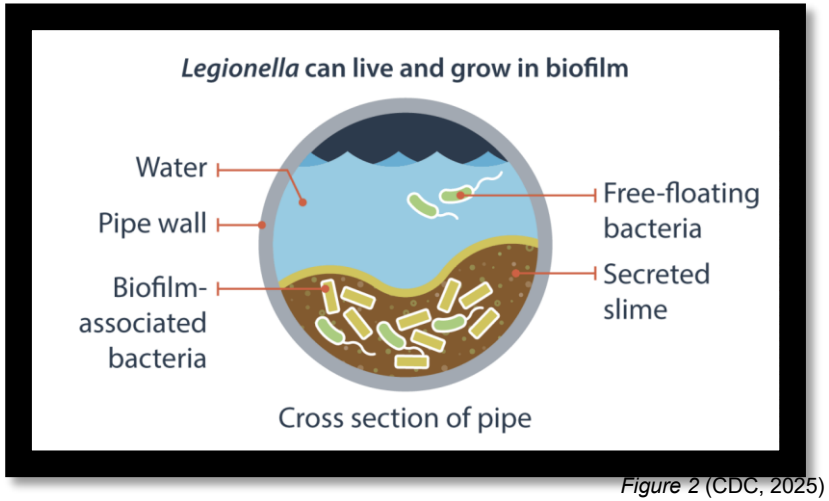


Figure 2 (CDC, 2025)

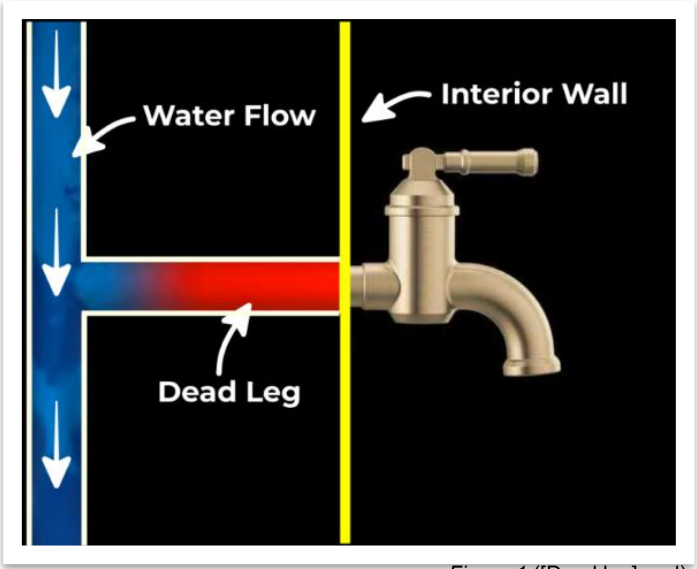


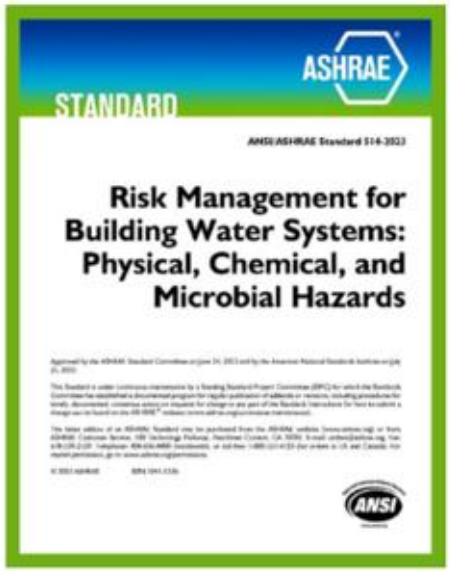
Figure 1 ([Dead leg], n.d)

Figure 2 ([Dead leg], n.d.)

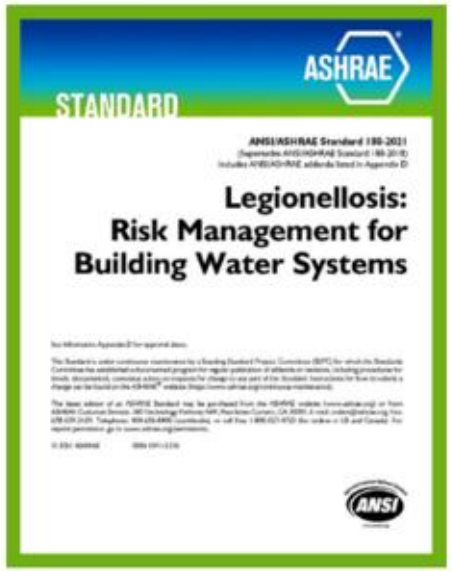
Dead Legs

A **dead leg** in a plumbing system refers to a section of piping that receives no or infrequent water flow.

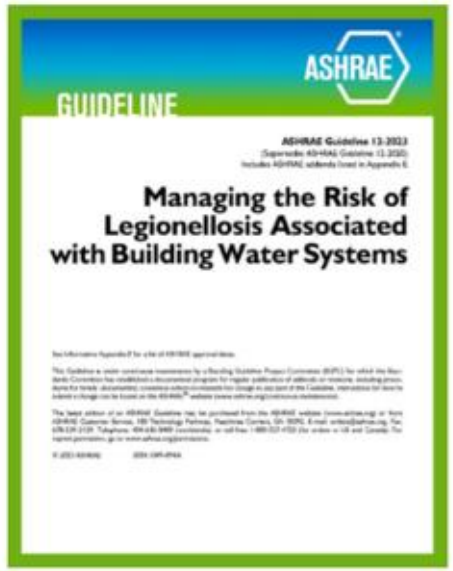
Water Management Industry Standards



ASHRAE STANDARD 514



ASHRAE STANDARD 188



ASHRAE GUIDELINE 12

- Industry standard
  - ASHRAE Standard (2015, 2018)
- Health care
  - VHA Directive 1061 (2014)
  - CMS requirement (2017)
  - The Joint Commission
- Regulations
  - State & local

Image sources: (ASHRAE, CMS, The Joint Commission, US Dept of Veterans Affairs, CMC, and NY State)

Figure 1([Drinking water], n.d.)

What is the OSHA Standard for Legionella bacteria in water?

Raw/Non-potable: not safe for human consumption and must be treated to remove impurities and contaminates.

Tap/potable water: water safe for drinking and meeting safety standards

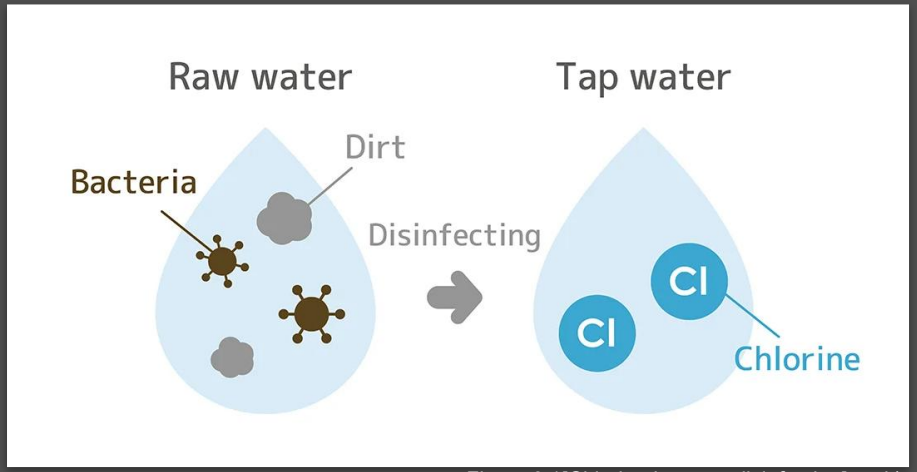


Figure 2 ([Chlorine in water disinfection], n.d.)

Figure 1. Routine *Legionella* testing: A multifactorial approach to performance indicator interpretation*°Δ

Concentration indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled			
≥10 CFU/mL† in potable water **OR** ≥100 CFU/mL in cooling towers	1.0–9.9 CFU/mL in potable water **OR** 10–99 CFU/mL in cooling towers	Detectable to 0.9 CFU/mL in potable water **OR** Detectable to 9 CFU/mL in cooling towers	No *Legionella* detected in a single round of testing	No *Legionella* detected in multiple rounds of testing	No *Legionella* detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any *Legionella* species

Change in concentration over time indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled			
100-fold or greater increase in concentration (e.g., 0.05 to 5 CFU/mL)	10-fold increase in concentration (e.g., 0.05 to 0.5 CFU/mL)	*Legionella* concentration steady (e.g., 0.5 CFU/mL for two consecutive sampling rounds)	No *Legionella* detected in a single round of testing	No *Legionella* detected in multiple rounds of testing	No *Legionella* detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any *Legionella* species

Extent indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled			
Detection in multiple locations **AND** a common source location‡ **OR** Detection across many locations within a water system	Detection in a common source location that serves multiple areas **OR** Detection in more than one location within a water system	Detection in a few of many tested locations within a water system	No *Legionella* detected in a single round of testing	No *Legionella* detected in multiple rounds of testing	No *Legionella* detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any *Legionella* species

Type¥ of *Legionella* (species and serogroup) associated with Legionnaires' disease:

Highly Associated	Less Associated
L. pneumophila serogroup 1; Non-Lp1 *L. pneumophila*; Presence of multiple different *Legionella* species or serogroups	Any non-*pneumophila Legionella* species including "blue-white" fluorescent *Legionella*

* This figure is intended for use during routine testing of potable water and cooling towers only. Due to their ability to rapidly grow and spread *Legionella*, any detection of viable *Legionella* in a hot tub or decorative fountain should prompt a response, including a review of the water management program and corrective actions. Test results are performance indicators and are not a measure of risk of human illness. This figure is not intended for use if a building or device is associated with Legionnaires' disease (LD) cases or an outbreak.

° See "Routine testing for *Legionella*" for guidance regarding suggested response activities. Comparable results may lead to different suggested response activities when other factors are considered (e.g., if there is evidence of poorly controlled growth at a healthcare facility).

Δ Considering the type of *Legionella* identified along with other *Legionella* testing performance indicators provides a clearer picture of water system control than the results of any single indicator. For example, facility owners and operators may consider implementing immediate interventions for a healthcare facility with: A. detectable but <10 colony-forming units per milliliter (CFU/mL), B. non-Lp1 *Legionella pneumophila*, C. observed at steady concentrations, but D. detected at multiple distal locations including a central water heater.

† Concentrations expressed as CFU/mL are for test results generated by traditional spread plate culture methods. If other test methods are used, consult testing lab or manufacturer instructions for appropriate interpretation.

‡ Common source location examples include water heaters, hot water returns, storage tanks, and cooling tower basins.

¥ If a facility has a history of associated LD cases, then sequencing isolates obtained during routine testing may provide performance indicators regarding outbreak strain persistence (if that strain is detected).

321985-G

Figure 1(CDC, 2025)

CDC Legionella Water Management Program Toolkit

- It is a step-by-step guide on how to create a water management plan
- Translates ASHRAE Standard 188 into plain language for wider audiences

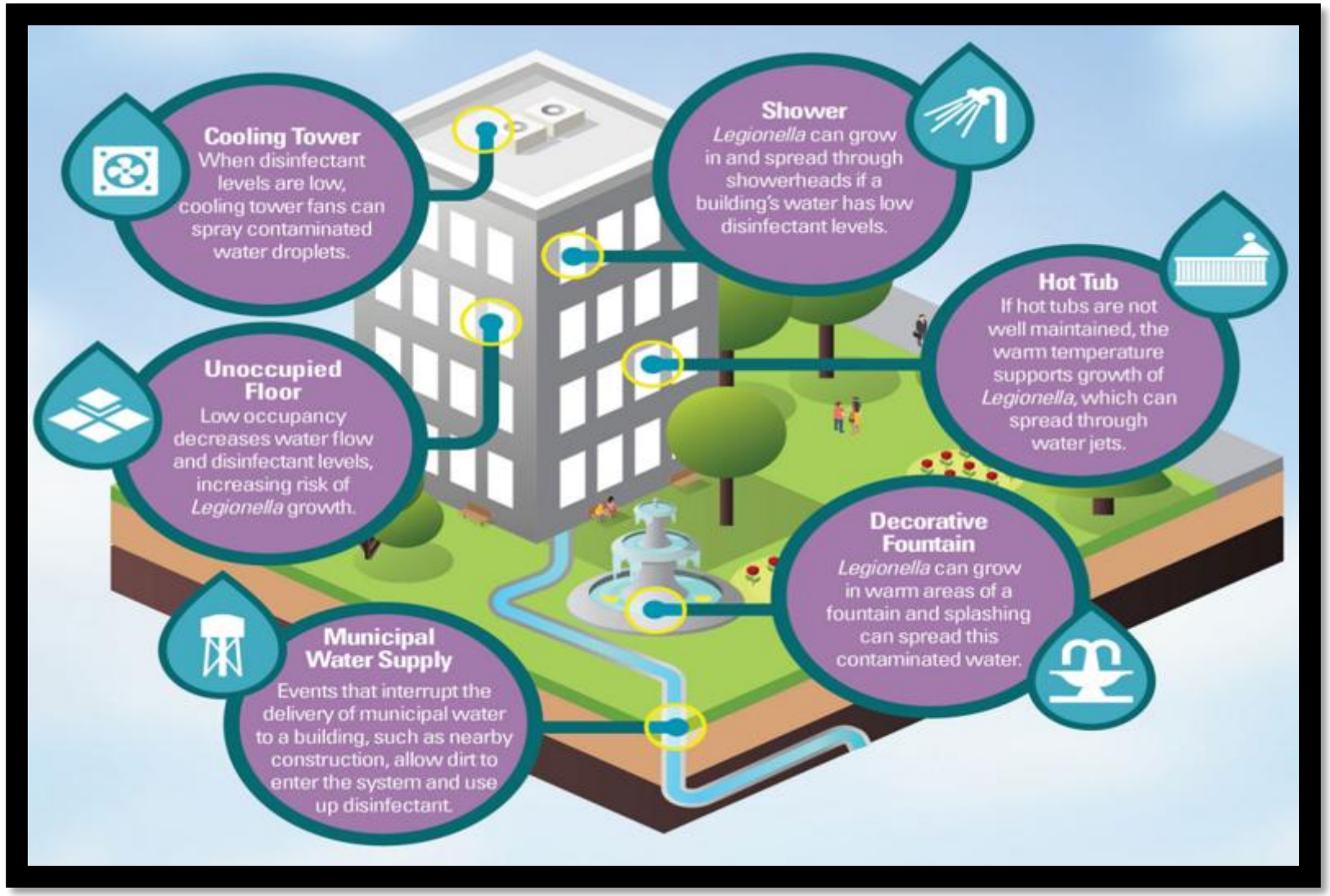


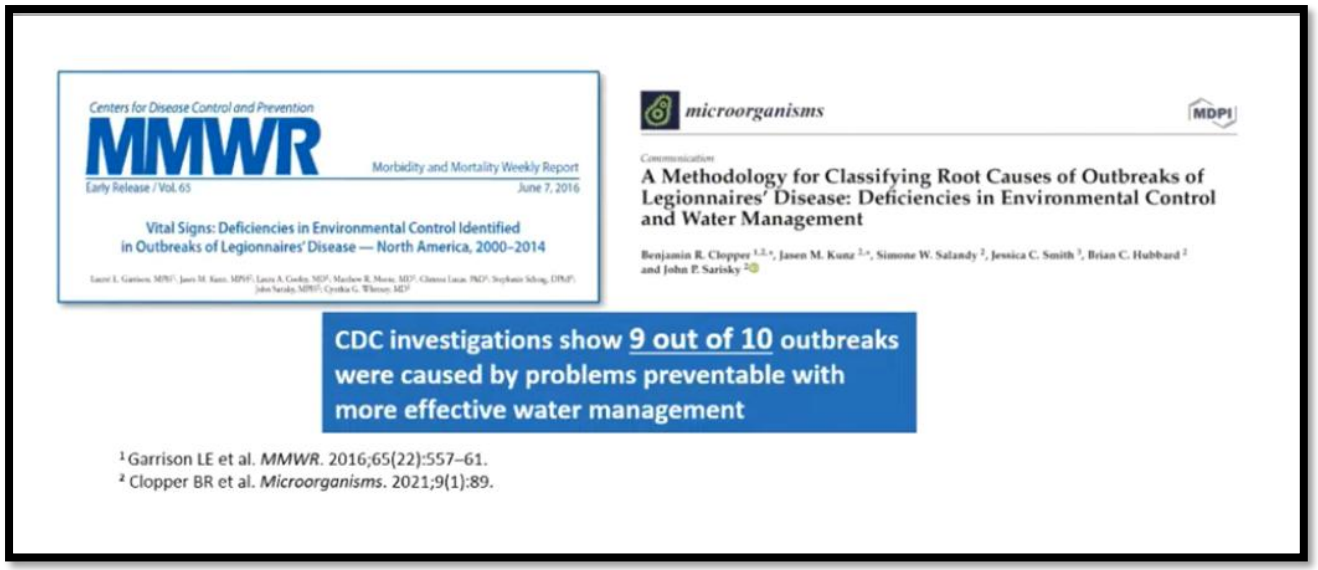
Figure 1(CDC, 2025)

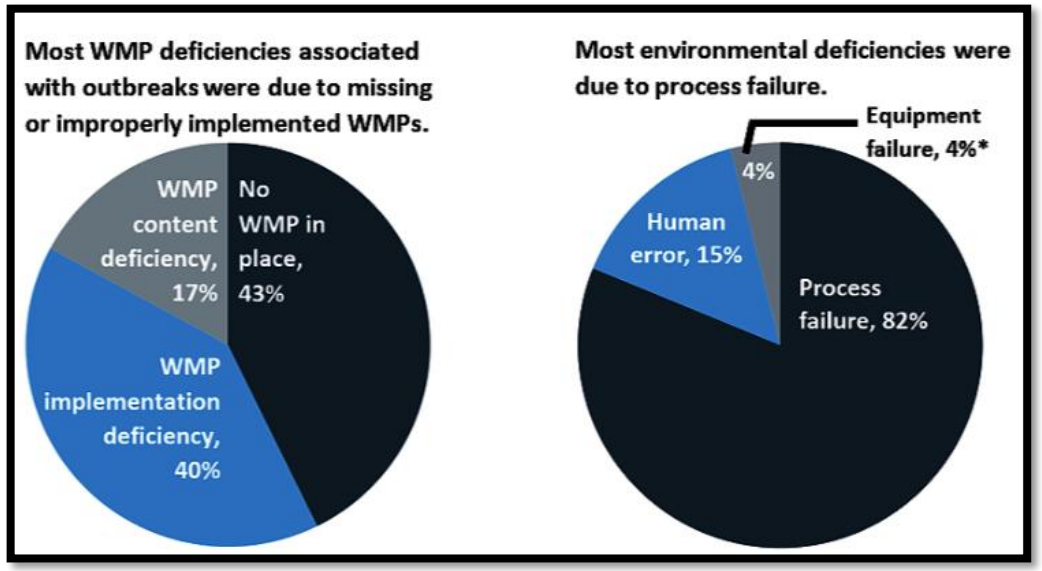
Waterborne Management Program: The Healthcare Statistics: 2022

- 25% of hospitals **do NOT** have a water management program
- 77% of hospitals **have NOT** implemented their water management program

Figure 1*(Joint Commission Resources, 2022)*

Inadequate water management leads to increased risk of LD





All the deficiencies associated with outbreaks could have been prevented by comprehensive, properly implemented water management programs.

All images: (CDC, n.d.)

Figure 1: (CDC 2024)

Partnership is the key & requires the efforts of:

- Environmental health
- Epidemiology
- Laboratory science

UCONN Water Management Team

Figure 1: (Walker, 2022)

- Director of **Facilities** Engineering
- Director of **Epidemiology**
- **Infection prevention**
- Program Director of **Bone Marrow Transplant**
- Clinical Program Coordinator BMT
- **Central Sterile**
- Supervisor **Plumbing**
- Associate Prof of **Pathology & Lab Medicine**
- Supervisor **HVAC**
- Clinical Lab Supervisor of **Microbiology**
- Associate Director of Clinical Laboratory
- Accreditation and **Regulatory Affairs**
- Safety and Quality Office School of Dental
- Director of **Environmental Health and Safety**
- **Clinical Engineering**
- Director of **Physical Environment**
- Supervisor of Engineering Control Center
- **Regulatory Compliance** Office
- **Infectious Disease/Epidemiology** MD
- **MDC Water Company**

COMPLIANCE WITH CMS

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/Quality, Safety and Oversight Group

Ref: *QSO*-17-30- Hospitals/CAHs/NHs
REVISED 07.06.2018

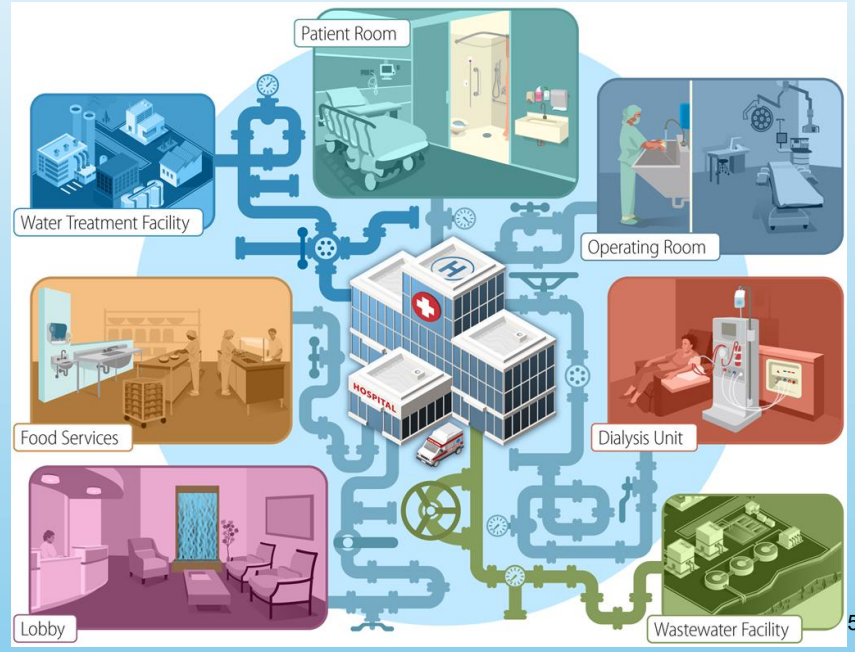
DATE: **June 02, 2017**

TO: State Survey Agency Directors

FROM: Director
Quality, Safety and Oversight Group (*formerly Survey & Certification Group*)

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

Water Management Plan: Assessing Building Risk



5)

Potential Sources of Contamination

- Cooling towers and evaporative condensers
- Dialysis water and equipment
- Hydrotherapy tanks and pools
- Heating and cooling equipment
- Equipment that is connected to main water systems (such as endoscope reprocessors and dental unit water lines)

Currently Owned and Occupied on or near Farmington Campus

Building/ Area ID		Description	Gross SF	Interior SF	Address	City, ST Zip Code	Owned/ Leased	Condition	Year Built / Acq	Primary Usage	Table 5.1 Cooling Towers	Table 5.1 Whirlpools	Table 5.1 Ornamental Fixtures	Table 5.2 Multiple housing with cent hw	Table 5.2 >10 Stories	Table 5.2 24/7 Health care	Table 5.2 Burn unit, Chemo, Cancer, Organ trans	Table 5.2 Weakend Immun	Table 5.2 Housing for 64 and older	Table 5.3 Action Code
1		MAIN BUILDING	1,773,403	1,557,071	263 FARMINGTON AVE	FARMINGTON, CT 06030	OWNED/OCC													
	Area AA	ACADEMIC ADDITION	32,029	14,656				EXCELLENT	2016	EDUCATION	N	N	N	N	N	N	N	N	N	A
	Area A	ACADEMIC	168,591	151,129				GOOD	1972	EDUCATION	N	N	N	N	N	N	N	N	N	A
	Area B	CENTER FOR COMPARATIVE MEDICINE	54,068	45,923				EXCELLENT	1972	RESEARCH SUPPORT	Y	N	N	N	N	N	N	N	N	B
	Area C	CLINIC	335,935	304,034				GOOD	1975	CLINIC	N	N	Y	N	N	N	N	N	N	A
	Area F	CANZONETTI	96,391	86,257				GOOD	1993	HOSPITAL	Y	N	N	Y	N	N	N	N	N	D
	Area H	CONNECTICUT TOWER	190,093	167,786				FAIR	1975	HOSPITAL	N	N	N	Y	N	Y	N	Y	Y	C
	Area L	BLDG L	476,138	414,417				GOOD	1972	RESEARCH	N	N	N	N	N	N	N	N	N	A
	Area T	UNIVERSITY TOWER	420,158	372,869				EXCELLENT	2016	HOSPITAL	Y	N	N	Y	Y	Y	Y	Y	Y	D

Action Code	5.1	5.2	Action
A	No Y	No Y	Review if conditions change
B	1 +	No Y	Treatment plan for areas of concerns
C	No Y	1+	Treatment and management plan
D	1+	1+	Include in management plan

ASHE: Risk groups for Legionella in hospital

Low risk:

- Office areas
- Common areas

Medium risk:

- Outpatient care areas
- Outpatient surgery, PACU
- Behavioral Health
- Food & nutrition
- Cardiac Cath Lab
- Radiation Therapy
- Pharmacy
- Laboratories
- Echocardiography
- Endoscopy
- Nuclear Medicine
- PT & RT

High risk:

- Medical inpatient areas
- Surgical inpatient areas
- MICU, SICU, NICU, CCU
- L&D and newborn nurseries
- Pediatrics
- Skilled nursing facilities
- Long term acute care ventilator units

Highest risk:

- Special units caring for immunocompromised patients
- Burn units
- Oncology units
- Transplant units

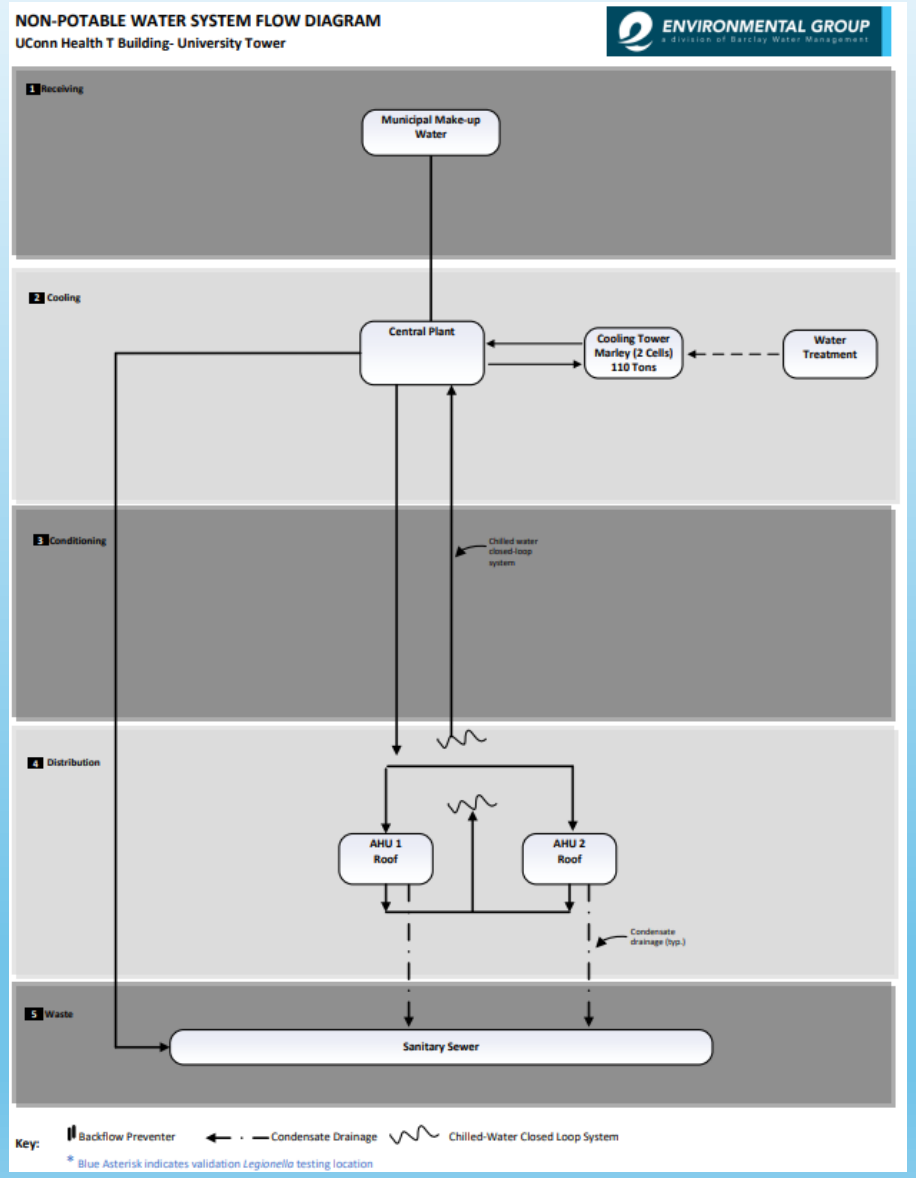
Risk Assessment

	UNIVERSITY TOWER		CONNECTICUT TOWER	
P	N/A	MECHANICAL	N/A	MECHANICAL
7	N/A	Info Tech - Offices	LOW	7: Med/Surg/Pt Obs
6	High	Oncology / BMT	LOW	6: Out Pat Infussion/ Sleep
5	MED	ORTHO/SURGE	MED	5: DOC UNIT
4	MED	MEDICAL SURVICAL	LOW	4: Out Pat Sickle Cell
3	MED	MEDICAL SURGICAL / DIALYSIS	LOW	3: Out Pt - Neuro
2	MED	INTERMEDIATE CARE	LOW	2: ON-CALL/OFFICES
1	HIGH	ICU	LOW	1: PSYCH
M	LOW	SURGERY SUPPORT/IMAGING/CAFE	LOW	M: RADIOLOGY
G	HIGH	SURGERY	HIGH	G: NICU/MATERINTY
B	LOW	EMERGENCY/CS	LOW	B:GI/ENDO/CT / Vacant ORs
LB	N/A	MECHANICAL	N/A	SB: MECH

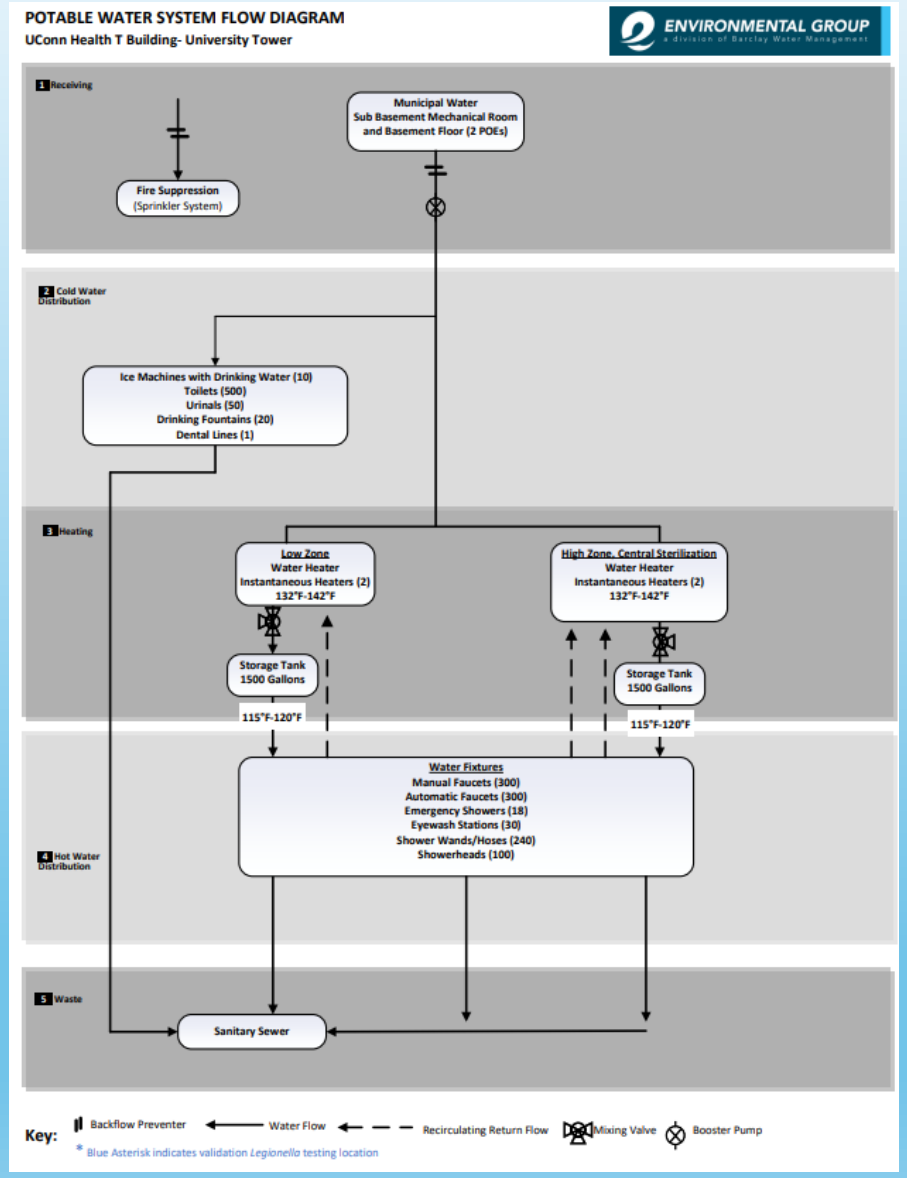
UConn John Dempsey Hospital
Legionella Risk Assessment
April 2026

Other Uconn Health Facilities:
OP – Cancer Center and Radiation
Oncology = Med/High
MSI Ors= High
All other areas reviewed and considered Low

Water Management Diagram-University Tower



Non-Potable Water System Flow Diagram



Potable Water System Flow Diagram

Monitoring internal factors: WATER TESTING

Sample / Sampling Description

Date/ Time Collected: 02/02/2026 10:23 am
Collected By: Matt Dalton
Collection Site: 28 Shepard Dr.
Collection Source: Municipal
Sample Point: Quench Water System
Treatment: Quench Water System
Sample Temp. at Receipt: 4-21°C
Chilling Process: ☑ Started ☐ Not Started
Holding Times: ☑ Met ☐ Not Met

Parameter	Results	Units	Method	MCL/Range	Date and Time Tested	
Coliform	ABSENT	per 100 mL	SM9223B	ABSENT	02/02/2026	4:00 pm
E. coli	NEGATIVE	per 100 mL	SM9223B	NEGATIVE	02/02/2026	4:00 pm
Apparent Color	0	CU	SM2120B	15	02/02/2026	1:41 pm
Chlorides*	12.3	mg/L	E300.0	250	02/03/2026	
Free Chlorine	<0.13	mg/L	SM4500Cl-G	4	02/02/2026	1:33 pm
Hardness*	16.0	mg/L	SM2340B11	200	02/05/2026	
Iron*	0.030	mg/L	E200.7	0.3	02/05/2026	
Manganese*	0.002	mg/L	E200.7	0.3	02/05/2026	
Nitrate – Nitrogen*	0.03	mg/L	E300.0	10	02/03/2026	7:12 pm
Nitrite – Nitrogen*	<0.004	mg/L	E300.0	1	02/03/2026	7:12 pm
Odor	ND	TON	SM2150B	2	02/02/2026	1:41 pm
pH	6.70	pH units	SM4500HB	6.4-10.0	02/02/2026	1:41 pm
Sodium*	12.0	mg/L	E200.7	100	02/05/2026	
Sulfate*	<5.0	mg/L	E300.0-2.1	250	02/03/2026	
Turbidity	0.25	NTU	SM2130B	5	02/02/2026	1:41 pm

CU = Color Units MCL = Maximum Contaminant Level NTU = Nephelometric Turbidity Unit ND = none detected TON = Threshold Odor Number

Sample / Sampling Description

Date/ Time Collected: 02/02/2026 10:25 am
Collected By: Matt Dalton
Collection Site: 28 Shepard Dr.
Collection Source: Municipal
Sample Point: Quench Water System
Treatment: Quench Water System
Sample Temp. at Receipt: 4-21°C
Chilling Process: ☑ Started ☐ Not Started
Holding Times: ☑ Met ☐ Not Met

Parameter	Results	Units	Method	MCL/Range	Date and Time Tested	
Coliform	ABSENT	per 100 mL	SM9223B	ABSENT	02/02/2026	4:00 pm
E. coli	NEGATIVE	per 100 mL	SM9223B	NEGATIVE	02/02/2026	4:00 pm
Apparent Color	0	CU	SM2120B	15	02/02/2026	1:45 pm
Chlorides*	<5.0	mg/L	E300.0	250	02/03/2026	
Free Chlorine	<0.13	mg/L	SM4500Cl-G	4	02/02/2026	1:39 pm
Hardness*	<0.1	mg/L	SM2340B11	200	02/05/2026	
Iron*	<0.010	mg/L	E200.7	0.3	02/05/2026	
Manganese*	<0.001	mg/L	E200.7	0.3	02/05/2026	
Nitrate – Nitrogen*	<0.01	mg/L	E300.0	10	02/03/2026	7:21 pm
Nitrite – Nitrogen*	<0.004	mg/L	E300.0	1	02/03/2026	7:21 pm
Odor	ND	TON	SM2150B	2	02/02/2026	1:45 pm
pH	8.22	pH units	SM4500HB	6.4-10.0	02/02/2026	1:45 pm
Sodium*	<0.2	mg/L	E200.7	100	02/05/2026	
Sulfate*	<5.0	mg/L	E300.0-2.1	250	02/03/2026	
Turbidity	<0.14	NTU	SM2130B	5	02/02/2026	1:45 pm

CU = Color Units MCL = Maximum Contaminant Level NTU = Nephelometric Turbidity Unit ND = none detected TON = Threshold Odor Number

Control Measures-Hot Water

Water temperature is tested monthly in the control towers

Pros:
- Effective at killing Legionella
- Works quickly to kill Legionella
- ASHRAE 188 recommended

Cons
- Scalding is a concern
- Equipment longevity (scale, corrosion)
- Does not penetrate biofilm

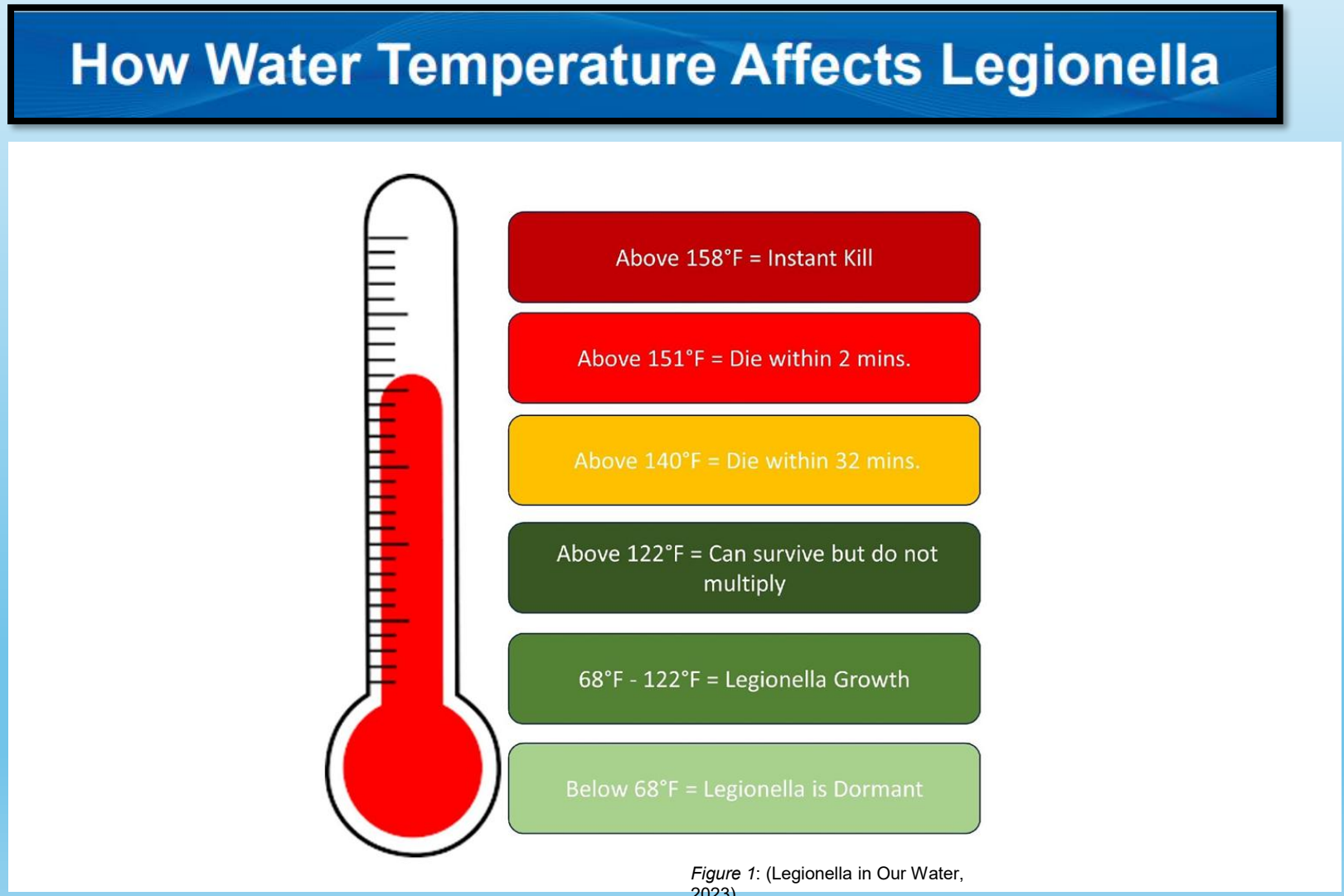


Figure 1: (Legionella in Our Water, 2023)

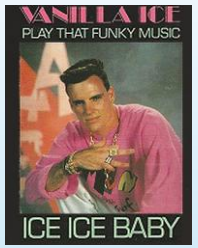
LEGIONELLA TESTING –performed semi annually (only on BMT unit)

Date/ Time Collected: 02/03/2026 10:45 am – 11:00 am
Collection Site: UCONN HC BMT, 263 Farmington Ave
Sample Temp. at Receipt: 13-16°C

Collected By: Matthew Dalton
Collection Source: Municipal
Treatment: N/A
Chilling Process: ☑ Started ☐ Not Started
Holding Times: ☑ Met ☐ Not Met

ID	Sample Description	*Legionella Pneumophila*	Date Tested
01	P-Sink 625	Not Detected*	02/04/2026
02	BR-Sink 625	Not Detected*	02/04/2026
03	Shower 625	Not Detected*	02/04/2026
04	P-Sink 626	Not Detected*	02/04/2026
05	BR-Sink 626	Not Detected*	02/04/2026
06	Shower 626	Not Detected*	02/04/2026
07	P-Sink 624	Not Detected*	02/04/2026
08	P-Sink 627	Not Detected*	02/04/2026
09	P-Sink 628	Not Detected*	02/04/2026
10	Main Water Supply	Not Detected*	02/04/2026

CFU = Colony Forming Units



ICE, ICE, ~~BABY~~ DEADLY

Bacteria in UPMC Ice Machine Contributed to Patient Death

Figure 1 (Staff, 2014)

Figure 2 ([Dirty ice machine legionella], n.d.)

HEALTH NEWS

Legionella bacteria at Syracuse hospital found in two patient sinks, ice machine

Figure 3 (Mudler, 2015)

Ice maker, sinks linked to UW Medical Center Legionnaires' outbreak; 2 dead

Figure 4 (Staff, 2016)

Palliative care patient tests positive for legionnaires

DEADLY DISEASE IN ICE

EXCLUSIVE
JACKIE SINNERTON

LEGIONNAIRES disease is back at one of Queensland's leading hospitals, finding its way into an ice machine despite strict measures being put in place at the facility in the wake of a deadly 2013 outbreak.

A palliative care patient has tested positive for legionella pneumophila at The Wesley Hospital and an ice machine has also returned a positive result. Queensland Health has confirmed an investigation is underway.

Seriously ill patients in hospitals are often offered pieces of ice to refresh their mouths.

In 2013 legionella bacteria brought the Brisbane Univing-

CHILLING REMINDER OF EARLIER PANIC

• The Wesley Hospital was the site of a deadly legionnaires outbreak in 2013

• The hospital delayed reporting the positive legionella test to authorities by a week; infection must be reported within 24 hours

• A man, 80, died after contracting the disease; a woman, 66, was put in intensive care

• Admissions and surgeries were cancelled

• Discharged patients were contacted

• Legionnaires bacteria was found in the hot water system

• Chief Health Officer carried out a review

• Health Minister then announced mandatory periodic water testing

Mr Seymour said the hospital's ice machines are serviced regularly and filters are replaced every three months

lus significant complex medi-

Figure 5 (Sinnerton, 2016)

Water Management External Factors:

- Changes in municipal water quality
- Changes in water pressure
- Water main breaks
- Construction

Hospital construction & renovation risk to hospitalized patients

Figure 1 (Lin et al., 2011)

- In Ohio, 11 cases of hospital-acquired Legionnaires disease were identified in patients moved to a newly constructed 12-story addition in a hospital, and 1 of those died.
- 407 cases of legionella linked to soil intensive activities resulting in 48 deaths from 2000-2014 according to a recent CDC investigation

Water Problems: WATER MAIN BREAKS

2016 & 2019

Water Problems:
MDC Water pressure: 2019

Figure 1 (Fox Plumbing, 2023)

0245: MDC poor pressure notification → 0255: UCONN PD discovers large amount of water on Farmington Ave → 0345: Main pipe leak confirmed → 0419: Activation Emergency Operation Plan/Incident Command Center → 0500: leak isolated by MDC & water pressure improves → 0504: decision to delay procedures

0525: DPH updated → 0530: 5-gallon containers and drinking water supplied to all floors → 0532: notification water main break to employees → 0618: water flow restored by MDC → 1030: OR deemed available for use → 1100: Posters for lobbies distributed re: water safety issue

1200: Out pt clinics up and running → 1400: MDC repair complete & water restored to campus → 1545: media update → 1800: main water line flushed for 4 hrs. by MDC & Incident Command Center demobilizes

Water problems: Legionella in BMT unit (prior to the grand opening of the unit)

Legionella Detection - ID, Enumeration, & Serotyping of *L. pneumophila* plus 10 other *Legionella* species by ISO 11731:2017 Culture Method (EMSL Test Code M343 & Method MICRO-SOP-105)

Client Sample ID/Sample Location Lab Sample Number	Sample Type	Volume Submitted (mL)	Volume Filtered (mL)	Method Processed	Identification	Volume Examined (mL)	Limit of Detection (CFU/mL)	Final Results (CFU/mL)
COLD-SINK 1 - PATIENT ROOM SINK *242304588-0001*	Potable	1000	1000	Concentrated	None Detected	20	0.05	ND
COLD-SINK 2 - PATIENT ROOM SINK *242304588-0002*	Potable	1000	1000	Concentrated	None Detected	20	0.05	ND
HOT-SINK 1 - PATIENT ROOM SINK *242304588-0003*	Potable	1000	1000	Concentrated	*Legionella pneumophila* (sero 1)	20	0.05	0.10
HOT-SINK 2 - PATIENT ROOM SINK *242304588-0004*	Potable	1000	1000	Concentrated	*Legionella pneumophila* (sero 1)	20	0.05	0.05
BATH-SINK 1 - BATH-SINK *242304588-0005*	Potable	1000	1000	Concentrated (Acid)	*Legionella pneumophila* (sero 1)	2	0.50	7.50
BATH-SINK 2 - BATH-SINK *242304588-0006*	Potable	1000	1000	Concentrated (Acid)	*Legionella pneumophila* (sero 1)	2	0.50	0.50
SHOWER-1 - SHOWER *242304588-0007*	Potable	1000	1000	Concentrated (Acid)	*Legionella pneumophila* (sero 1)	2	0.50	1.00
SHOWER-2 - SHOWER *242304588-0008*	Potable	1000	1000	Concentrated (Heat)	*Legionella pneumophila* (sero 1)	20	0.05	0.15
NURSE-SINK 1 - NURSE STATION *242304588-0009*	Potable	1000	1000	Concentrated	None Detected	20	0.05	ND
NURSE-SINK 2 - NURSE STATION *242304588-0010*	Potable	1000	1000	Concentrated	*Legionella pneumophila* (sero 1)	20	0.05	0.05

Infection Preventionist Role

- Basic knowledge of the components of water systems
- Identify sources and modes of transmission of water borne illness
- Help develop and monitor water management plans to align with industry standards
- Invite facilities to IPC Committee to discuss water management program
- Become a member of Water Management team
- Monitor ICRA (infection control risk assessment)-
- Reporting cases to DPH cases
- Provide education and training to staff on proper water management practices to reduce the risk.

Case Definition & Reporting

- The CT DPH uses the national surveillance case definition to determine case status.

- Is reportable to the CT DPH & is a nationally notifiable disease.

*Figure 1: (*DPH, n.d)

CDC's role

CDC monitors Legionellosis cases using two surveillance systems at the national level:

- National Notifiable Disease Surveillance System (NNDSS)
- Supplemental Legionnaires' Disease Surveillance System (SLDSS)

Figure 1 (CDC, n.d)

Figure 2 ([Epidemiology. Health danger risk spread laboratory], 2019)

Exposure Categories Definitions

Was the patient admitted to a healthcare facility during the 14 days before symptom onset?

YES

What was the duration of stay?

≥10 days of continuous stay during the 14-day exposure period

→ Presumptive Healthcare-Associated LD case

Any portion of the 14 days before symptom onset (if not ≥10 days of continuous stay)

→ Possible Healthcare-Associated LD Case

Patient spent at least one night away from home in the 14 days before symptom onset (includes nights in the state of residence, another state, or another country)

→ Travel Associated Case

Figure 1 (Smith, 2024)

Outbreaks of Legionnaires' disease can be difficult to detect

Figure 1(Kuester, 2017)

Criteria for a full investigation

- 1 or more cases of presumptive health-care associated legionnaire's disease at any time at the same healthcare facility
- 2 or more cases of possible healthcare-associated Legionnaire's disease within 12 months of each other at the same healthcare facility.
- When a statically significant increase in Legionnaires has been found in a defined geographic area compared against a historical background for the same geographic area

Investigations are Important for Linking Cases and Identifying Likely Sources

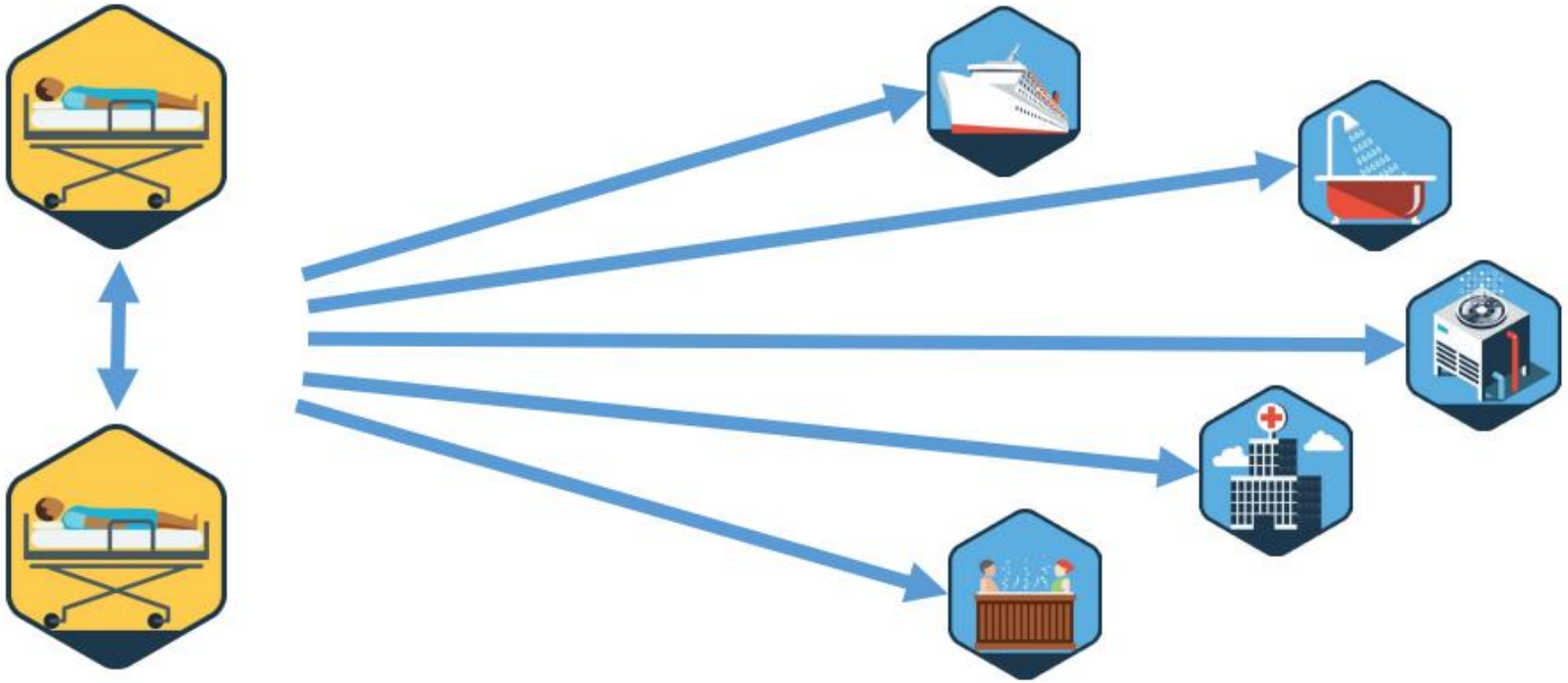


Figure 1 (CDC, 2025)

Figure 1 ([Adorable scared baby in a white onsie in a cozy living room], 2024)

HOSPITAL OUTBREAK

..

When risk becomes reality

Initial steps

Confirm diagnosis & contact the local health department

Interview case-patient to determine the exposure

Environmental assessments: changes in water quality and water sampling

Implement water restrictions: no using ice machines,
no showering, no tap water-use bottled water

DPH-Enhanced surveillance plan

- Instruct clinicians at the facility to evaluate patients with respiratory symptoms for pneumonia.
- Order chest X-rays to confirm pneumonia.
- Coordinate appropriate testing
- Create and maintain line list for patients with any respiratory illness and results of any relevant testing (i.e., testing for other pathogens that may cause respiratory illness).
- Maintain surveillance for at least 6 months from the time of last facility-associated case.

Environmental assessment, Facility Inspection and Water System Sampling

- Conduct a thorough building inspection to identify all potential *Legionella* sources.
    - Water-cooled, heat-transfer systems
    - Domestic water systems
    - Humidifiers and misters
    - Any water sources maintained above 20°C (68°F) and that could be aerosolized.
- Perform environmental water system sampling

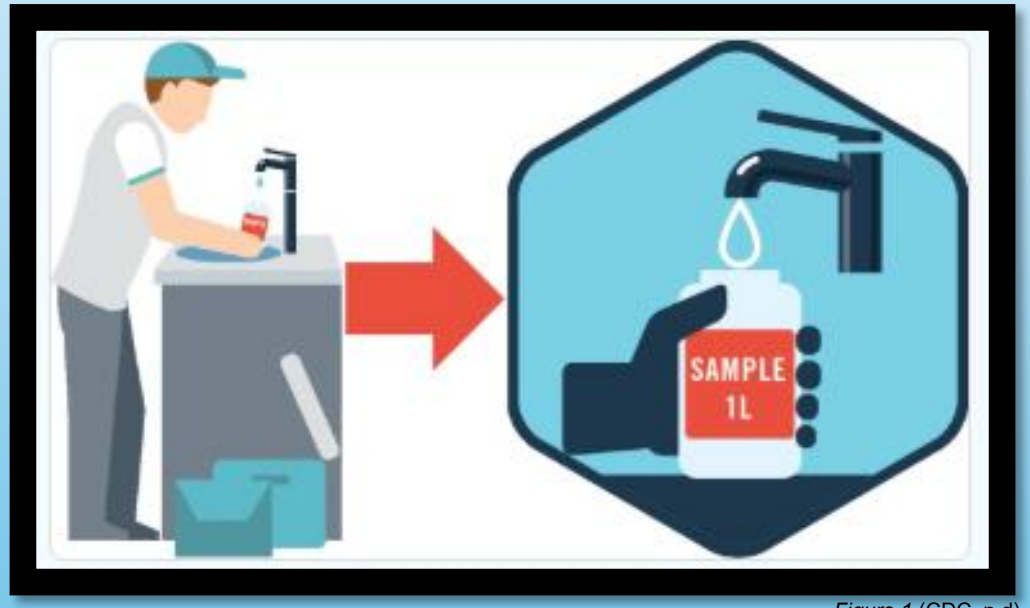


Figure 1 (CDC, n.d)

Stock image: water droplet. https://wallpapers.com/wallpapers/two-water-droplets-falling-l22245hs0yki8grp.html

Implement Controls to Prevent Additional Exposure

Controlling	Controlling exposure to Legionella during an outbreak might not require facility shutdown. Temporary provisions to isolate the affected water system can allow work to continue, and may include:
Supplying	Supplying bottled water for drinking instead of drinking from the domestic cold-water system.
Shutting	Shutting down water heaters to eliminate access to hot water in the domestic system.
Using	Using temporary cooling towers.
Utilizing	Utilizing portable heaters, air conditioners, and fans instead of the contaminated HVAC system

Water Treatment for Legionella

- Chlorine as a disinfectant
- Monochloramine
- Chlorine Dioxide
- Copper-Silver Ionization
- Ozone
- Ultraviolet Light Disinfection

Treatment will alter water quality

- >lead, copper, nitrate, nitrites, chlorite (to name a few)
- Corrosion to medical devices & equipment

When is an Outbreak Investigation Over Over

No new cases following implementation of long-term legionella control strategies

No detection of legionella during post-remediation environmental monitoring

Figure 1 ([Magic book], n.d.)

Although the medical case had been solved, Legionnaires' disease has not been confined to the history books

BURDEN

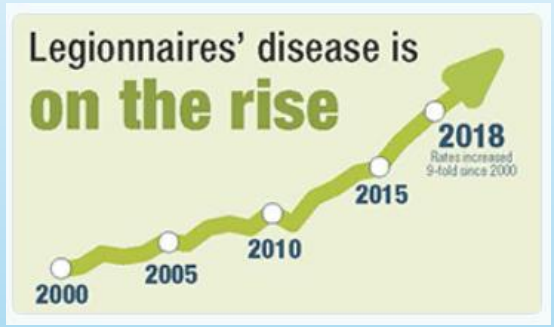
- 1800-8000 cases annually
- 1,000 deaths annually
- $402 M in healthcare cost
- $835 M lifetime econmonic burden

Figure 1 (Baker-Goering, et. al, 2021))

Figure 2 ([Dollar sign], n.d.)

Figure32 ([Danger], n.d.)

2018: USA Peak in Cases



Quick Stats - Current Filters

Outbreaks	Illnesses
98	375
Hospitalizations	**Deaths**
281	34

Source: CDC

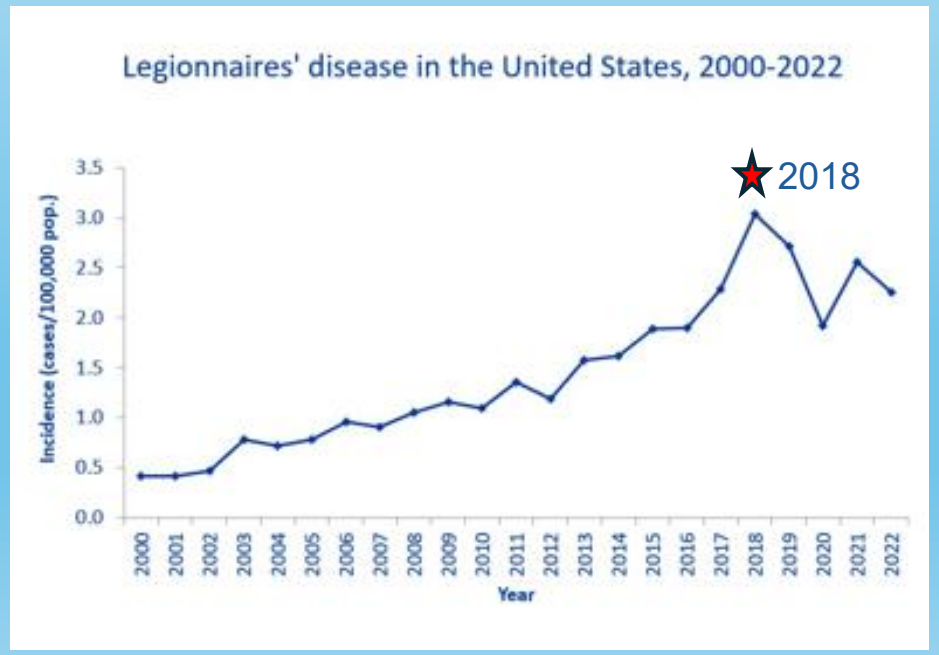
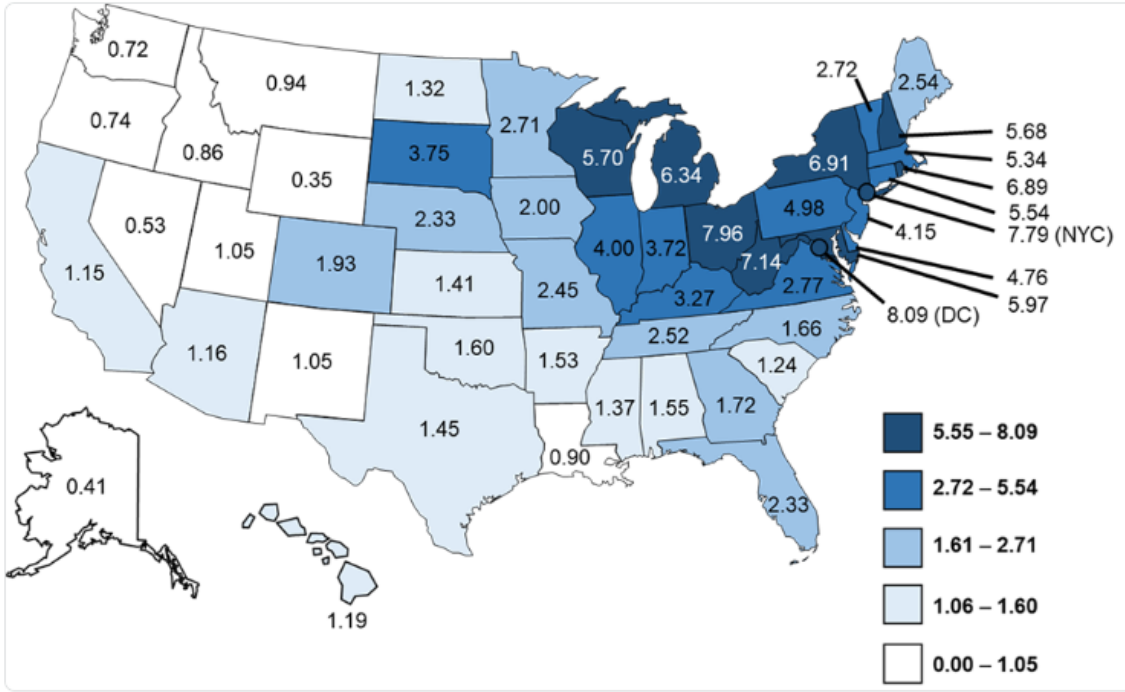


Figure 3a. Crude incidence[a] rates of reported confirmed cases of Legionnaires' disease[b] by jurisdiction of residence[c]—NNDSS,[d] United States, 2018.[e,f]



[a]Crude incidence of cases per 100,000 population (number of confirmed Legionnaires' disease cases reported that year divided by postcensal resident jurisdiction population estimate for that year times 100,000 population).

All images: (CDC 2025.)

Figure 6a. Number of reported confirmed cases and deaths of Legionnaires' disease by exposure category[a] —SLDSS,[b] complete reporting jurisdictions,[c] 2018.[d]

	Cases		Deaths	
	N	%	N	CFR[e]
Exposure category	**(Total = 8,764)**		**(Total= 719)**	
Any Healthcare	1,584	18.1	156	9.8
Definite Healthcare	204	2.3	53	26.0
Possible Healthcare	1,380	15.7	103	7.5
Any Travel	1,279	14.6	35	2.7
Any Assisted or senior living	326	3.7	30	9.2
None of these	5,886	67.2	342	5.8

Figure 1 (CDC, 2025)

Seasonal pattern of Legionella in 2018 in USA

Figure 2. Number of reported confirmed cases of Legionnaires' disease[a] by month[b] and year[c]—NNDSS,[d] United States, 2018 and 2019.

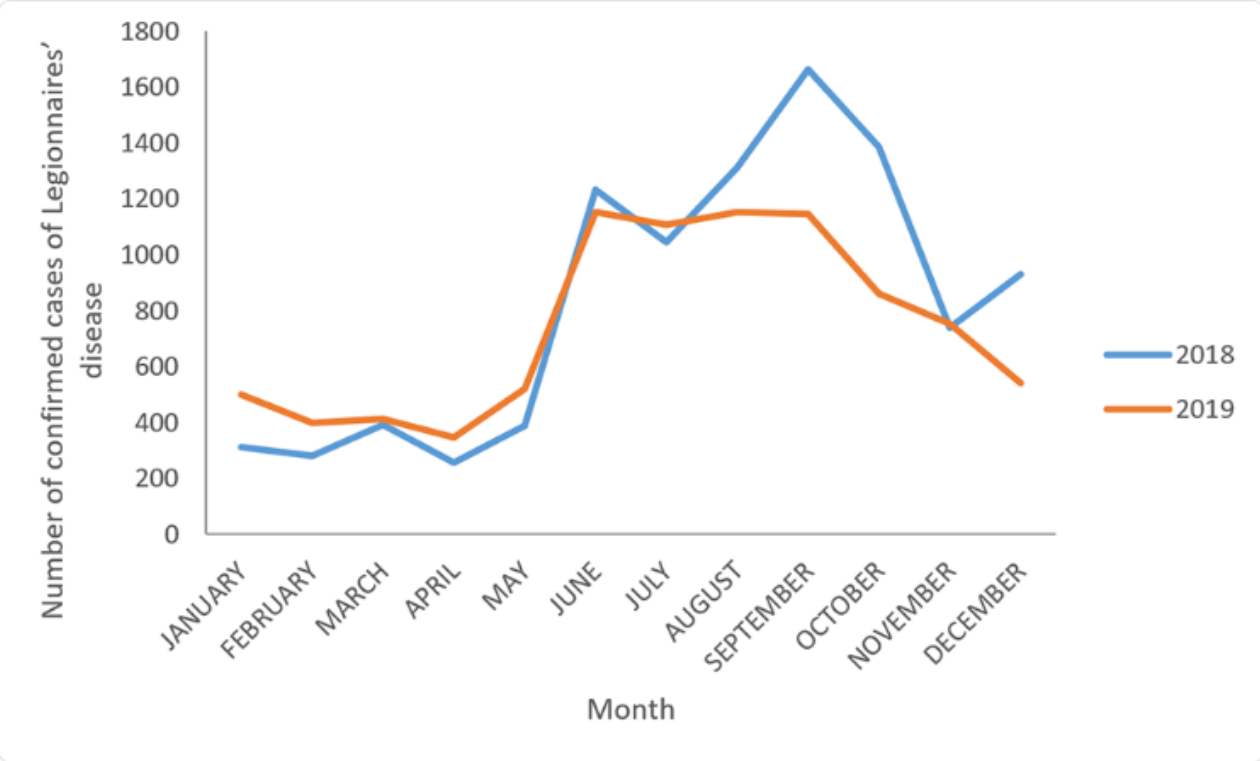


Figure 1 (CDC, 2025.)

Figure 2 ([Cold drink on high temperature], n.d.)

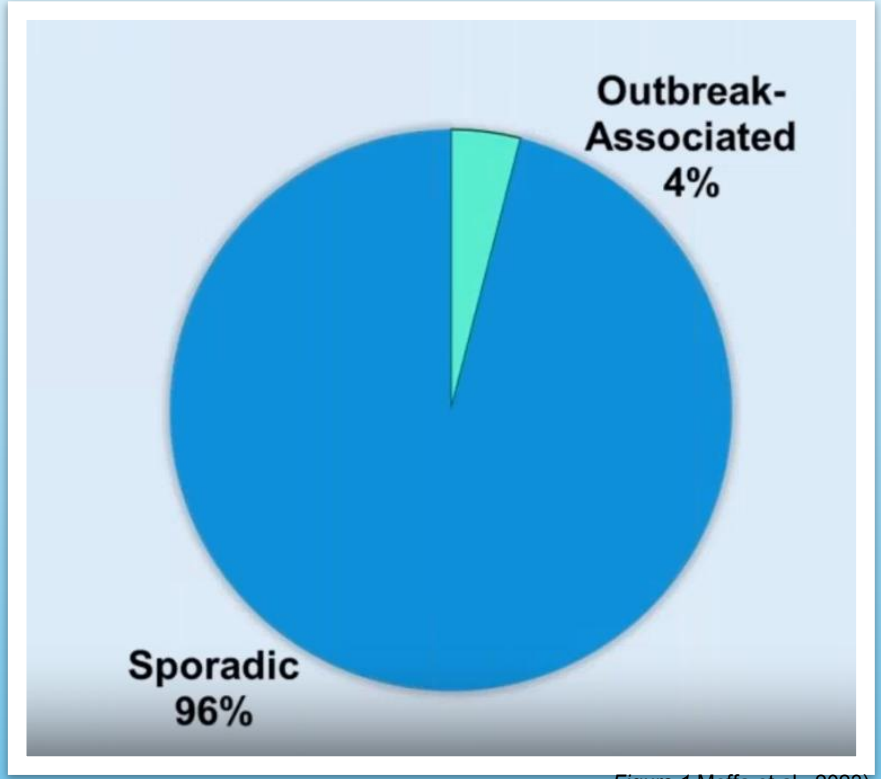


Figure 1 Moffa et al., 2023)

Most legionella cases are sporadic

Epidemiol Infect. 2023 Jul 28;151:e133. doi: 10.1017/S0950268823001206

Legionellosis on the rise: A scoping review of sporadic, community-acquired incidence in the United States

Michelle A Moffa [1], Clare Rock [2,3], Panagis Galiatsatos [4,5], Shantini D Gamage [6,7], Kellogg J Schwab [8], Natalie G Exum [8,✉]

Legionella in CT 1980-1997

(prior to the surveillance era)

Nosocomial Legionnaires Disease Associated with Exposure to Respiratory Therapy Equipment, Connecticut

ELLEN JONES, PATRICIA CHECKO, ANECIA DALTON, JOHN COPE, JAMES BARBAREE, GEORGE KLEIN, WILLIAM MARTIN, AND CLAIRE BROOME

Centers for Disease Control, Atlanta, Georgia 30333, and State Department of Health Services, Hartford, Connecticut 06010

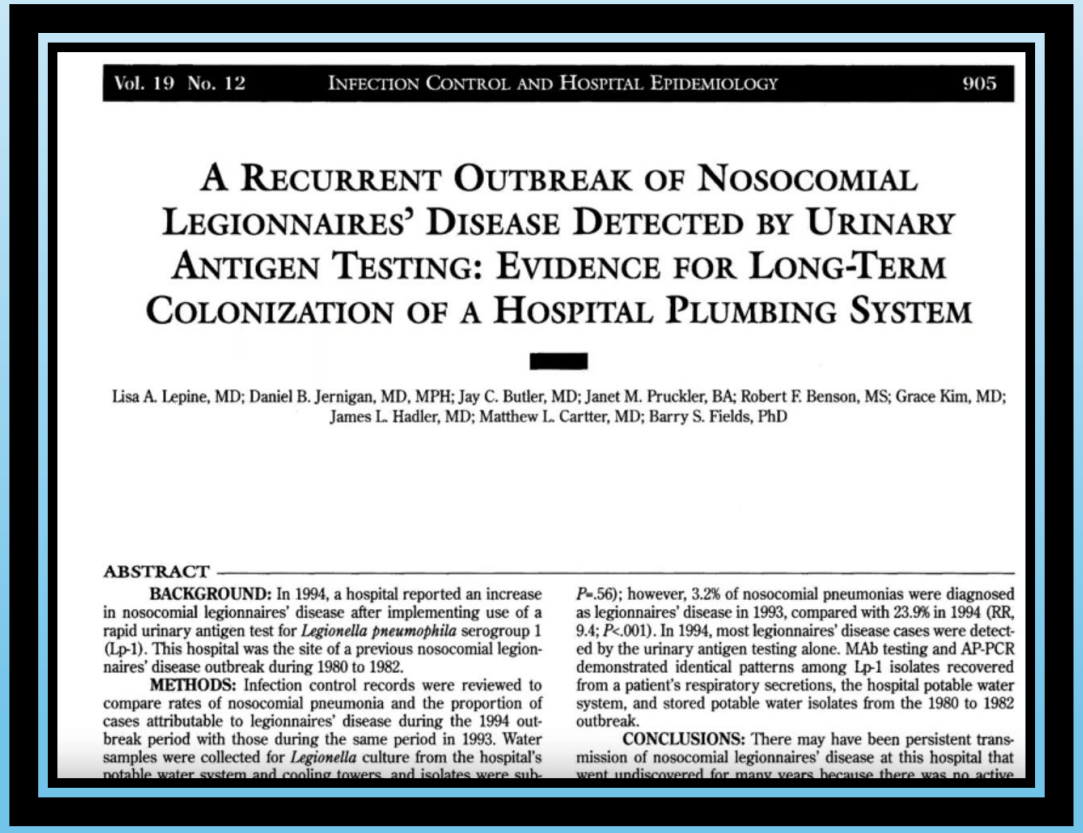
Numerous investigators have suggested a role for potable water in outbreaks of nosocomial Legionnaires disease (LD) (1, 2, 3). An investigation of an outbreak of nosocomial LD has allowed us to extend previous observations concerning the role of contaminated potable water among immunosuppressed patients receiving respiratory therapy.

Between December 1980 and December 1982, 36 cases of nosocomial LD occurred in a 400-bed Connecticut hospital. However, only 18 of these patients had been hospitalized continuously during the 10 days before onset of illness, so only correlated and it was difficult to evaluate them as independent variables. Further analysis of the relationship between steroids and antacids, nebulizers and steroids, and antacids and nebulizers also was limited by the small number of cases. However, examining the data in an unmatched fashion was useful in examining trends among variables.

Among those receiving steroids, antacid use increased the risk of illness (88 versus 17%) (Table 1). However, among those not being treated with steroids, antacid therapy did not appear to have an effect (20 versus 17%).

Figure 1(CDC, 1982)

1994: 12 years later-outbreak at the same hospital



Vol. 19 No. 12 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY 905

A RECURRENT OUTBREAK OF NOSOCOMIAL LEGIONNAIRES' DISEASE DETECTED BY URINARY ANTIGEN TESTING: EVIDENCE FOR LONG-TERM COLONIZATION OF A HOSPITAL PLUMBING SYSTEM

Lisa A. Lepine, MD; Daniel B. Jernigan, MD, MPH; Jay C. Butler, MD; Janet M. Pruckler, BA; Robert F. Benson, MS; Grace Kim, MD; James L. Hadler, MD; Matthew L. Cartter, MD; Barry S. Fields, PhD

ABSTRACT

BACKGROUND: In 1994, a hospital reported an increase in nosocomial legionnaires' disease after implementing use of a rapid urinary antigen test for *Legionella pneumophila* serogroup 1 (Lp-1). This hospital was the site of a previous nosocomial legionnaires' disease outbreak during 1980 to 1982.

METHODS: Infection control records were reviewed to compare rates of nosocomial pneumonia and the proportion of cases attributable to legionnaires' disease during the 1994 outbreak period with those during the same period in 1993. Water samples were collected for *Legionella* culture from the hospital's potable water system and cooling towers, and isolates were sub-

P=.56); however, 3.2% of nosocomial pneumonias were diagnosed as legionnaires' disease in 1993, compared with 23.9% in 1994 (RR, 9.4; P<.001). In 1994, most legionnaires' disease cases were detected by the urinary antigen testing alone. MAb testing and AP-PCR demonstrated identical patterns among Lp-1 isolates recovered from a patient's respiratory secretions, the hospital potable water system, and stored potable water isolates from the 1980 to 1982 outbreak.

CONCLUSIONS: There may have been persistent transmission of nosocomial legionnaires' disease at this hospital that went undiscovered for many years because there was no active

Nosocomial Legionnaires' Disease Outbreaks Acute Care Hospitals, CT, 1980 - 1995

Hospital	Year(s)	Number of Cases: Confirmed	Probable	Serogroups	Source
A	1980-1982	19	18	1,4,5	Water
B	1986	2	2	1	Water
A	1994	7	13	1	Water
C	1995	4	1	3	Water

Figure 1 & 2 (Lepine, et al, 1998)

1997 and beyond… Legionellosis surveillance in CT

- 1997: added to list of physician & laboratory reportable diseases to CT DPH & the local health department
- 1999-2021: median number cases reported annually 55 (range 14-201) cases
- 2018: highest reported cases=201

Figure 1 (Furian, 2020)

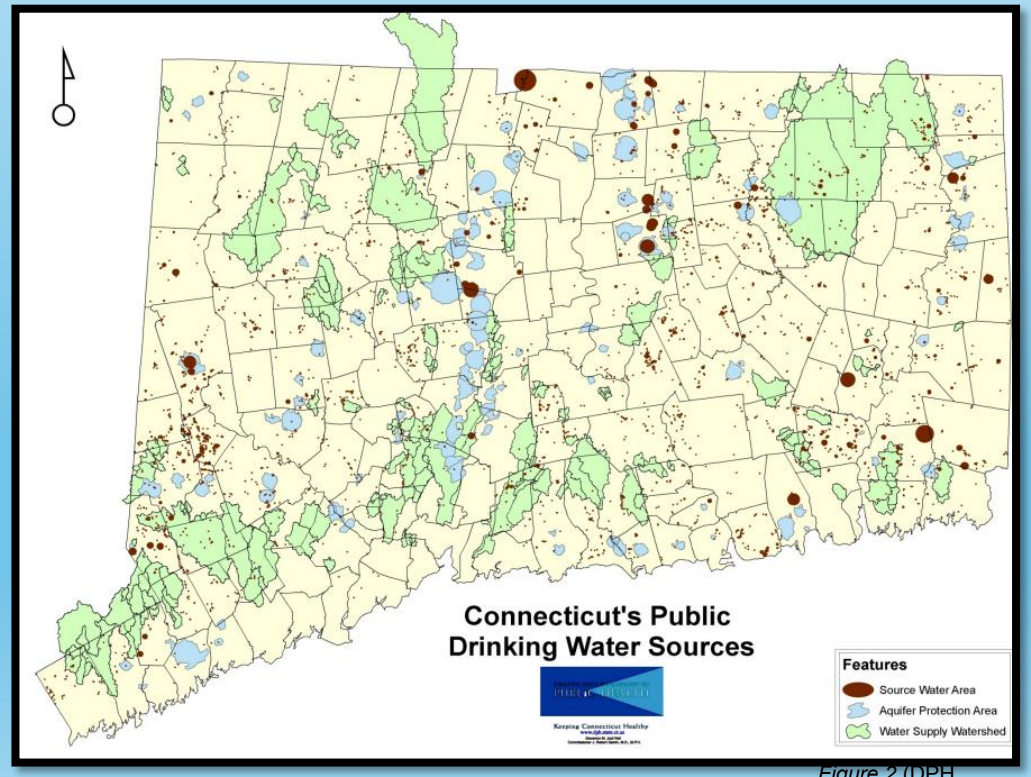


Figure 2 (DPH, 2015)

Figure 1 ([Joyful Puddle Jump], n.d)

Are Peaks in Legionnaires' Disease Linked to Increased Rainfall?

Epidemiol. Infect. (2007), **135**, 811–817. © 2006 Cambridge University Press
doi:10.1017/S0950268806007552 Printed in the United Kingdom

Increased rainfall is associated with increased risk for legionellosis

L. A. HICKS[1,2*], C. E. ROSE Jr.[3], B. S. FIELDS[1], M. L. DREES[2,4], J. P. ENGEL[5], P. R. JENKINS[5], B. S. ROUSE[6], D. BLYTHE[7], A. P. KHALIFAH[1], D. R. FEIKIN[1] AND C. G. WHITNEY[1]

Rainfall Is a Risk Factor for Sporadic Cases of *Legionella pneumophila* Pneumonia

Carolina Garcia-Vidal[1,2*], Maria Labori[1], Diego Viasus[1], Antonella Simonetti[1], Dolors Garcia-Somoza[3], Jordi Dorca[4], Francesc Gudiol[1,2], Jordi Carratalà[1,2]

1 Department of Infectious Diseases, Hospital Universitari de Bellvitge, IDIBELL (Institut dInvestigació Biomèdica de Bellvitge), Universitat de Barcelona, Barcelona, Spain, **2** REIPI (Spanish Network for Research in Infectious Diseases), Madrid, Spain, **3** Department of Microbiology, Hospital Universitari de Bellvitge, Barcelona, Spain, **4** Department of Respiratory Medicine, Hospital Universitari de Bellvitge, Barcelona, Spain

JOURNAL ARTICLE

It's Not the Heat, It's the Humidity: Wet Weather Increases Legionellosis Risk in the Greater Philadelphia Metropolitan Area

David N. Fisman ✉, Suet Lim, Gregory A. Wellenius, Caroline Johnson, Phyllis Britz, Meredith Gaskins, John Maher, Murray A. Mittleman, C. Victor Spain, Charles N. Haas ... Show more

The Journal of Infectious Diseases, Volume 192, Issue 12, 15 December 2005, Pages 2066–2073, https://doi.org/10.1086/498248

Published: 15 December 2005 **Article history** ▾

(*Figure 1* Law, Ryan, 2017)

Legionella is becoming more common

- Warmer temperatures/climate change
- Outdated plumbing
- More extreme weather condition (increased rainfall)
- Human error & negligence in maintaining water systems
- Aging population
- Budget constraints

Morbidity and Mortality Weekly Report (*MMWR*)

Two Outbreaks of Legionnaires Disease Associated with Outdoor Hot Tubs for Private Use — Two Cruise Ships, November 2022–July 2024

Weekly / October 24, 2024 / 73(42):950–954

Print

Sooji Lee, MSPH[1]; Chris Edens, PhD[1]; Troy Ritter, PhD[2]; Luis O. Rodriguez, MS[2]; Kara Tardivel, MD[3]; Natalia A. Kozak-Muiznieks, PhD[1]; Melisa Willby, PhD[1]; Nancy Ortiz, PhD[3]; Adam L. Cohen, MD[1]; Jessica C. Smith, MPH[1] (VIEW AUTHOR AFFILIATIONS)

All images: (CDC, 2024)

HARLEM OUTBREAK SUMMER 2025

Figure 1 [NYC Legionnaires' Disease Outbreak: 2 Dead, 58 Sick-What New Yorkers Need to Know], 2025)

WORLDWIDE ISSUE

Lancet Microbe. 2025 Apr;6(4):101031. doi: 10.1016/j.lanmic.2024.101031. Epub 2024 Nov 26.

Global surge of Legionnaires' disease in 2024: urgent call for heightened awareness and preparedness

Ashutosh Pareek [1], Runjhun Singhal [2], Aaushi Pareek [2], Anil Chuturgoon [3], Ranjit Sah [4], Vasso Apostolopoulos [5]

Figure 1 (Pareek, et al, 2025)

Figure 2 ([Worldwide], n.d)

- In Australia, Europe and the United States of America, there are about 10-15 cases detected per million population

Lancet Microbe. 2025 Apr;6(4):101031. doi: 10.1016/j.lanmic.2024.101031. Epub 2024 Nov 26.

Global surge of Legionnaires' disease in 2024: urgent call for heightened awareness and preparedness

Ashutosh Pareek [1], Runjhun Singhal [2], Aaushi Pareek [2], Anil Chuturgoon [3], Ranjit Sah [4], Vasso Apostolopoulos [5]

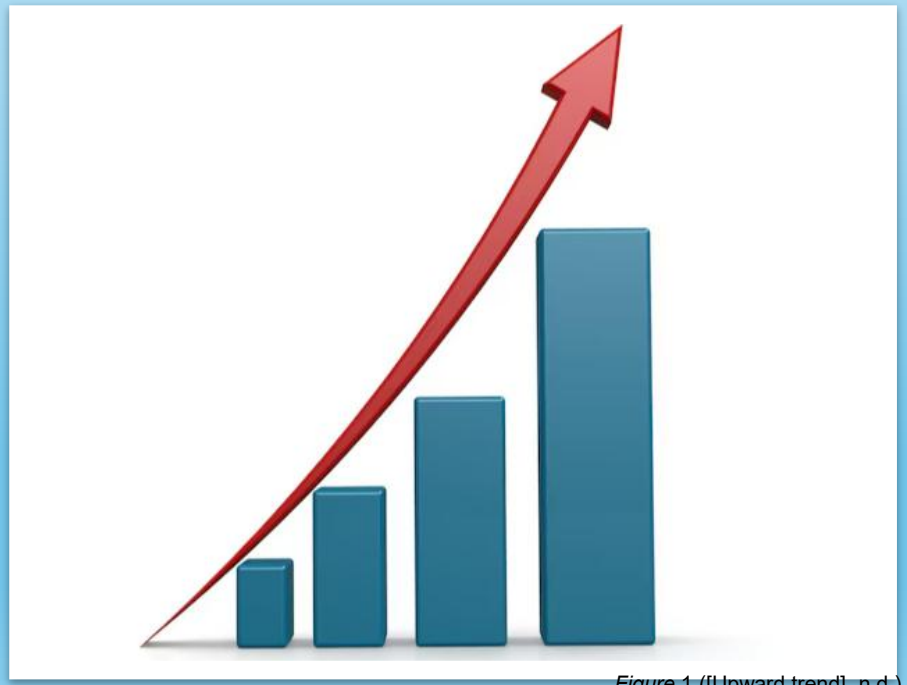


Figure 1 ([Upward trend]. n.d.)

114 cases and two fatalities linked to a cooling tower in Laverton North, Melbourne, Australia.

30 confirmed cases and two deaths in London, UK.

26 Aug. 2024

27 Sep.

20 Aug.

26 Sep.

53 cases and four fatalities linked to suspected deficiencies in building water systems in Lombardy, Italy

108 cases in New Zealand

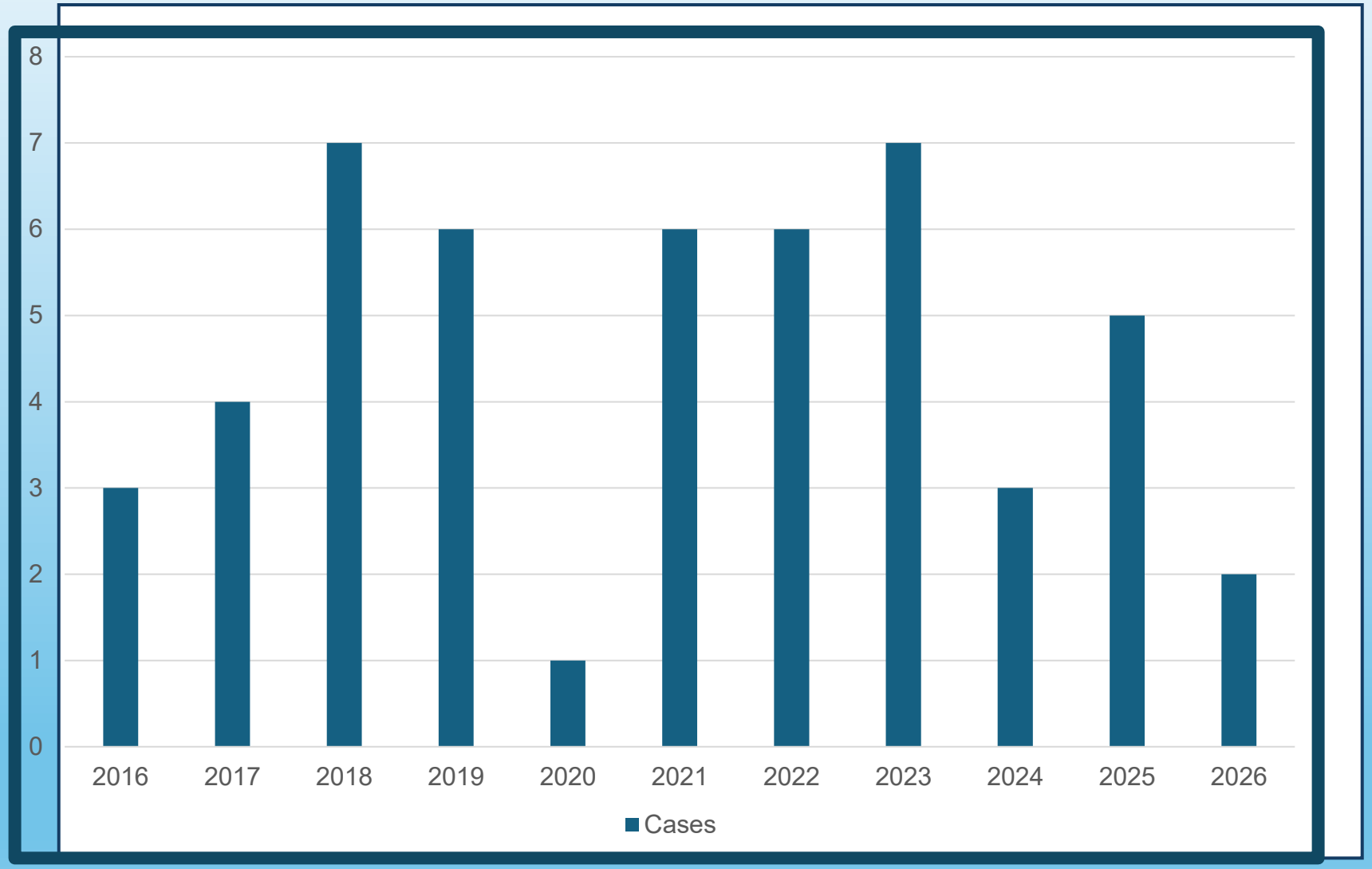
In the summer of 2025, Legionnaires' disease has spiked, with outbreaks from New York City to Sydney

Recent Legionella Outbreaks

Date	Location	Cases/Deaths	Summary
Nov-Dec 2025	Orlando, Florida	14/0	Legionnaires' Outbreak in a Gym
Nov 2025	Milan, Italy	11/1	Legionella, Community Outbreak
Nov 2025	Cincinatti, Ohio	2/0	Legionella in a Hospital
Oct 2025	Bloomingdale, Illinois	2/0	Legionella in a Nursing Facility
Aug-Sep 2025	Marshalltown, Iowa	71/2	Legionella, Community Outbreak
June-Sep 2025	Westchester County, New York	37/2	Legionella, Community Outbreak
Jul-Aug 2025	Harlem, New York	114/7	Legionella, Community Outbreak
July 2025	London, Ontario	64/2	Legionella, Community Outbreak
Mar-Apr 2025	Sydney, Australia	12/1	Legionella, Community Outbreak

Figure 1([Recent Outbreaks from *Legionella* and Other Waterborne Pathogens], n.d)

UCONN Legionella cases reported CT DHP 2016-2026



Legionellosis (Week 14) Weekly cases* of notifiable diseases, United States, U.S. Territories, and Non-U.S. Residents week ending April 11, 2026

Nationally Notifiable Infectious Diseases and Conditions, United States: Weekly Tables

Weekly cases* of notifiable diseases, United States, U.S. Territories, and Non-U.S. Residents week ending April 11, 2026 (Week 14)

Reporting Area	Legionellosis			
	Current week	Previous 52 weeks Max †	Cum YTD 2026 †	Cum YTD 2025 †
U.S. Residents, excluding U.S. Territories	41	299	1,344	1,743
New England	3	30	69	107
Connecticut	3	12	36	50
Maine	-	2	1	2
Massachusetts	-	19	28	37
New Hampshire	-	5	4	7
Rhode Island	-	6	-	1
Vermont	-	1	-	10

*Figure 1: (*CDC, 2025)

It continues to silently kill claiming victims and leaving death in its wake

A cartoon in the Observer newspaper on Sunday 11 August 1985, page 19, about Legionnaires' disease after a 1985 hospital outbreak in Brittain

Figure 1 (MacFarlane, et. Al, 1977)

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Thank You!

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Closing Remarks

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