# Disclosures

- Nothing to disclose

CDPH

# Learning Objectives

- List at least two common groups of Opportunistic Premise Plumbing Pathogens (OPPP) and name at least one organism in each group.
- Describe three properties of OPPP that enable survival and growth in hospital water distribution systems.
- Understand the national guidelines and resources available to implement a successful Water Management Program to reduce risk of growth and spread of *Legionella* and other opportunistic pathogens in water as required by Centers for Medicare Services (CMS).
- Identify three sink hygiene measures that your infection prevention and control program can implement to reduce risk of transmission of waterborne multidrug-resistant organisms (MDROs).

# Outline

- Background
  - Water in healthcare
  - Legionella and other Opportunistic Premise Plumbing Pathogens (OPPP)
- OPPP Outbreaks in Healthcare Settings
- Infection Prevention and Control Strategies
  - Water Management Program (WMP) and Tools
  - Sinks, Drains, Ice Machines

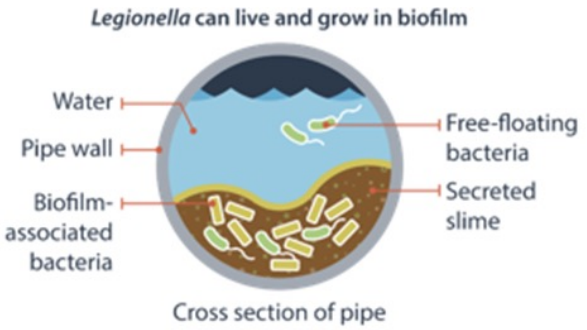
# Water in Healthcare

- Tap water meets stringent U.S. drinking water standards but is not sterile
- Water and moist environments support microbial growth
  - Source for Healthcare-Associated Infections (HAI) and antibiotic-resistant pathogens
- In Healthcare:
  - **Large complex water system**. Large surface-to-volume ratio, intermittent stagnation, low disinfection residual → biofilm formation.
  - Water used in different ways in healthcare. Required for many types of products, processes and procedures
  - **Multiple routes of exposure**. Medical devices could be a vehicle.
  - Certain patient populations especially vulnerable


CDPH

# *Legionella*

- Gram-negative bacteria non-fermenter, many species
  - most cases *L pneumophila* serogroup 1
- Cause of  Legionnaires' Disease – pneumonia
- Environmental organism
  - freshwater, some species in soil
- Transmission via inhalation or aspiration
  - not transmitted person-to-person
- Chlorine tolerant. Low levels in municipal drinking water.
- Thrives in stagnant warm water (77-108 ◦F)
- Proliferates in cooling towers, biofilm lining plumbing pipes. Can colonize ice machines.
- Relevant for healthcare facilities
  - Large complex water plumbing systems & cooling towers
  - Vulnerable population




# Opportunistic Premise Plumbing Pathogens (OPPP)

- Microorganisms in building water systems that are more likely to cause disease in at-risk or immunocompromised individuals and have been described in outbreaks linked to healthcare settings.
- Tap water is not sterile and the OPPP community in different municipal water systems can vary.
- Three common OPPP categories include:
  - Gram-negative non-lactose fermenters
  - Non-fecal coliforms
  - Non-tuberculous mycobacteria

Considerations for Reducing Risk: Water in Healthcare Facilities | HAIs | CDC

# Opportunistic Premise Plumbing Pathogens (OPPP)

## Gram-negative non-fermenting bacteria

- *Achromobacter xylosoxidans*
- *Acinetobacter baumannii complex*
- ***Burkholderia cepacia* complex**
- *Cupriavidus spp.,Some Ralstonia* spp.
- *Delftia* spp., *Elizabethkingia* spp.
- ***Legionella pneumophila***
- *Methylobacterium mesophilicum*
- ***Pseudomonas aeruginosa**, P. fluorescens, P. putida*
- *Sphingomonas paucimobilis*
- *Stenotrophomonas maltophilia*

*Legionella pneumophila*

*Aspergillus fumigatus*

*Pseudomonas aeruginosa*

- **Non-fecal coliforms**
  - *Enterobacter spp.*
  - *Klebsiella spp.*
  - *Pantoea agglomerans complex*
  - *Serratia marcescens, S. liquefacients*.

## Nontuberculous mycobacteria (NTM)

### Fungi

- Aspergillus fumigatus, A niger
- Fusarium; Philaemonium

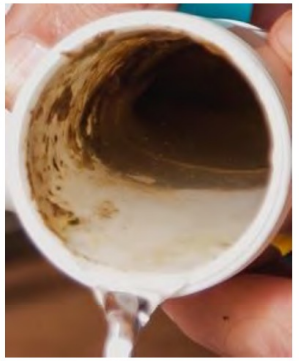
### Protozoa

- Acanthamoeba & Naegleria spp.

Considerations for Reducing Risk: Water in Healthcare Facilities | HAIs | CDC

# Opportunistic Premise Plumbing Pathogens: Characteristics

| | *Legionella* | Other OPPP |
|---|---|---|
| Environmental organisms. Naturally occurring in tap water | Yes | Yes |
| Resistant to water disinfectants | Yes | Yes |
| Thermophilic | Yes | Varies by pathogen |
| Thrives in stagnant water | Yes | Yes |
| Proliferates in biofilm lining plumbing | Yes | Yes |
| Potential infection risk in healthcare facilities | Yes | Yes |
| Routes of transmission in healthcare | Inhalation or aspiration* | Direct or indirect contact.** |



Wastewater drain biofilm

*Direct contact when inhaling aerosols containing Legionella. Rare direct inoculation.

** Transmission of NTM can also occur by inhalation or aspiration (especially members of the Mycobacterium avium complex (MAC).

# The 7 most reported water-associated healthcare acquired pathogens, CLABSI, VAP, CAUTI, SSI — NHSN, 2011–2014

| Organism | Number of reports | % |
|---|---|---|
| *Klebsiella pneumoniae/oxytoca* | 31,498 | 7.7 |
| *Pseudomonas aeruginosa* | 29,636 | 7.3 |
| *Enterobacter* spp. | 17,235 | 4.2 |
| Yeast | 10,811 | 2.6 |
| *Serratia* spp. | 5,463 | 1.3 |
| *Acinetobacter baumannii* | 4,375 | 1.1 |
| *Stenotrophomonas maltophilia* | 1,758 | 0.4 |

Slide courtesy of M. Arduino, CDC

# Water and Water-Containing (Aqueous) Products: Ubiquitous in Healthcare

- **Many uses of water in healthcare settings**, including:
  - **Drinking water, handwashing, bathing**
  - **Facility water for plant operations** (HVAC, **cooling towers**, fire suppression)
  - **Medication preparation**, enteral feedings
  - Therapy
    - Renal replacement therapy, **burn wound debridement**, hydrotherapy
  - **Device reprocessing**
  - Water for steam generation (autoclaves) or water baths
  - **Ice** for hydration, pain management, physical therapy, medication/ specimen transport
  - Medical device use (e.g., heater-cooler units)
  - **Dental Unit Water Lines**
- **Aqueous products** used in medications, infusions, procedures, patient hygiene **can become contaminated**

# OPPP Outbreaks

*Clinical Infectious Diseases*

INVITED ARTICLE

HEALTHCARE EPIDEMIOLOGY: Robert A. Weinstein, Section Editor

# Healthcare Outbreaks Associated With a Water Reservoir and Infection Prevention Strategies

**Hajime Kanamori,[1,2] David J. Weber,[1,2] and William A. Rutala[1,2]**

[1]Division of Infectious Diseases, University of North Carolina School of Medicine, and [2]Hospital Epidemiology, University of North Carolina Health Care, Chapel Hill

Hospital water may serve as a reservoir of healthcare-associated pathogens, and contaminated water can lead to outbreaks and severe infections. The clinical features of waterborne outbreaks and infections as well as prevention strategies and control measures are reviewed. The common waterborne pathogens were bacteria, including *Legionella* and other gram-negative bacteria, and nontuberculous mycobacteria, although fungi and viruses were occasionally described. These pathogens caused a variety of infections, including bacteremia and invasive and disseminated diseases, particularly among immunocompromised hosts and critically ill adults as well as neonates. Waterborne outbreaks occurred in healthcare settings with emergence of new reported reservoirs, including electronic faucets (*Pseudomonas aeruginosa* and *Legionella*), decorative water wall fountains (*Legionella*), and heater-cooler devices used in cardiac surgery (*Mycobacterium chimaera*). Advanced molecular techniques are useful for achieving a better understanding of reservoirs and transmission pathways of waterborne pathogens. Developing prevention strategies based on water reservoirs provides a practical approach for healthcare personnel.

**Keywords.** waterborne outbreaks; healthcare-associated infections; water; outbreaks.

Hospital water and water-related devices as well as moist environments and aqueous solutions can serve as a reservoir of waterborne pathogens in healthcare settings [1, 2]. The hospital environment may allow contamination by waterborne pathogens, in part because water temperatures are suitable for bacterial growth, and the complex structure of hospital water systems

The aim of this review article was to (1) review healthcare-associated outbreaks and infections associated with a water reservoir from the published literature, and (2) provide infection prevention strategies and control measures by water reservoirs based on the published scientific evidence and available guidelines.



CDPH

Kanamori H, et al. . Clin Infect Dis. 2016 Jun 1;62(11):1423-35. https://pubmed.ncbi.nlm.nih.gov/26936670/

*Infection Control & Hospital Epidemiology* (2019), **40**, 621–626
doi:10.1017/ice.2019.60

**Original Article**

# Investigation of healthcare infection risks from water-related organisms: Summary of CDC consultations, 2014—2017

Kiran M. Perkins MD, MPH, Sujan C. Reddy MD, Ryan Fagan MD, MPH, Matthew J. Arduino MS, DrPH and Joseph F. Perz DrPH, MA

Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

**Abstract**

Objective: Water exposures in healthcare settings and during healthcare delivery can place patients at risk for infection with water-related organisms and can potentially lead to outbreaks. We aimed to describe Centers for Disease Control and Prevention (CDC) consultations involving water-related organisms leading to healthcare-associated infections (HAIs).

Design: Retrospective observational study.

Methods: We reviewed internal CDC records from January 1, 2014, through December 31, 2017, using water-related terms and organisms, excluding *Legionella*, to identify consultations that involved potential or confirmed transmission of water-related organisms in healthcare. We determined plausible exposure pathways and routes of transmission when possible.

Results: Of 620 consultations during the study period, we identified 134 consultations (21.6%), with 1,380 patients, that involved the investigation of potential water-related HAIs or infection control lapses with the potential for water-related HAIs. Nontuberculous mycobacteria were involved in the greatest number of investigations (n = 40, 29.9%). Most frequently, investigations involved medical products (n = 48, 35.8%), and most of these products were medical devices (n = 40, 83.3%). We identified a variety of plausible water-exposure pathways, including medication preparation near water splash zones and water contamination at the manufacturing sites of medications and medical devices.

CDPH

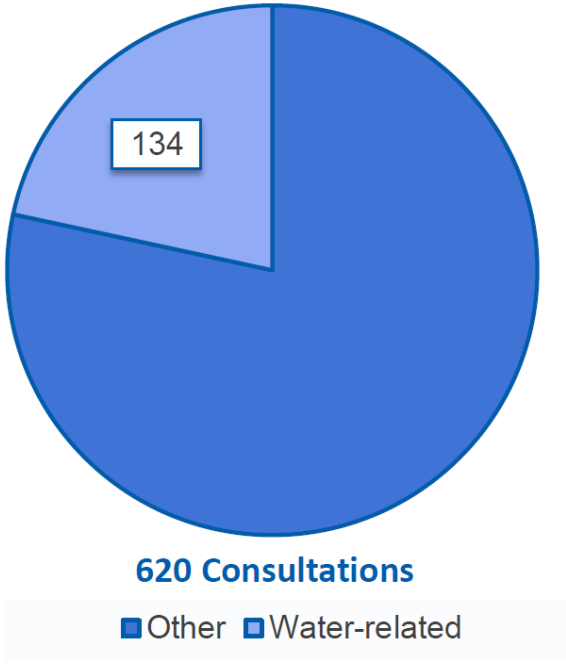
Perkins KM et al. *Infection Control & Hospital Epidemiology*. 2019.
https://pubmed.ncbi.nlm.nih.gov/30942147/

# CDC Consultations 2014-2017*

Water related outbreaks (n=134)

- ~ 22% involved pediatric patients
- 40 (30%) involved NTMs
- 45 (35%) involved MDROs
- 24 (18%) (surgery-related)
- 40 (30%) involved medical devices
  - Heater cooler units (8), bronchoscopes (5)
  - other endoscopes (3), ventilators (3), others (21)
- 13 (10%) involved medication contamination

22% are water-related (134 of 620)




*Perkins KM et al. *Infection Control & Hospital Epidemiology*. 2019. https://pubmed.ncbi.nlm.nih.gov/30942147/

CDPH

# Possible Exposure Pathways: Water to Patient*

**Table 3.** Possible Exposure Pathways and Routes of Transmission Involved in Water-Related Investigations, Division of Healthcare Quality Promotion, CDC, United States, 2014–2017

| |
|---|
| Injection/medication preparation near sink[a] |
| Nutrition (including breast milk and infant formula) preparation near sink[a] |
| Patient care supplies stored by sinks and toilets in intensive care unit[a] |
| Contaminated compounded nasal spray used prior to laryngoscopy |
| Contaminated water from neonatal intensive care unit (NICU) sinks[a] |
| Contaminated water from operating room scrub sinks[a] |
| Contaminated sink drains[a] |
| Contaminated dialysis wall boxes[a] |
| Use of nonsterile ice for patient care among immunocompromised patients[a] |
| Use of contaminated water in dental water lines[10,11,a] |
| Water introduction during respiratory therapy[a] |
| Use of tap water during bronchoscopy procedures[a] |
| Use of nonsterile water for humidification reservoirs of infant incubators in NICU[a] |
| Use of consumer-grade humidifier in operating room during LASIK procedures[12] |
| Use of nonsterile water and inadequate disinfection of heater-cooler devices used during cardiac surgery[13–15,a] |
| Intrinsic contamination of medical products due to water contamination at production site[16,17,a] |
| Poor medical device reprocessing procedures[a] |
| Contaminated automated endoscope reprocessors |
| Poor cleaning and disinfection of hydrotherapy rooms and equipment[a] |
| Water from contaminated shower heads[a] |
| Improperly cleaned mobile shower trolleys |
| Hot tub use by surgical personnel[a] |
| Water contamination of specimens/reagents in the laboratory[a] |
| Building water leaks in patient care areas |

[a]Indicates a potential exposure pathway or route of transmission that was documented as the possible source of infection in two or more investigations.

*Perkins KM et al. *Infection Control & Hospital Epidemiology*. 2019. https://pubmed.ncbi.nlm.nih.gov/30942147/

Potential Transmission Routes from Water to Patients


# Potential Transmission Routes from Water to Patients

- Improperly reprocessing medical devices
- Using poor quality water for immunocompromised patients
- Using poor quality water in NICU infant incubators
- Preparing nutrition (e.g., infant formula) near a sink
- Preparing injections and medications near sinks
- Improper tap water use in respiratory care
- Improper oral care in immunocompromised patients
- Water droplets and aerosolization from contaminated shower heads and toilets
- Splashes from sink drains

https://www.cdc.gov/hai/images/Potential-Transmission-Routes-from-Water-to-Patients.jpg

Slide courtesy of M. Arduino, CDC

# Recent outbreaks in healthcare settings related to contaminated tap water.

- **Neonatal Intensive Care Units (NICU)**
  - *Pseudomonas aeruginosa* infections among neonates contamination of breast milk, MD
- **Long-term Acute Care Hospitals (LTACH)**
  - *Elizabethkingia menigosepticum* and *E. anopheles* associated with showering (mechanically ventilated patients, handling of nebulizers, etc.), AZ, CA, KY, IL (2017–2019)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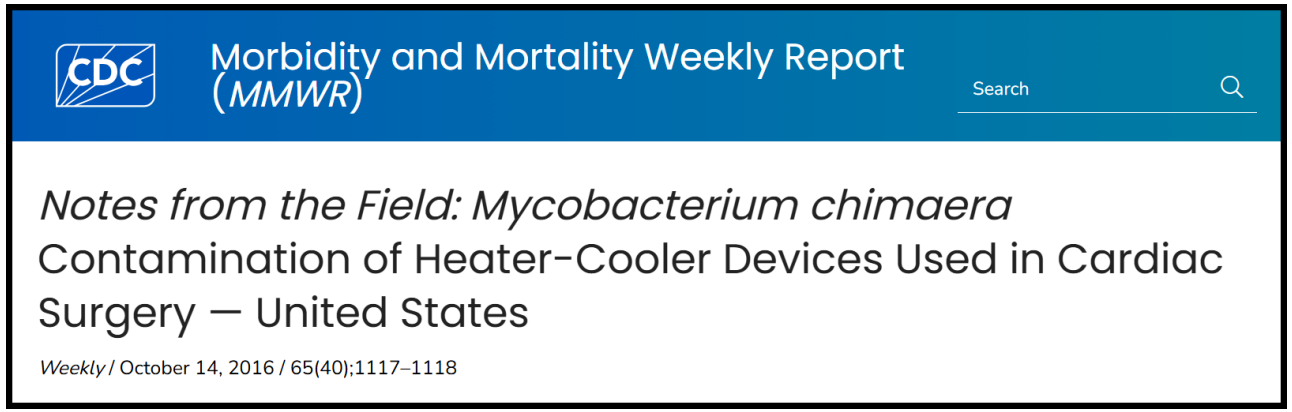
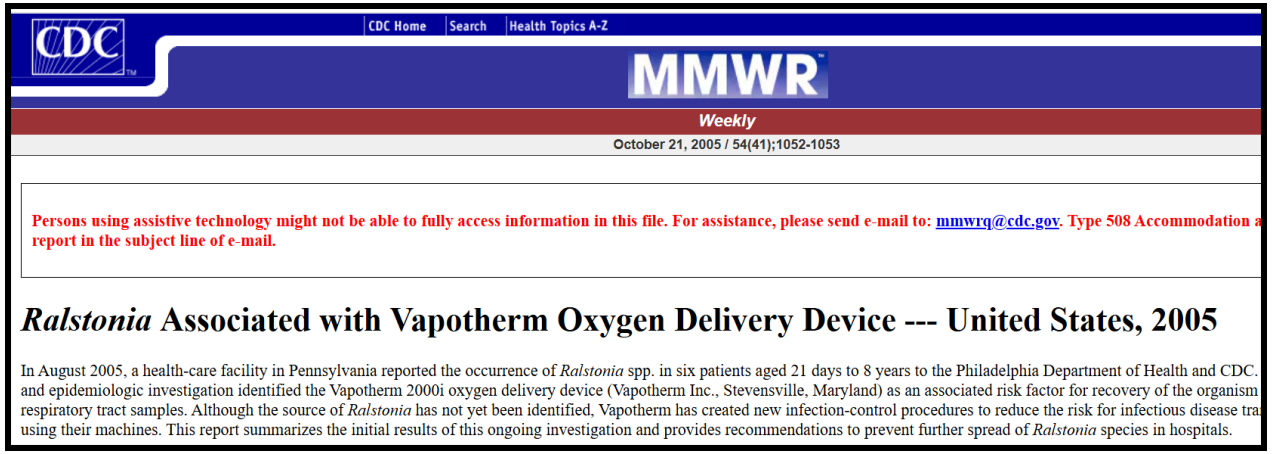
Slide courtesy of M. Arduino, CDC

# Outbreaks Linked to Manufacturing of Medical Devices

- Liva Nova 3T Heater-Cooler Units
  - Device used during cardiopulmonary bypass in cardiac surgeries.
  - International outbreak
  - *Mycobacterium chimera*
  - MMWR October 14, 2016

- *Respiratory therapy device*
  - *Vapotherm Oxygen Delivery*
  - *Ralstonia species.*
  - MMWR October 21, 2005.

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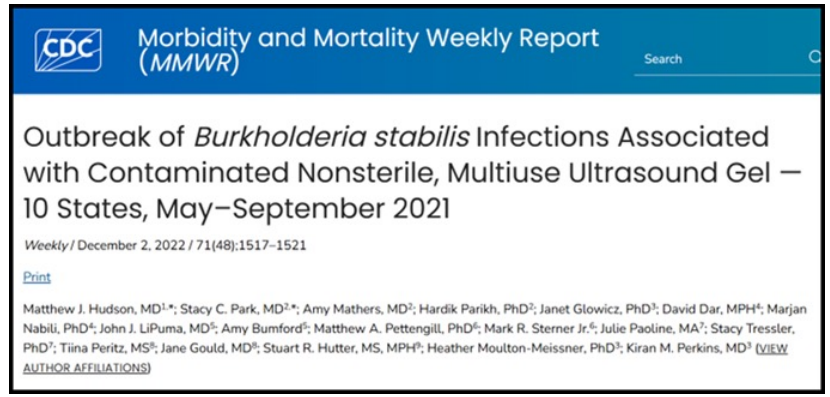
# Contamination of Water-Containing Products Used in Healthcare Linked to Outbreaks: Some examples.

- **Extrinsic contamination**: (contamination after opening).
  - *Serratia marcescens* outbreaks linked to **HCP hand cream**; **Multi-use vials** of methylprednisolone.
  - *Acinetobacter baumannii* outbreak linked to contaminated **ultrasound gel in burn unit**
- **Intrinsic contamination:** (contamination of product)
  - *Serratia marcescens multi-state outbreak due to contaminated heparin-saline flush syringes*
  - *Burkholderia cepacia complex* outbreaks due to intrinsic product contamination
    - Liquid docusate stool softener (2017)
    - Antiseptic oral care product (2018)
    - No-rinse cleansing foam for bathing & perineal care (2017-2018)
    - Ultrasound gel (2021)

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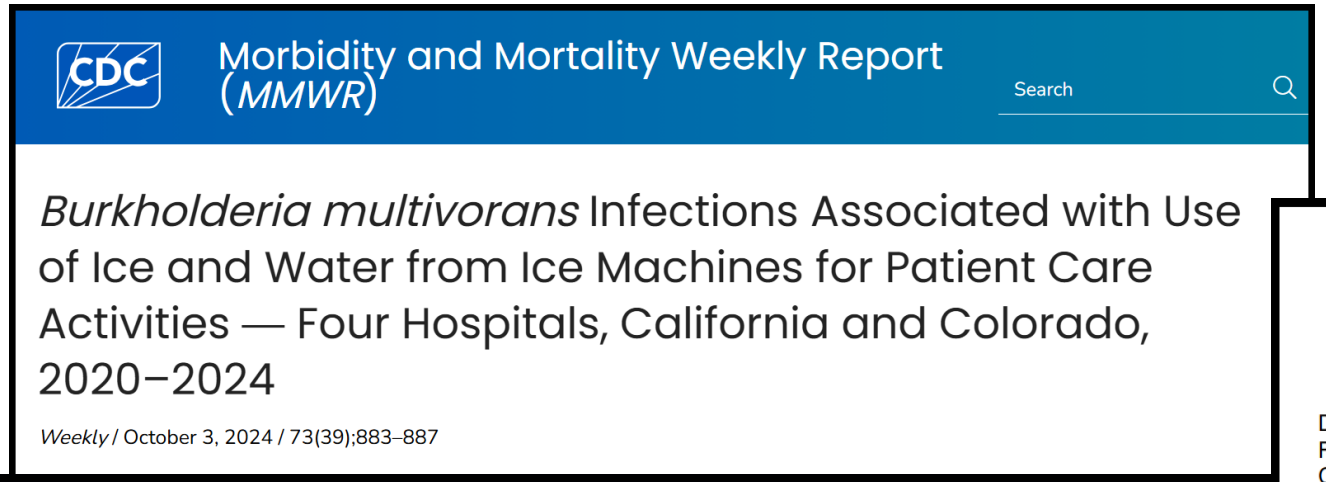
# Recent OPPP Outbreaks involving CA residents: *Burkholderia*, NTM, VIM- *Pseudomonas*

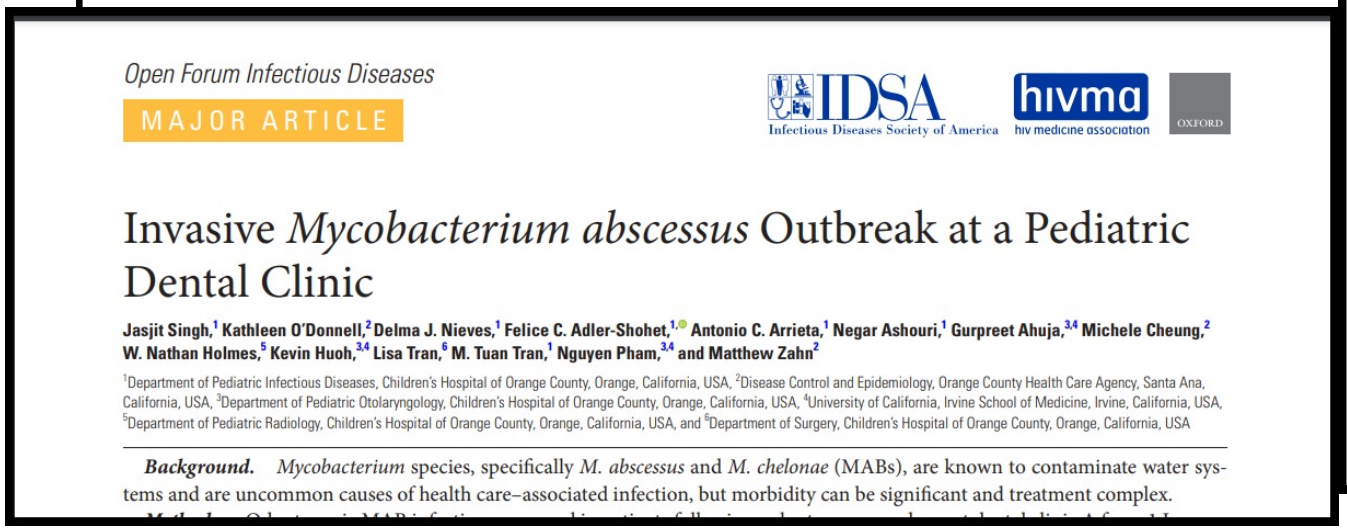


Morbidity and Mortality Weekly Report (*MMWR*)

Search

*Burkholderia multivorans* Infections Associated with Use of Ice and Water from Ice Machines for Patient Care Activities — Four Hospitals, California and Colorado, 2020–2024

*Weekly* / October 3, 2024 / 73(39);883–887



*Open Forum Infectious Diseases*

MAJOR ARTICLE

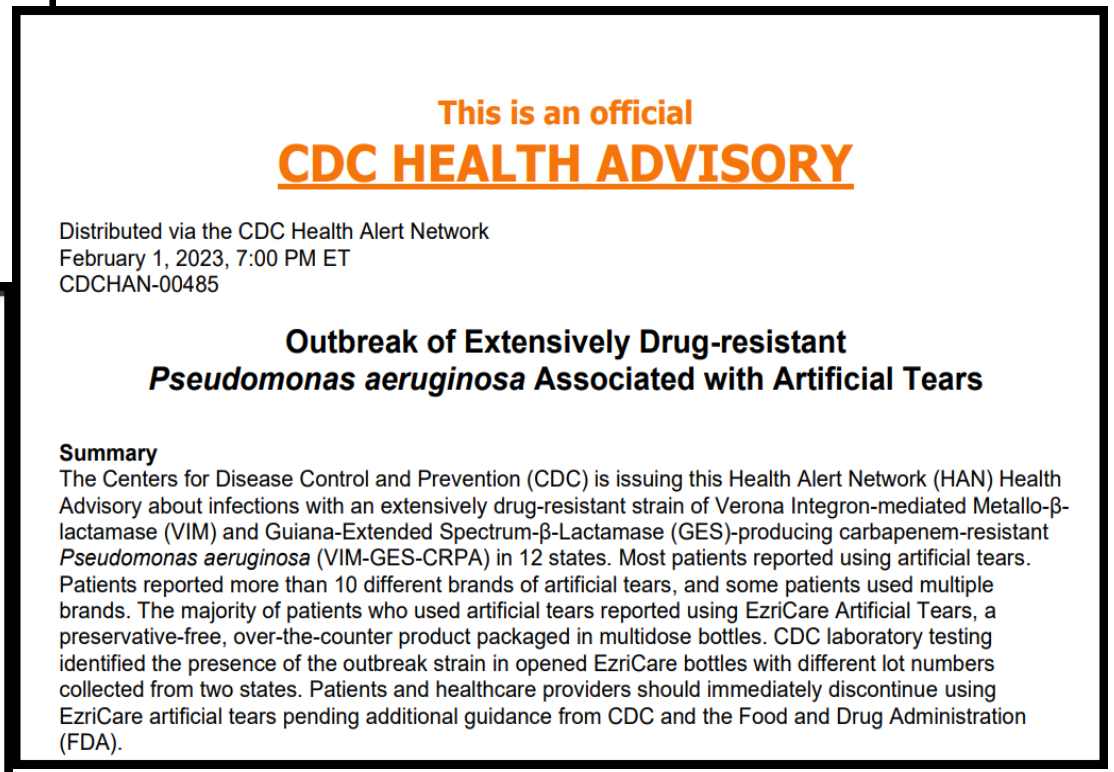
IDSA Infectious Diseases Society of America · hivma hiv medicine association · OXFORD

Invasive *Mycobacterium abscessus* Outbreak at a Pediatric Dental Clinic

Jasjit Singh,[1] Kathleen O'Donnell,[2] Delma J. Nieves,[1] Felice C. Adler-Shohet,[1,©] Antonio C. Arrieta,[1] Negar Ashouri,[1] Gurpreet Ahuja,[3,4] Michele Cheung,[2] W. Nathan Holmes,[5] Kevin Huoh,[3,4] Lisa Tran,[6] M. Tuan Tran,[1] Nguyen Pham,[3,4] and Matthew Zahn[2]

[1]Department of Pediatric Infectious Diseases, Children's Hospital of Orange County, Orange, California, USA, [2]Disease Control and Epidemiology, Orange County Health Care Agency, Santa Ana, California, USA, [3]Department of Pediatric Otolaryngology, Children's Hospital of Orange County, Orange, California, USA, [4]University of California, Irvine School of Medicine, Irvine, California, USA, [5]Department of Pediatric Radiology, Children's Hospital of Orange County, Orange, California, USA, and [6]Department of Surgery, Children's Hospital of Orange County, Orange, California, USA

***Background.*** *Mycobacterium* species, specifically *M. abscessus* and *M. chelonae* (MABs), are known to contaminate water systems and are uncommon causes of health care–associated infection, but morbidity can be significant and treatment complex.



This is an official

**CDC HEALTH ADVISORY**

Distributed via the CDC Health Alert Network
February 1, 2023, 7:00 PM ET
CDCHAN-00485

**Outbreak of Extensively Drug-resistant *Pseudomonas aeruginosa* Associated with Artificial Tears**

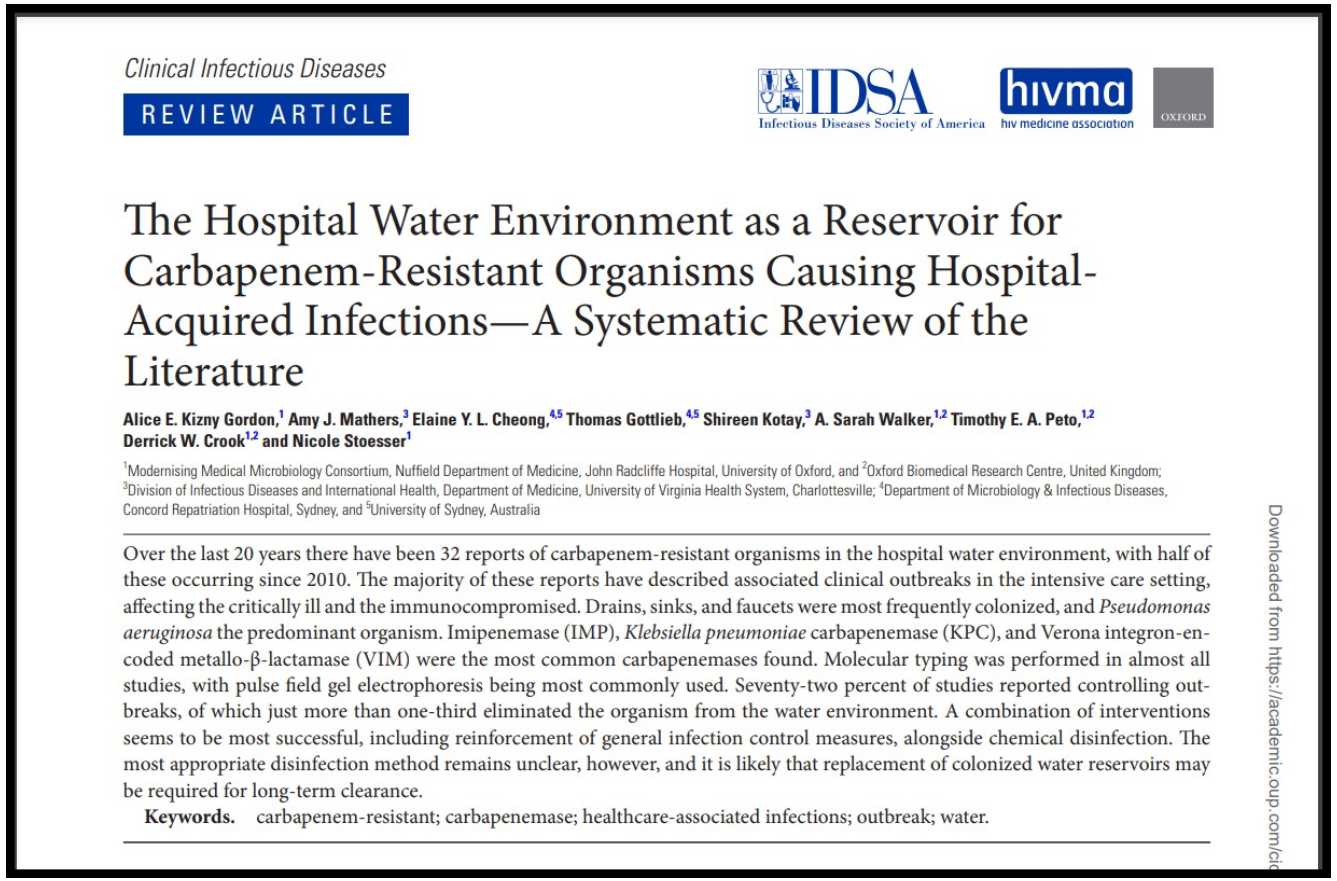
**Summary**
The Centers for Disease Control and Prevention (CDC) is issuing this Health Alert Network (HAN) Health Advisory about infections with an extensively drug-resistant strain of Verona Integron-mediated Metallo-β-lactamase (VIM) and Guiana-Extended Spectrum-β-Lactamase (GES)-producing carbapenem-resistant *Pseudomonas aeruginosa* (VIM-GES-CRPA) in 12 states. Most patients reported using artificial tears. Patients reported more than 10 different brands of artificial tears, and some patients used multiple brands. The majority of patients who used artificial tears reported using EzriCare Artificial Tears, a preservative-free, over-the-counter product packaged in multidose bottles. CDC laboratory testing identified the presence of the outbreak strain in opened EzriCare bottles with different lot numbers collected from two states. Patients and healthcare providers should immediately discontinue using EzriCare artificial tears pending additional guidance from CDC and the Food and Drug Administration (FDA).

# Surgical Personnel "Tubbing" Before Work

- Surgical site infections; pace-maker pocket infections, infections following orthopedic and cosmetic surgery (*M. abscessus*, *M. goodii*, *M. jaccuzzii*, *M. wolynskii*)
  - Groenewold MR, et al. Investigation of a cluster of rapidly growing mycobacteria infections associated with joint replacement surgery in a Kentucky hospital, 2013-2014 with 8-year follow-up. *Am J Infect Control*. 2023;51(4):454-460
  - Scheflan M, Wixtrom RN. **Over Troubled Water: An Outbreak of Infection Due to a New Species of Mycobacterium following Implant-Based Breast Surgery.** *Plast Reconstr Surg* 2016;137(1):97-105
  - Rahav G, et al. **An outbreak of *Mycobacterium jacuzzii* infection following insertion of breast implants.** *Clin Infect Dis.* 2006;43(7):823-30.

Slide courtesy of M. Arduino, CDC

# Carbapenem-Resistant Organisms (CROs) associated with hospital water



*Clinical Infectious Diseases*

REVIEW ARTICLE

## The Hospital Water Environment as a Reservoir for Carbapenem-Resistant Organisms Causing Hospital-Acquired Infections—A Systematic Review of the Literature

**Alice E. Kizny Gordon,[1] Amy J. Mathers,[3] Elaine Y. L. Cheong,[4,5] Thomas Gottlieb,[4,5] Shireen Kotay,[3] A. Sarah Walker,[1,2] Timothy E. A. Peto,[1,2] Derrick W. Crook[1,2] and Nicole Stoesser[1]**

[1]Modernising Medical Microbiology Consortium, Nuffield Department of Medicine, John Radcliffe Hospital, University of Oxford, and [2]Oxford Biomedical Research Centre, United Kingdom; [3]Division of Infectious Diseases and International Health, Department of Medicine, University of Virginia Health System, Charlottesville; [4]Department of Microbiology & Infectious Diseases, Concord Repatriation Hospital, Sydney, and [5]University of Sydney, Australia

Over the last 20 years there have been 32 reports of carbapenem-resistant organisms in the hospital water environment, with half of these occurring since 2010. The majority of these reports have described associated clinical outbreaks in the intensive care setting, affecting the critically ill and the immunocompromised. Drains, sinks, and faucets were most frequently colonized, and *Pseudomonas aeruginosa* the predominant organism. Imipenemase (IMP), *Klebsiella pneumoniae* carbapenemase (KPC), and Verona integron-encoded metallo-β-lactamase (VIM) were the most common carbapenemases found. Molecular typing was performed in almost all studies, with pulse field gel electrophoresis being most commonly used. Seventy-two percent of studies reported controlling outbreaks, of which just more than one-third eliminated the organism from the water environment. A combination of interventions seems to be most successful, including reinforcement of general infection control measures, alongside chemical disinfection. The most appropriate disinfection method remains unclear, however, and it is likely that replacement of colonized water reservoirs may be required for long-term clearance.

**Keywords.** carbapenem-resistant; carbapenemase; healthcare-associated infections; outbreak; water.



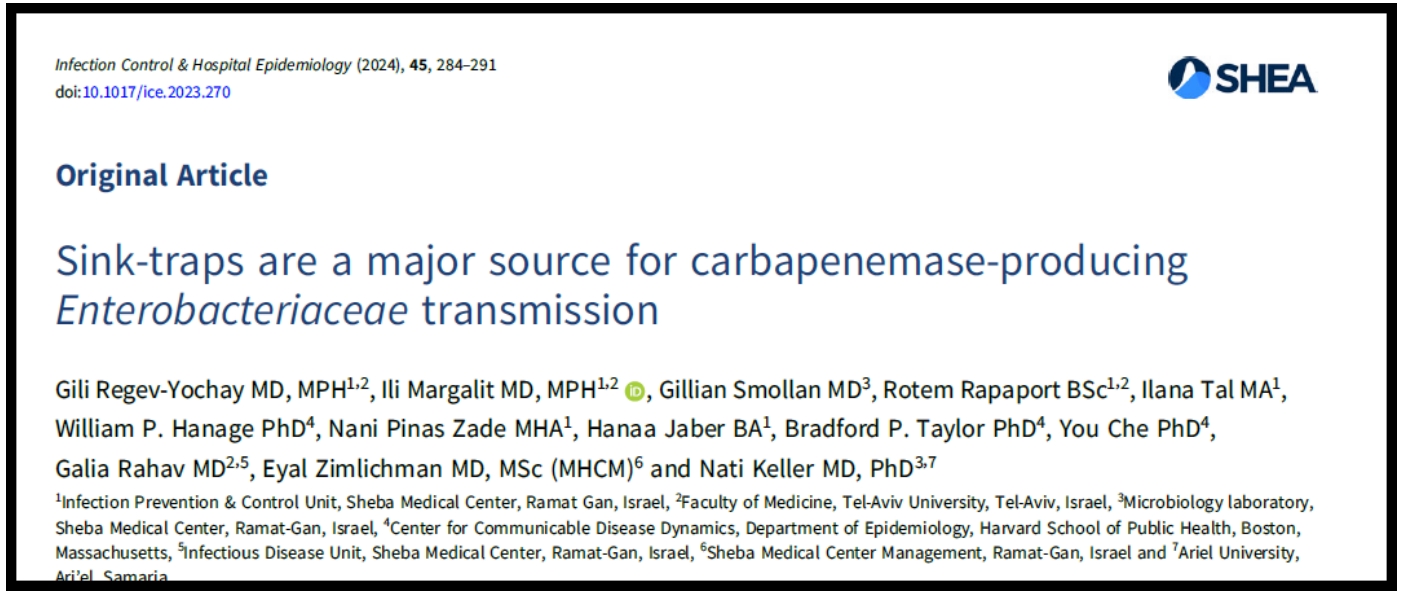
32 reports of CROs in hospital water environment

- *Pseudomonas aeruginosa* most common
- Carbapenemase producing–Klebsiella pneumoniae (KPC) with AR genes including VIM or IMP,
- Most in ICU or immunocompromised
- Drains, sinks, and faucets frequently colonized.
- Clinical and environmental match
- A combination of interventions needed to control outbreak

CDPH

# Sink-traps: a source of Carbapenemase-producing Enterobacterales transmission

- Recent publication by Regev-Yochav et al. ICHE 2024
- Discussion summarizes literature on intervention studies to date
- **In his hospital**, new wing rapidly colonized, **interventions** including sink-trap decontamination, replacement of entire sinks/ P-traps were **unsuccessful**
- Persistent colonization despite measures to decolonize



*Infection Control & Hospital Epidemiology* (2024), **45**, 284–291
doi:10.1017/ice.2023.270

SHEA

**Original Article**

## Sink-traps are a major source for carbapenemase-producing *Enterobacteriaceae* transmission

Gili Regev-Yochay MD, MPH[1,2], Ili Margalit MD, MPH[1,2], Gillian Smollan MD[3], Rotem Rapaport BSc[1,2], Ilana Tal MA[1], William P. Hanage PhD[4], Nani Pinas Zade MHA[1], Hanaa Jaber BA[1], Bradford P. Taylor PhD[4], You Che PhD[4], Galia Rahav MD[2,5], Eyal Zimlichman MD, MSc (MHCM)[6] and Nati Keller MD, PhD[3,7]

[1]Infection Prevention & Control Unit, Sheba Medical Center, Ramat Gan, Israel, [2]Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel, [3]Microbiology laboratory, Sheba Medical Center, Ramat-Gan, Israel, [4]Center for Communicable Disease Dynamics, Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts, [5]Infectious Disease Unit, Sheba Medical Center, Ramat-Gan, Israel, [6]Sheba Medical Center Management, Ramat-Gan, Israel and [7]Ariel University, Ari'el, Samaria

https://pubmed.ncbi.nlm.nih.gov/38149351/

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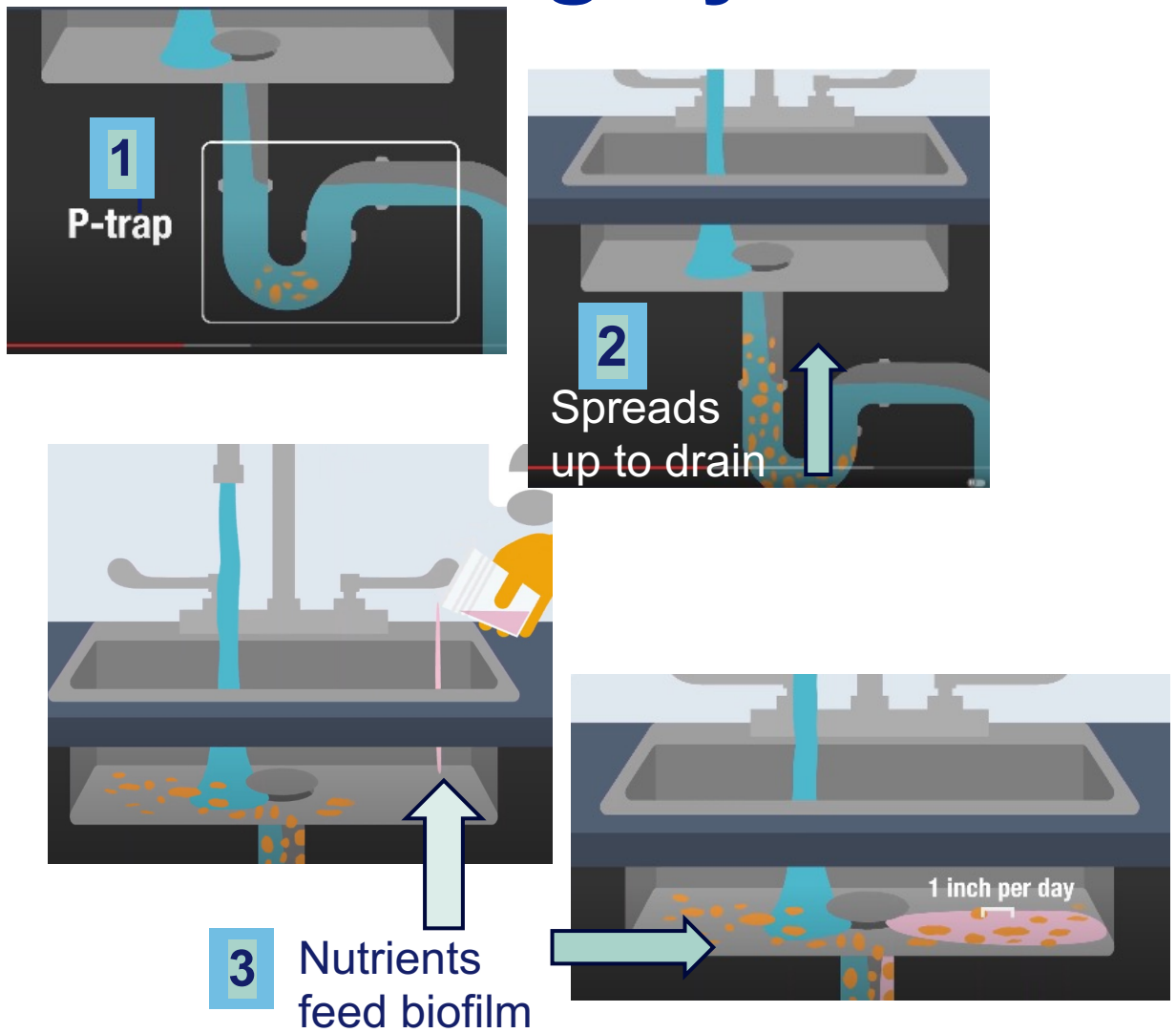
# Part I: MDROs and Antimicrobial-Resistance (AR) Gene Exchange in Plumbing Systems

**Pathogens colonize sinks and drains during patient care activities.**

1. **Biofilm growth in P traps with potential Antimicrobial-Resistance gene exchange**
2. **AR Pathogen spreads retrograde to drain**
3. **Liquids with nutrients emptied into sink**
   - Promotes bacterial/ biofilm growth
   - Biofilm spreads up to one inch /day. Running water helps biofilm spread



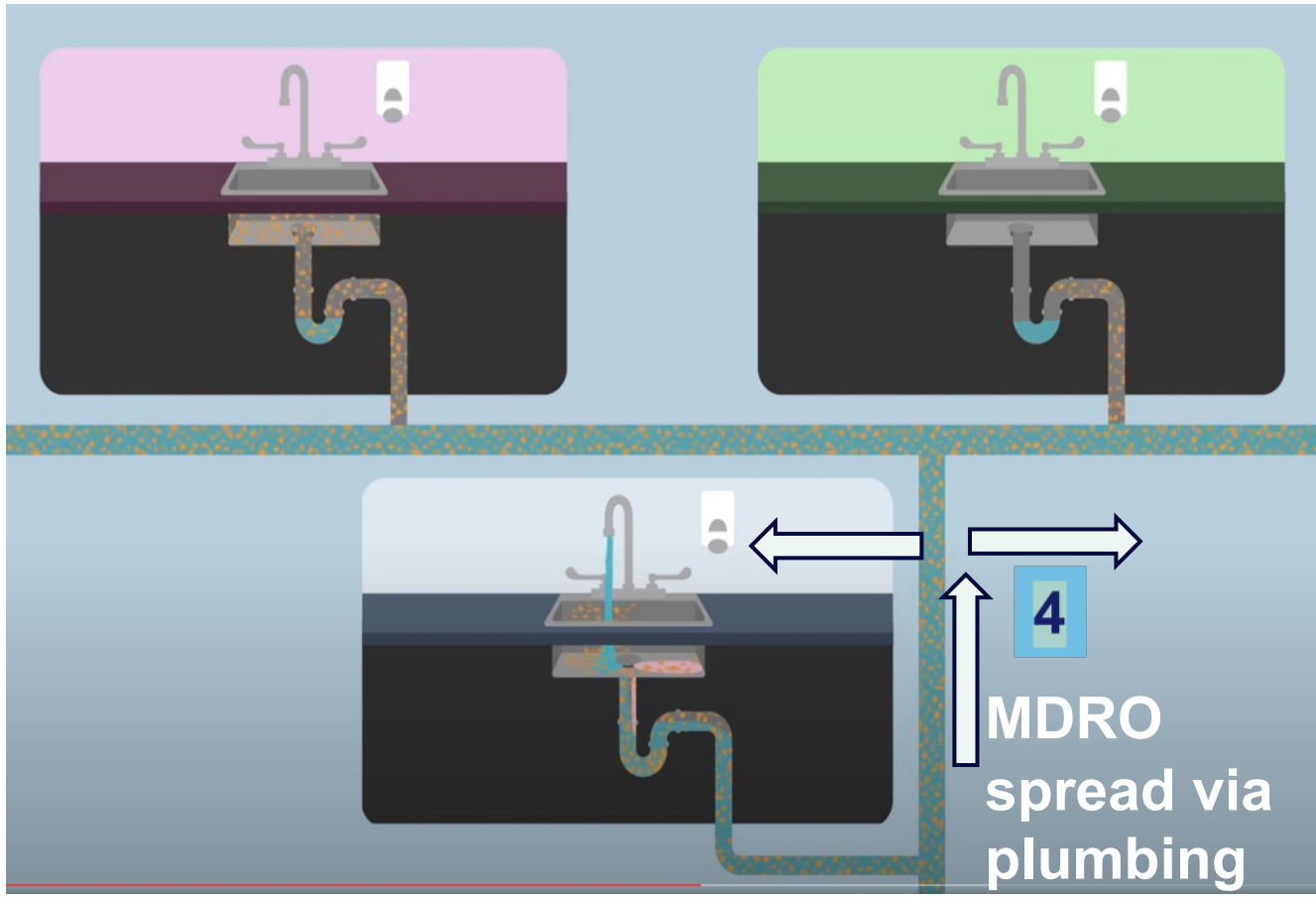

CDPH

Kotay … Mathers, et al, 2017.

# Part II: MDROs and AR Gene Exchange and Spread in Plumbing Systems

**Pathogens colonize sinks and drains during patient care activities.**

1. Growth in P traps with potential Antimicrobial-Resistance gene exchange
2. Spreads retrograde to drain
3. Liquids with nutrients emptied into sink
4. **Biofilm spreads to other sinks and drains via plumbing system**




Kotay et al, 2017

Figures (adapted): Virginia Infection Prevention Center, VA DOH, Staying Safe in the Splash Zone

# Summary: MDRO Exposure from Wastewater

- Non-fecal coliforms and some non-lactose fermenters (e.g., pseudomonas, CRAB) present in water, soil
  - Thrive in moist environments including drains, wastewater, and p-traps
  - Perfect milieu for exchange or mobile AR resistance genes such as carbapenemases
  - Tube feeding a risk for MDRO drain colonization in some studies

Splashes created from

- water flow hitting contaminated sink drain or or hopper flushed →
- contamination of nearby surfaces



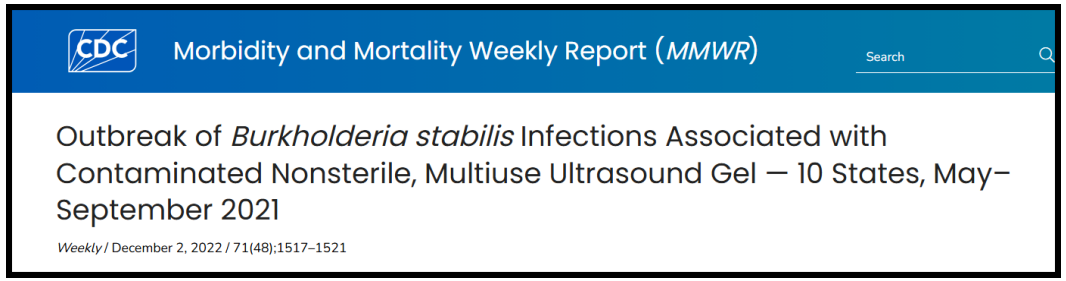
CDPH

# Ultrasound Imaging

- Numerous outbreaks linked to contaminated multi-use ultrasound gel


CDPH

# CDC: Considerations for Use of Ultrasound Gel*



Morbidity and Mortality Weekly Report (*MMWR*)

Search

Outbreak of *Burkholderia stabilis* Infections Associated with Contaminated Nonsterile, Multiuse Ultrasound Gel — 10 States, May–September 2021

*Weekly* / December 2, 2022 / 71(48);1517–1521

- Use single-use sterile packets when preparing for percutaneous procedures, on non-intact skin or near fresh surgical wounds
- If non-sterile ultrasound gel used inadvertently, ensure removal and perform skin antisepsis before the procedure

**Sterile ultrasound gel**

- Use single-use, sterile ultrasound gel for ultrasonography performed in preparation for or during percutaneous procedures (e.g., placement of central and peripheral intravenous lines, amniocentesis, paracentesis, tissue biopsy, and surgical procedures).†
  - Do not use nonsterile ultrasound gel for visualization before such procedures.
  - If nonsterile ultrasound gel is inadvertently used before such procedures (e.g., unanticipated procedure), care must be taken to ensure that all residual gel is removed from the skin and the appropriate skin antisepsis is performed before the procedure.
- Use single-use, sterile ultrasound gel for all ultrasound procedures performed on nonintact skin or near fresh surgical sites.†
- Whenever feasible, use single-use, sterile ultrasound gel inside single-use or sterile ultrasound probe covers.†

**Nonsterile ultrasound gel**

- If multiuse containers are used†:
  - Do not refill; discard and replace multidose containers when empty.
  - Seal container when not in use.
  - Avoid direct contact between gel container dispensing tip and any persons or instrumentation, including the ultrasound transducer.
- If a patient under contact precautions undergoes an ultrasound using gel dispensed from a multiuse container, discard the container after use.†
- After ultrasonography, clean the skin, ensuring that all residual ultrasound gel is removed.§

**Reprocessing of ultrasound equipment**

- Follow manufacturer's instructions for ultrasound probe reprocessing to ensure recommended cleaning and disinfection protocols are being followed.†,¶
- Clean and thoroughly disinfect ultrasound consoles and other parts of the ultrasound device that do not come into direct contact with the patient (e.g., handles, cables, connectors, and holders) and any warming devices or other noncritical surfaces associated with ultrasound procedures before use on another patient.† Containers for ultrasound gel and consoles should be considered high-touch surfaces.
- All transducers used on either mucous membranes or nonintact skin (e.g., use in transvaginal, transrectal, and transesophageal procedures) require high-level disinfection or sterilization before use on another patient.†,§,¶,**

* For all ultrasonography, standard precautions including adherence to hand hygiene and the use of personal protective equipment are recommended. Surgical hand scrub and use of sterile barriers is recommended for sterile procedures.
† https://www.aium.org/officialstatements/57
§ https://www.cdc.gov/infectioncontrol/guidelines/disinfection/
¶ https://doi.org/10.1002/jum.15653
** https://www.fda.gov/media/71100/download

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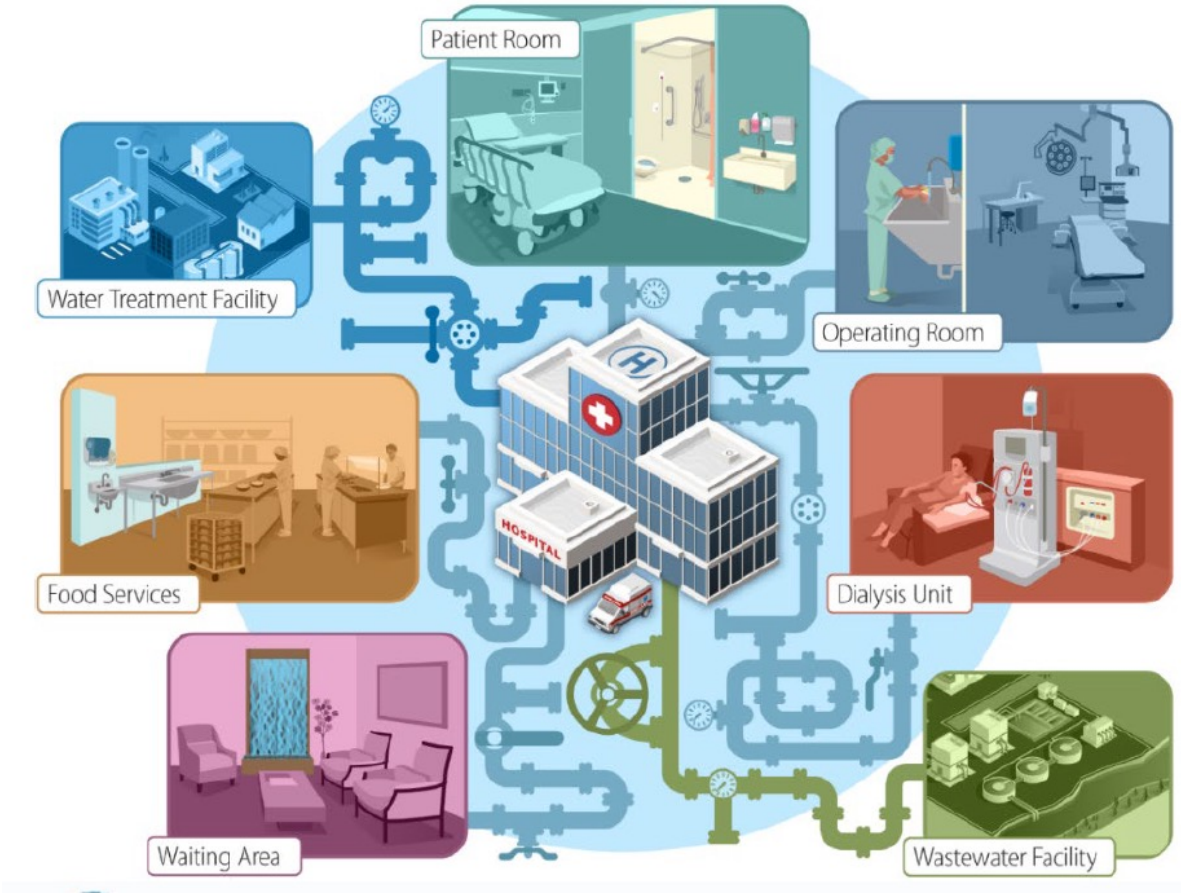
* CDC: MMWR December 2022 www.cdc.gov/mmwr/volumes/71/wr/mm7148a3.htm

# Water-related Outbreaks in Healthcare: Summary

- Water-related outbreaks are common
- Many possible sources of exposure in a facility
- Immunocompromised and ICU patients at increased risk

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# Infection Prevention and Control Strategies

## Water Management Program (WMP)

## WMP Tools

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)

****Revised to Clarify Expectations for Providers, Accrediting Organizations, and Surveyors****

**Memorandum Summary**

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

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# CMS QSO-17-30 Requirements

Facilities must have **water management plans** and documentation that, at a minimum, ensure each facility:

- Conducts a **facility risk assessment** to identify where Legionella and other opportunistic waterborne pathogens (e.g. Pseudomonas, Acinetobacter, Burkholderia, Stenotrophomonas, nontuberculous mycobacteria, and fungi) could grow and spread in the facility water system.
- Develops and **implements a water management program** that considers the **ASHRAE** industry standard and the **CDC toolkit.**
- Specifies testing protocols and **acceptable ranges for control measures**, and document the results of testing and **corrective actions taken when control limits are not maintained**.

ASHRAE 188 (Legionella).
ASHRAE 514, 2023 (Other OPPP)

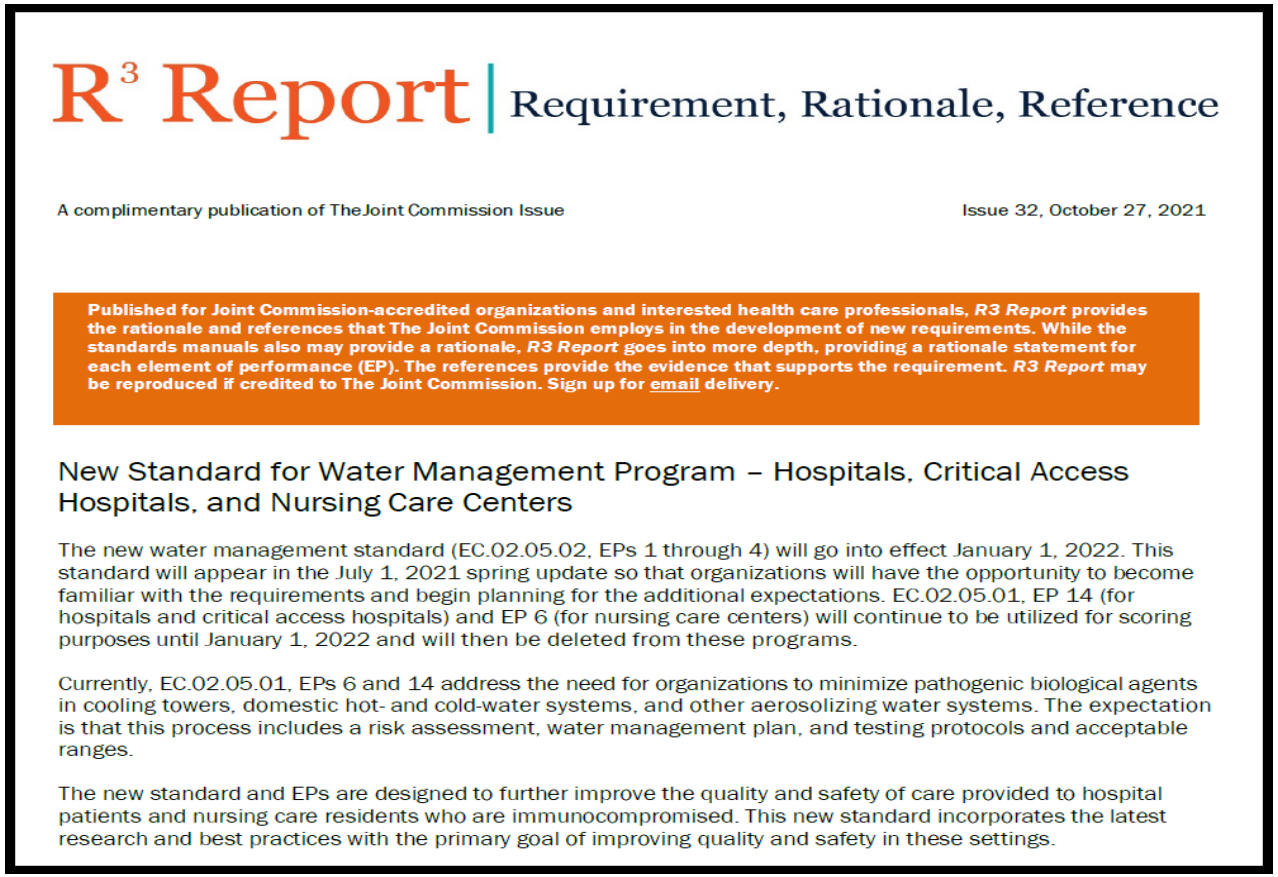
CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

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

# Joint Commission: Water Management Program

- Team or designee responsible for oversight, implementation
- Required elements: basic diagram mapping water supply sources, treatments, processing
- Water risk management based on diagram per CDC WICRA
- Specify control measures and end points. Consider monitoring basic water quality parameters:  temperature, *residual* disinfectant, pH.
- Address stagnation, new construction, new equipment
- Annual review and with changes

## Effective January 1, 2022



R³ Report | Requirement, Rationale, Reference

A complimentary publication of The Joint Commission Issue — Issue 32, October 27, 2021

**Published for Joint Commission-accredited organizations and interested health care professionals, *R3 Report* provides the rationale and references that The Joint Commission employs in the development of new requirements. While the standards manuals also may provide a rationale, *R3 Report* goes into more depth, providing a rationale statement for each element of performance (EP). The references provide the evidence that supports the requirement. *R3 Report* may be reproduced if credited to The Joint Commission. Sign up for email delivery.**

### New Standard for Water Management Program – Hospitals, Critical Access Hospitals, and Nursing Care Centers

The new water management standard (EC.02.05.02, EPs 1 through 4) will go into effect January 1, 2022. This standard will appear in the July 1, 2021 spring update so that organizations will have the opportunity to become familiar with the requirements and begin planning for the additional expectations. EC.02.05.01, EP 14 (for hospitals and critical access hospitals) and EP 6 (for nursing care centers) will continue to be utilized for scoring purposes until January 1, 2022 and will then be deleted from these programs.

Currently, EC.02.05.01, EPs 6 and 14 address the need for organizations to minimize pathogenic biological agents in cooling towers, domestic hot- and cold-water systems, and other aerosolizing water systems. The expectation is that this process includes a risk assessment, water management plan, and testing protocols and acceptable ranges.

The new standard and EPs are designed to further improve the quality and safety of care provided to hospital patients and nursing care residents who are immunocompromised. This new standard incorporates the latest research and best practices with the primary goal of improving quality and safety in these settings.

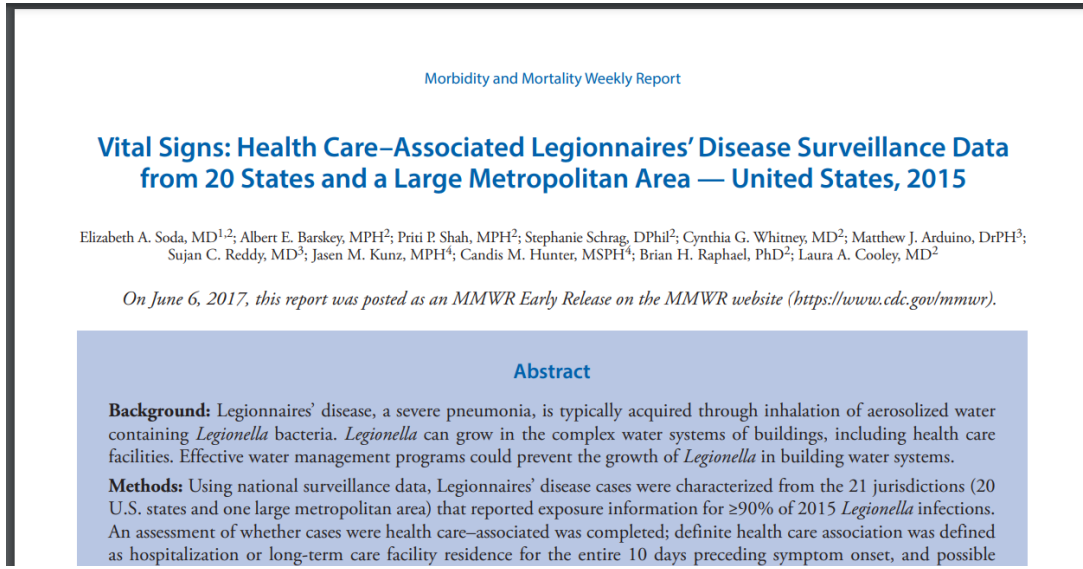
# Healthcare-Associated Legionnaires' Disease (HA-LD)

Presumptive  3%. Of these, 80% were SNF

- **Duration**: ≥10 days of continuous stay during 14-day exposure period in a healthcare facility

Possible 17 %

- Duration:  <10 days during 14-day exposure period
- CDC Vital Signs, 2015
  - 25% case facility for presumptive HA-LD
- Hospital-onset cases continue to occur
  - Recent outbreak 13 cases.
  - Copper-silver ion disinfection. Stopped cultures
  - Upgrades to disinfection system & water distribution contributed to this outbreak
  - Kessler et al. AJIC 2021 https://pubmed.ncbi.nlm.nih.gov/33631307/



Morbidity and Mortality Weekly Report

**Vital Signs: Health Care–Associated Legionnaires' Disease Surveillance Data from 20 States and a Large Metropolitan Area — United States, 2015**

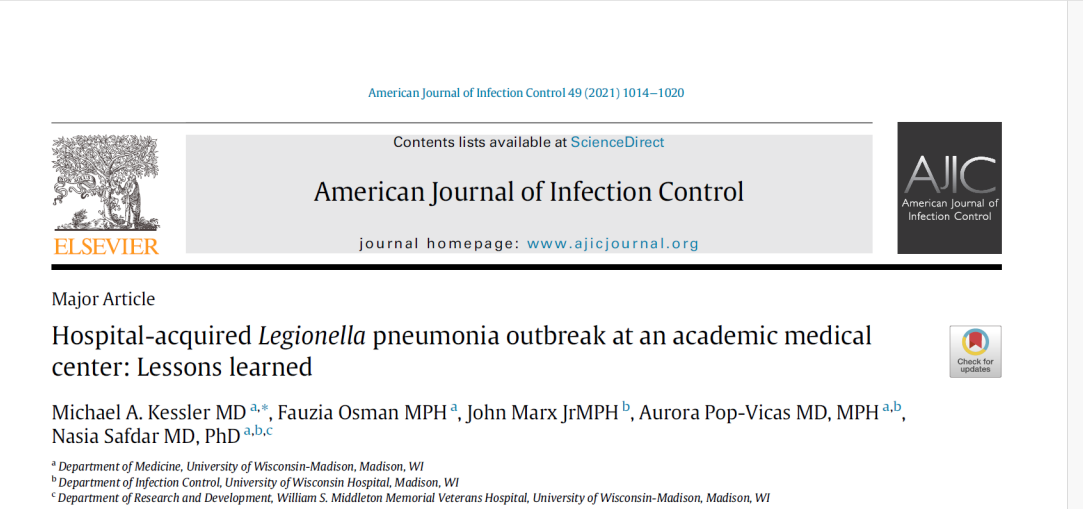
Elizabeth A. Soda, MD[1,2]; Albert E. Barskey, MPH[2]; Priti P. Shah, MPH[2]; Stephanie Schrag, DPhil[2]; Cynthia G. Whitney, MD[2]; Matthew J. Arduino, DrPH[3]; Sujan C. Reddy, MD[3]; Jasen M. Kunz, MPH[4]; Candis M. Hunter, MSPH[4]; Brian H. Raphael, PhD[2]; Laura A. Cooley, MD[2]

*On June 6, 2017, this report was posted as an MMWR Early Release on the MMWR website (https://www.cdc.gov/mmwr).*

**Abstract**

**Background:** Legionnaires' disease, a severe pneumonia, is typically acquired through inhalation of aerosolized water containing *Legionella* bacteria. *Legionella* can grow in the complex water systems of buildings, including health care facilities. Effective water management programs could prevent the growth of *Legionella* in building water systems.

**Methods:** Using national surveillance data, Legionnaires' disease cases were characterized from the 21 jurisdictions (20 U.S. states and one large metropolitan area) that reported exposure information for ≥90% of 2015 *Legionella* infections. An assessment of whether cases were health care–associated was completed; definite health care association was defined as hospitalization or long-term care facility residence for the entire 10 days preceding symptom onset, and possible



American Journal of Infection Control 49 (2021) 1014–1020

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

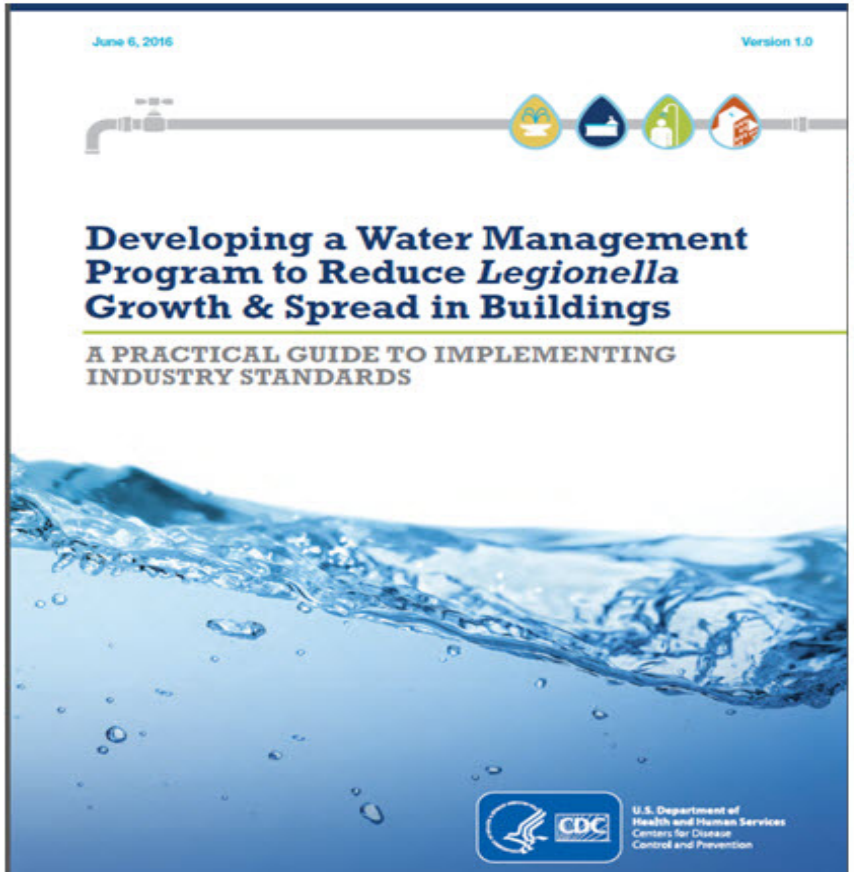
Major Article

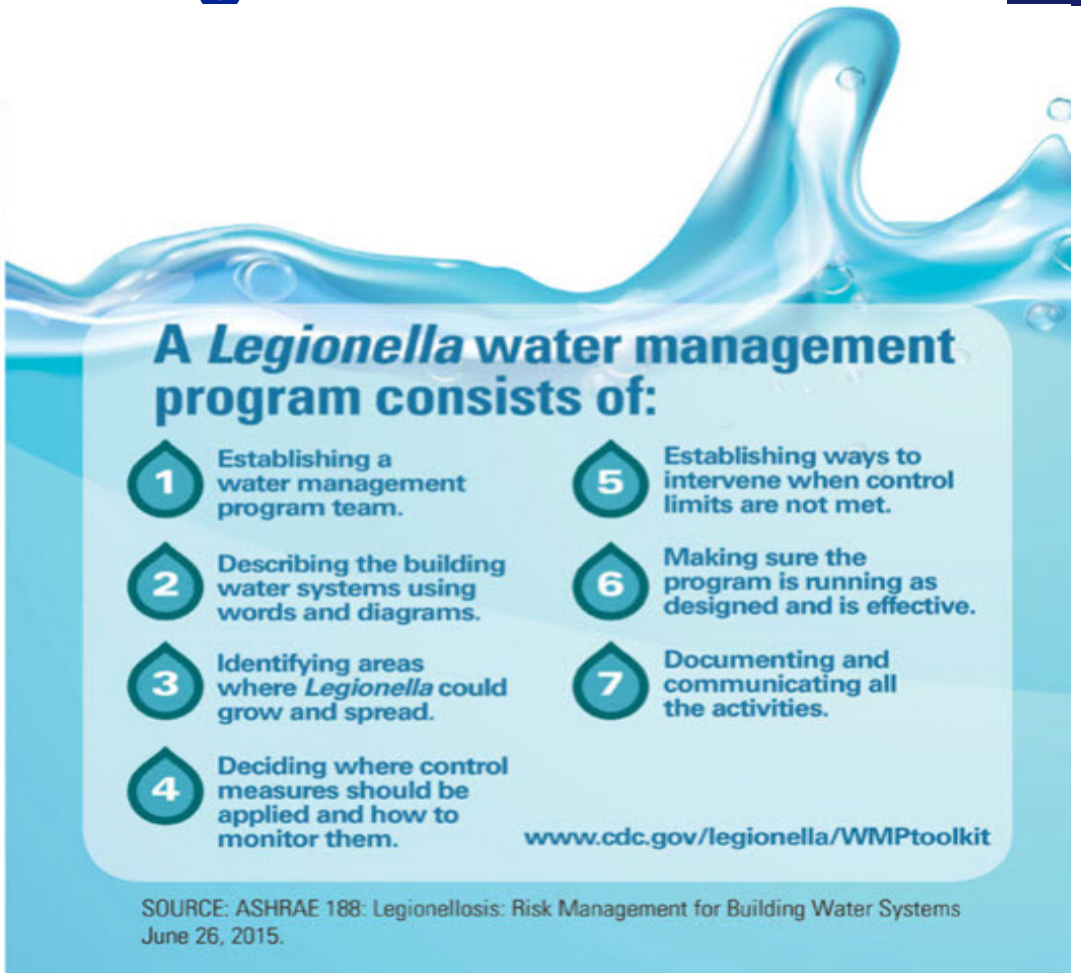
Hospital-acquired *Legionella* pneumonia outbreak at an academic medical center: Lessons learned

Michael A. Kessler MD [a,*], Fauzia Osman MPH [a], John Marx JrMPH [b], Aurora Pop-Vicas MD, MPH [a,b], Nasia Safdar MD, PhD [a,b,c]

[a] Department of Medicine, University of Wisconsin-Madison, Madison, WI
[b] Department of Infection Control, University of Wisconsin Hospital, Madison, WI
[c] Department of Research and Development, William S. Middleton Memorial Veterans Hospital, University of Wisconsin-Madison, Madison, WI

# CDC Toolkit: Developing a *Legionella* Water Management Program 2016

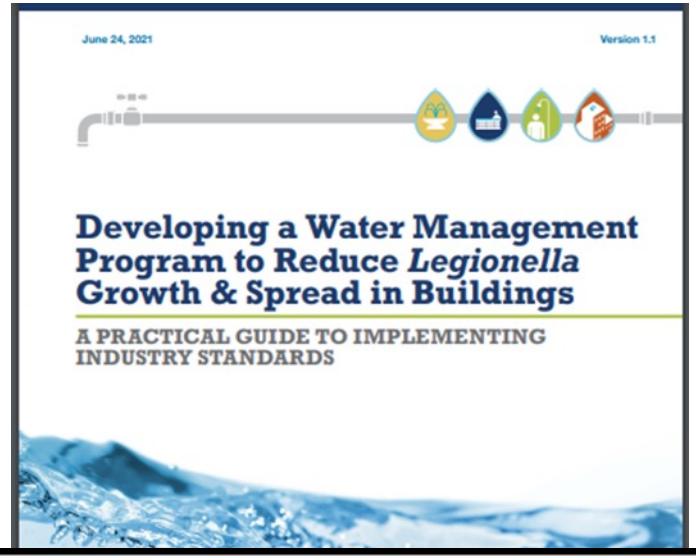


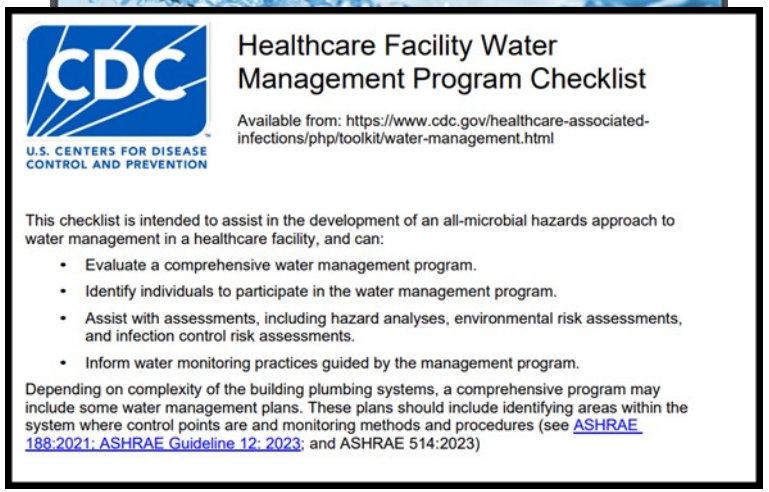




http://www.cdc.gov/legionella/maintenance/wmp-toolkit.html

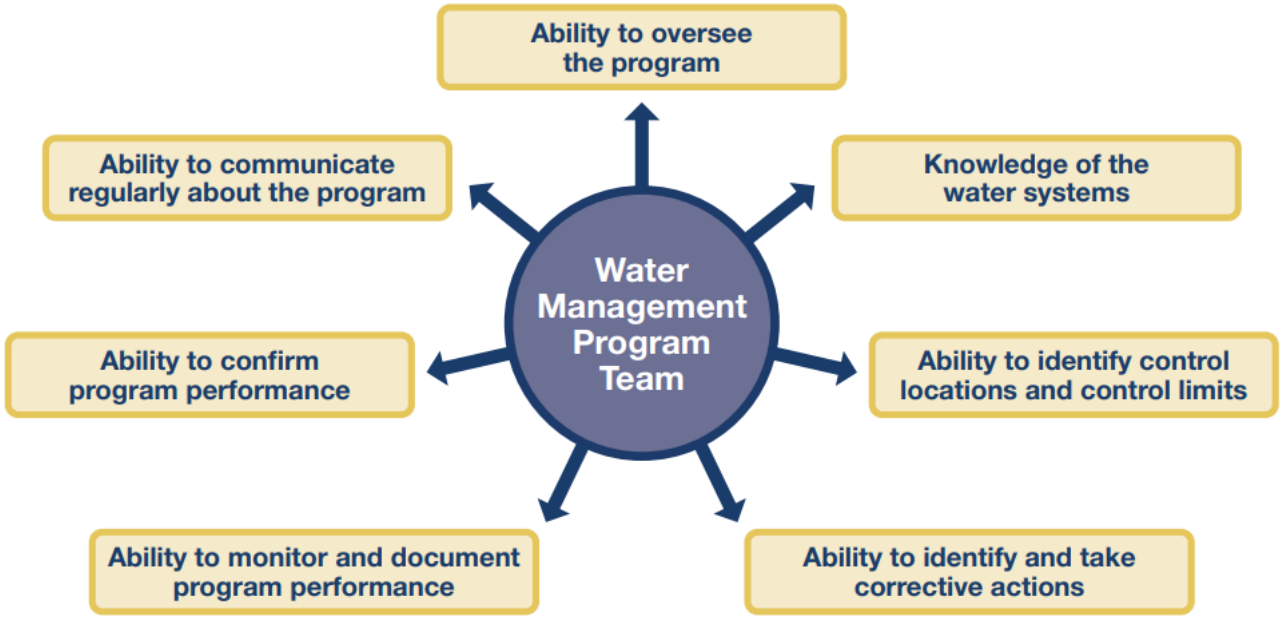
# Elements of a Water Management Program (WMP) for Control of Legionella and other OPPP

1. Establish a multi-disciplinary team
2. Describe the building water system with flow diagrams
3. Identify areas where OPPP could grow and spread.
4. Describe **where** control measures should be applied and how to monitor them.
   - Examples: temperature, disinfectant residuals, pH, splash guards, maintain ice machine. Refer also to the CDC Water Infection Control Risk Assessment (WICRA) for devices.
5. Establish interventions when control limits are not met.
   - Check hot water balance, disinfections depleted by stagnation or organic material
6. Make sure program is running as designed (**verify**) and is effective (**validate**)
7. Document and communicate all activities



# 1. Establish a Multi-disciplinary Water Management Program Team




https://www.cdc.gov/control-legionella/media/pdfs/toolkit.pdf

Healthcare Facilities Team should include other key members*. Establish roles and responsibilities.

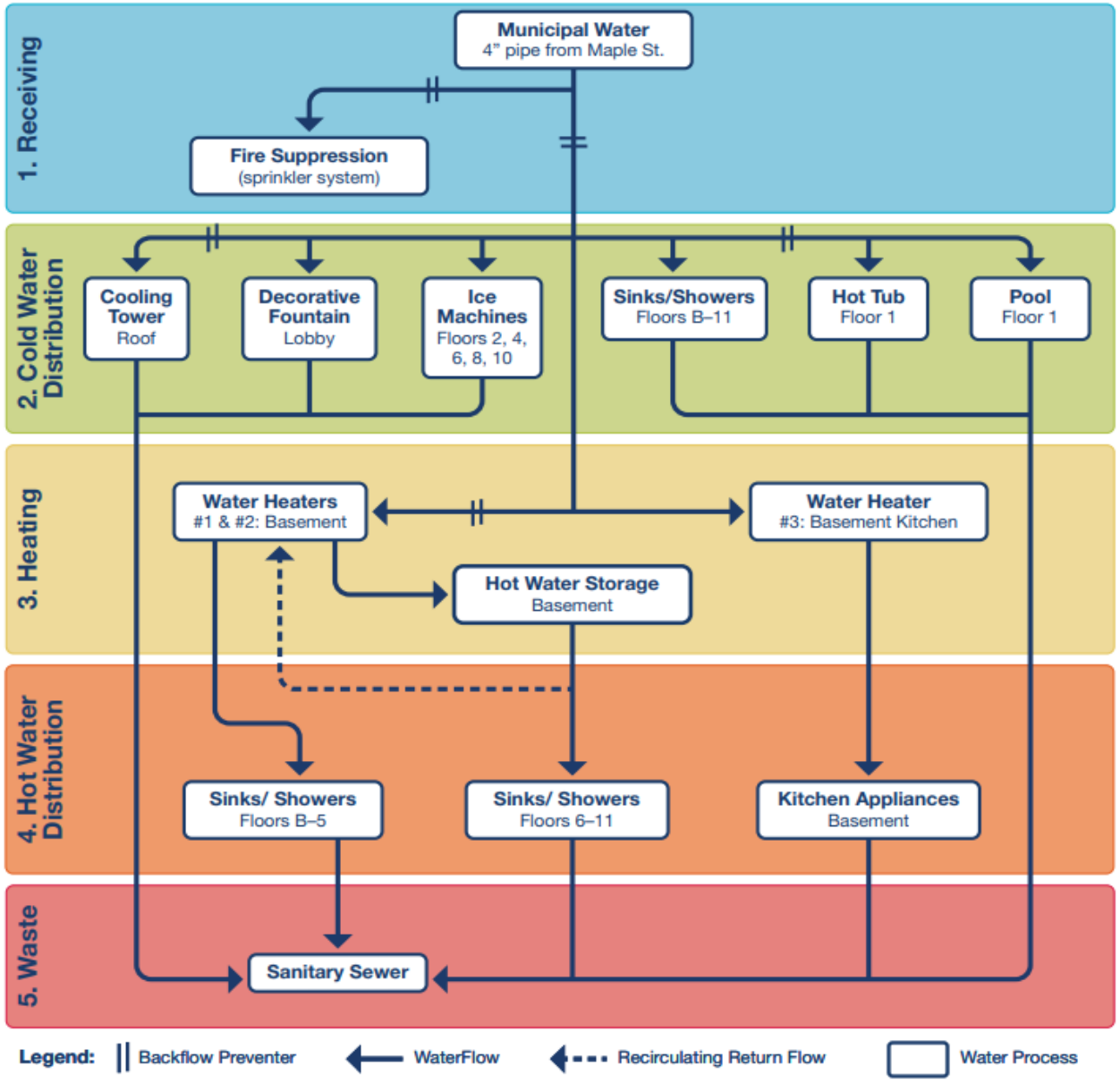
- Understanding of accreditation standards and licensing requirements
- Risk and quality management
- Expertise in infection prevention
- A clinician with expertise in infectious diseases

*Potential role of an environmental consultant with expertise in management/ response to Legionella in a health care facility

# 2. Describe building water system*

- Site specific diagram and short narrative description.
- Follow the hot and cold water.
  - Include any conditioners and storage tanks

*This is the role of another WMP team member (e.g., facilities engineer or facilities manager). An an environmental consultant might assist.

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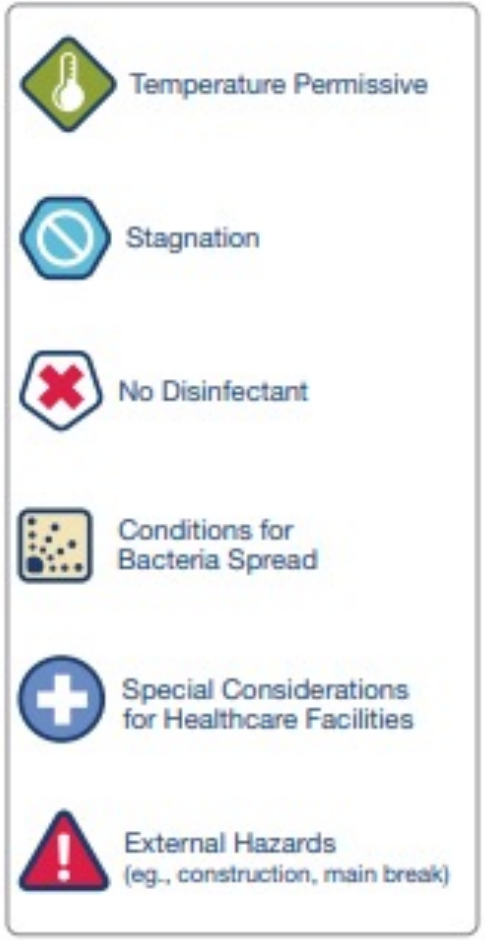
# 3. Identify areas where *Legionella* can grow and spread

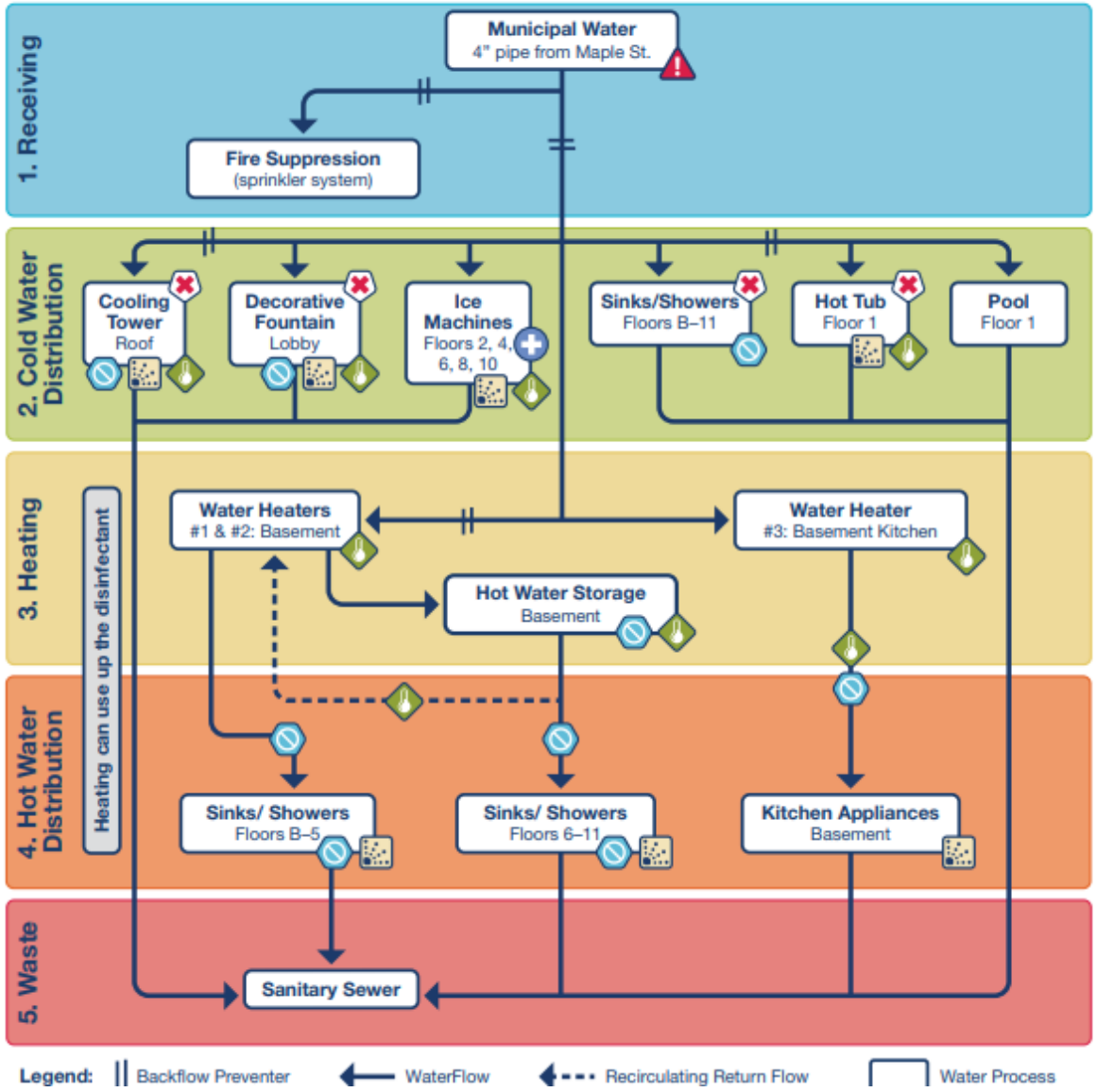
Cold water:

- cooling towers, decorative fountains, ice machines, sinks/ showers

Hot water:

- water heater, sinks/showers, kitchen
- Fixtures if not flushed / used regularly can have biofilm build up.

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# Step 4: Controlling *Legionella* and other OPPP in Potable (Drinking) Water Systems

- WMP requires multiple control measures. **Controls both *Legionella* and other waterborne pathogens.**
- Keep hot water hot, cold water cold, avoid stagnation, maintain systems and devices
- Operation, maintenance and control limits*

  **Monitor** temperature, disinfectant residuals and pH **and set (specify) control limits**
  - Hot Water: store above 140 ◦F, circulate at >120 ◦F. Point of delivery: <120 ◦F.
  - Cold water: Store & circulate below 77 ◦F. pH 6.5 - 8.5 (drinking water std.)
  - **Ensure disinfectant residual detectable** at **point of use**
  - **Flush low-flow areas**/ pipes and **dead legs** at least weekly.
  - Control sediment and biofilm by flushing, cleaning and regular maintenance of hot water heaters and fixtures, including ice machines. Consider other mitigation in high-risk areas.

www.cdc.gov/control-legionella/php/toolkit/potable-water-systems-module.html
www.cdc.gov/control-legionella/php/healthcare/water-management.html
www.cdc.gov/control-legionella/php/guidance/monitor-water-guidance.html

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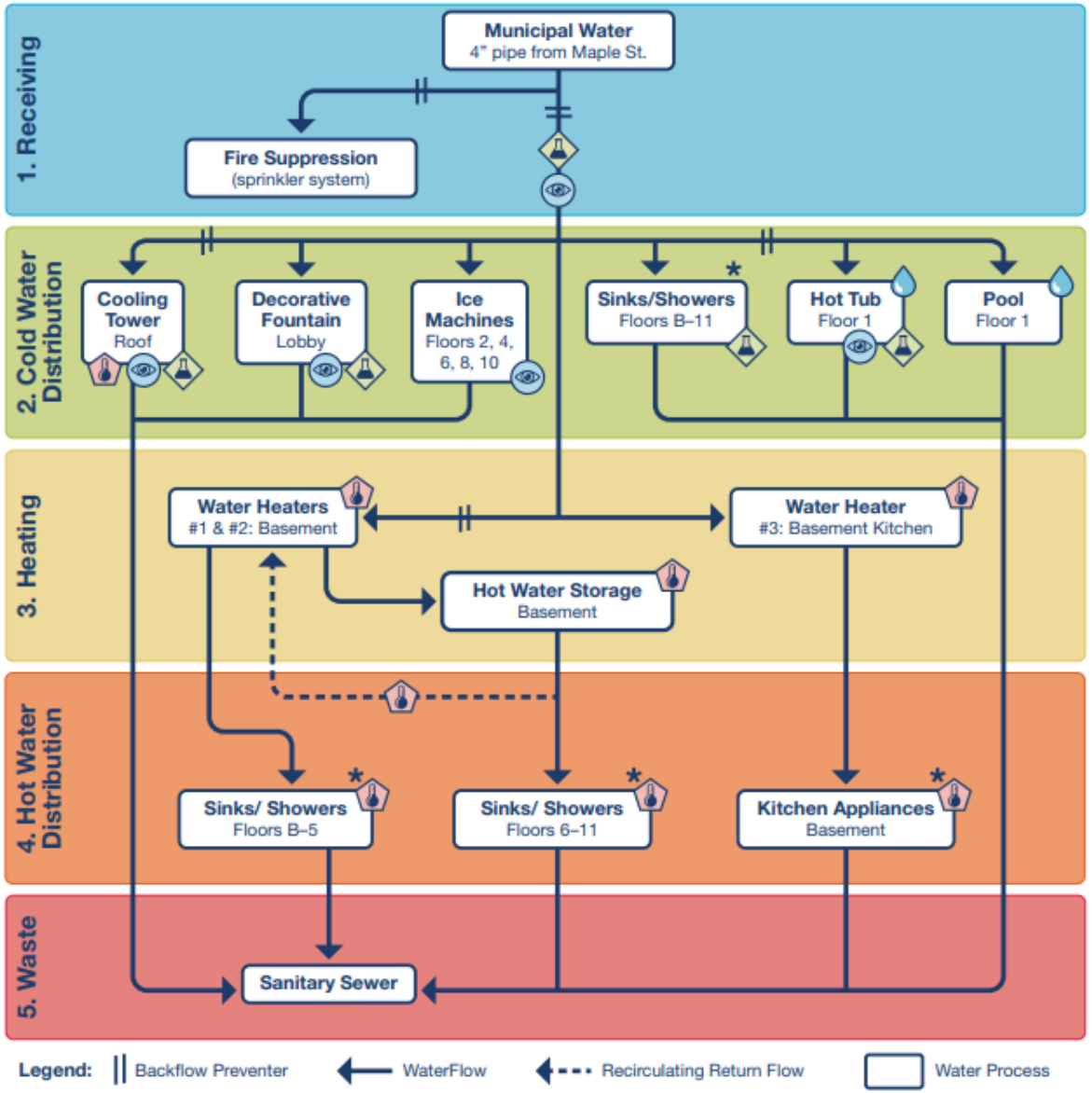
# 4. Specify monitoring and control measures: How and where


- Visual inspection and preventive maintenance
- Check hot water temperature at water heater, sink and showers
- Check disinfectant levels/ pH. Disinfectant residuals at point of use.
- Per WICRA, in high-risk areas, consider additional control measures e.g., point-of-use microbial filters or sterile water protocol *

ASHRAE 188 and ASHRAE 514* (new, 2023)



# Controlling Legionella and other OPPP in Potable (Drinking) Water Systems (cont.)

**Step 6:**

- Validation: Documentation that control measures are being met. Keep logs
- Verification
  - **Surveillance for hospital-onset clinical cases** (review microbiology reports)
    - Investigate hospital or SNF - onset Legionella cases and clusters of OPPP
  - ,Environmental samples for Legionella, another method of verification

Heterotrophic Plate Counts (HPC) – not used for verification.

- Consider as a water quality parameter (not pathogen specific).
- Has been used as an **indicator of a decrease in water quality and potential for biofilm** if consistently >500 cfu/ml.
- Refer to CDC Guidelines:  Environmental Infection Control in Healthcare Facilities, 2003

*https://www.cdc.gov/control-legionella/php/toolkit/potable-water-systems-module.html

# What about those “Dead Legs”?

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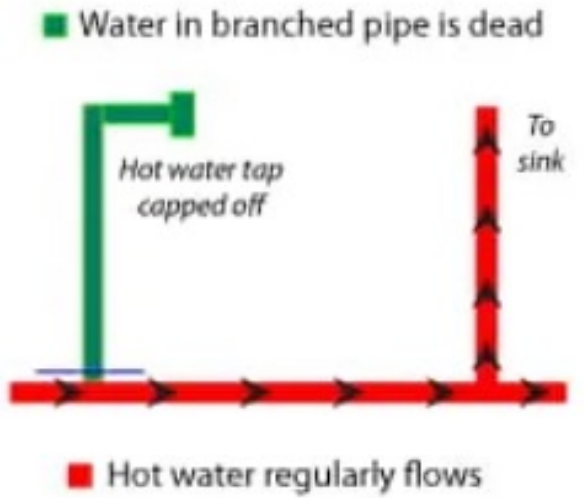
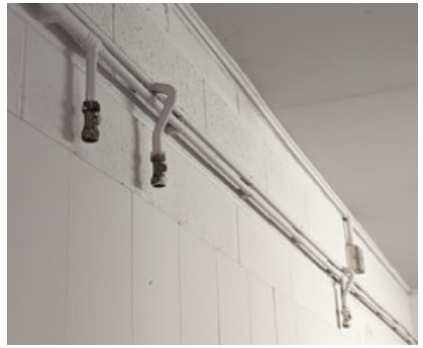
# Plumbing Dead Legs and Stagnation

- Dead legs or blind ends.
  - Sections of no-or low-water flow.
  - Often created during renovations
  - Potential source of biofilm proliferation- persistent local positive results despite system hyperchlorination.
- Avoid stagnation due to wing closure or new construction with lapses between commissioning and occupancy
- Prolonged stagnation can lead to plumbing colonization with *Legionella* and /or other OPPP
- Other WMP team members responsible for mitigation measures (facilities manager or engineer)



# Should my facility monitor for *Legionella*?

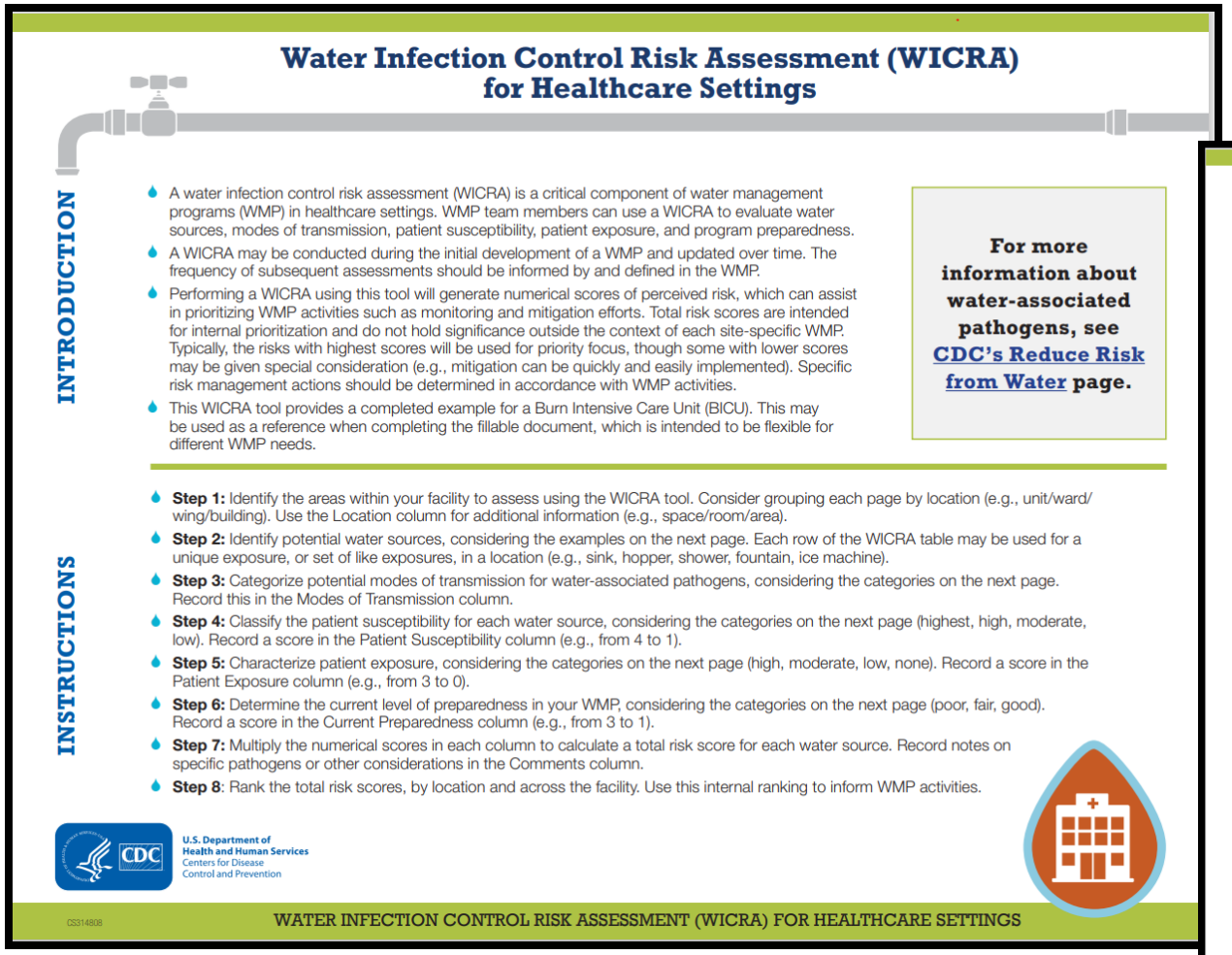
**CDC guidance**:

- Building owners and managers should confirm that their water management program (WMP) is working as intended (validation).
- The best method for validation of a WMP for *Legionella* is routine testing for *Legionella* over time. Testing for *Legionella* can provide critical information to ensure a WMP is operating as intended and *Legionella* is well-controlled.
- Because of the vulnerable population served, inpatient healthcare facilities should conduct routine testing for *Legionella* to validate their WMP. Other facilities serving a vulnerable population should consider conducting routine testing as a best practice.
- Use the *Legionella* Control Toolkit for managing Legionella in potable water, cooling towers, decorative fountains, and other devices.

www.cdc.gov/control-legionella/php/wmp/validation.html

www.cdc.gov/control-legionella/php/toolkit/control-toolkit.html

# CDC: Water Infection Control Risk Assessment (WICRA)



## Water Infection Control Risk Assessment (WICRA) for Healthcare Settings

### INTRODUCTION

- A water infection control risk assessment (WICRA) is a critical component of water management programs (WMP) in healthcare settings. WMP team members can use a WICRA to evaluate water sources, modes of transmission, patient susceptibility, patient exposure, and program preparedness.
- A WICRA may be conducted during the initial development of a WMP and updated over time. The frequency of subsequent assessments should be informed by and defined in the WMP.
- Performing a WICRA using this tool will generate numerical scores of perceived risk, which can assist in prioritizing WMP activities such as monitoring and mitigation efforts. Total risk scores are intended for internal prioritization and do not hold significance outside the context of each site-specific WMP. Typically, the risks with highest scores will be used for priority focus, though some with lower scores may be given special consideration (e.g., mitigation can be quickly and easily implemented). Specific risk management actions should be determined in accordance with WMP activities.
- This WICRA tool provides a completed example for a Burn Intensive Care Unit (BICU). This may be used as a reference when completing the fillable document, which is intended to be flexible for different WMP needs.

**For more information about water-associated pathogens, see CDC's Reduce Risk from Water page.**

### INSTRUCTIONS

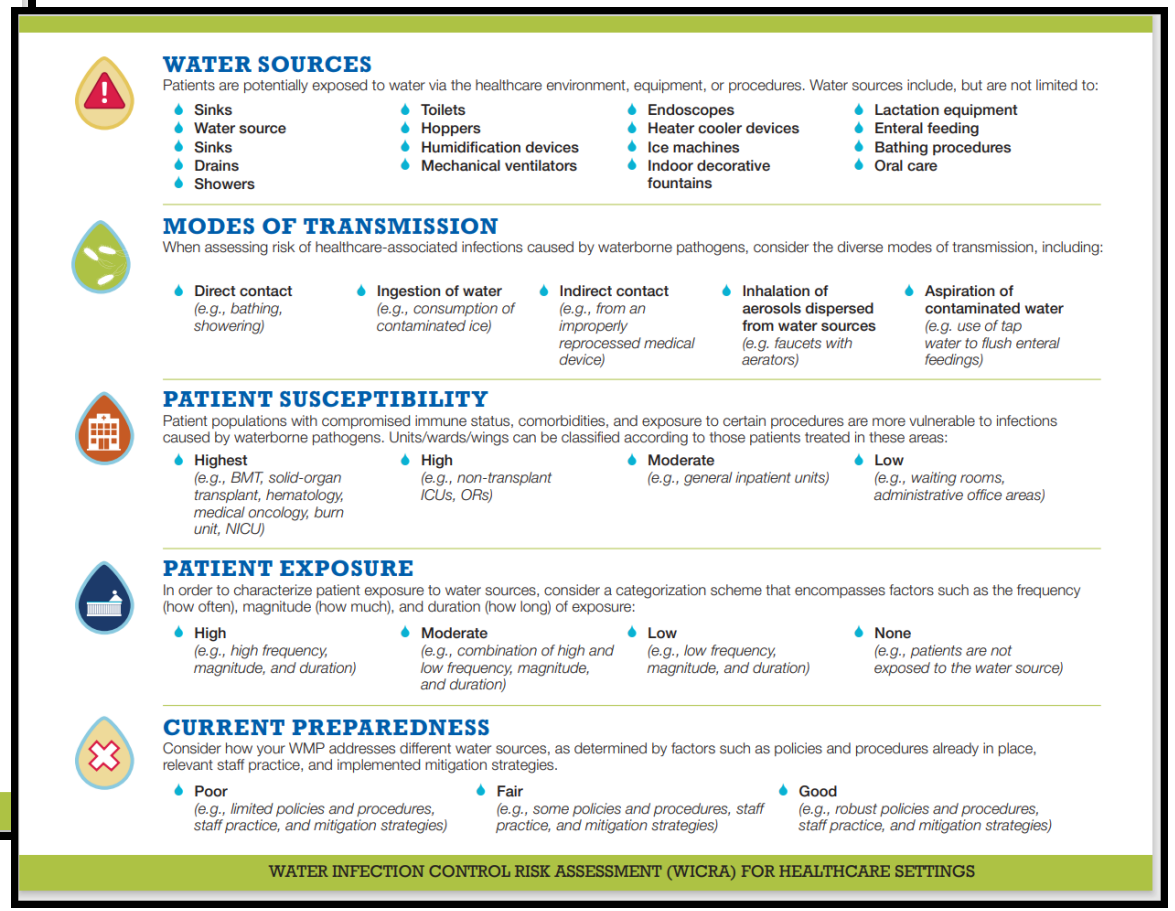
- **Step 1:** Identify the areas within your facility to assess using the WICRA tool. Consider grouping each page by location (e.g., unit/ward/wing/building). Use the Location column for additional information (e.g., space/room/area).
- **Step 2:** Identify potential water sources, considering the examples on the next page. Each row of the WICRA table may be used for a unique exposure, or set of like exposures, in a location (e.g., sink, hopper, shower, fountain, ice machine).
- **Step 3:** Categorize potential modes of transmission for water-associated pathogens, considering the categories on the next page. Record this in the Modes of Transmission column.
- **Step 4:** Classify the patient susceptibility for each water source, considering the categories on the next page (highest, high, moderate, low). Record a score in the Patient Susceptibility column (e.g., from 4 to 1).
- **Step 5:** Characterize patient exposure, considering the categories on the next page (high, moderate, low, none). Record a score in the Patient Exposure column (e.g., from 3 to 0).
- **Step 6:** Determine the current level of preparedness in your WMP, considering the categories on the next page (poor, fair, good). Record a score in the Current Preparedness column (e.g., from 3 to 1).
- **Step 7:** Multiply the numerical scores in each column to calculate a total risk score for each water source. Record notes on specific pathogens or other considerations in the Comments column.
- **Step 8**: Rank the total risk scores, by location and across the facility. Use this internal ranking to inform WMP activities.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CS314808

WATER INFECTION CONTROL RISK ASSESSMENT (WICRA) FOR HEALTHCARE SETTINGS

[Water Infection Control Risk Assessment (WICRA) for Healthcare Settings (cdc.gov)]



### WATER SOURCES

Patients are potentially exposed to water via the healthcare environment, equipment, or procedures. Water sources include, but are not limited to:

- Sinks
- Water source
- Sinks
- Drains
- Showers
- Toilets
- Hoppers
- Humidification devices
- Mechanical ventilators
- Endoscopes
- Heater cooler devices
- Ice machines
- Indoor decorative fountains
- Lactation equipment
- Enteral feeding
- Bathing procedures
- Oral care

### MODES OF TRANSMISSION

When assessing risk of healthcare-associated infections caused by waterborne pathogens, consider the diverse modes of transmission, including:

- **Direct contact** *(e.g., bathing, showering)*
- **Ingestion of water** *(e.g., consumption of contaminated ice)*
- **Indirect contact** *(e.g., from an improperly reprocessed medical device)*
- **Inhalation of aerosols dispersed from water sources** *(e.g. faucets with aerators)*
- **Aspiration of contaminated water** *(e.g. use of tap water to flush enteral feedings)*

### PATIENT SUSCEPTIBILITY

Patient populations with compromised immune status, comorbidities, and exposure to certain procedures are more vulnerable to infections caused by waterborne pathogens. Units/wards/wings can be classified according to those patients treated in these areas:

- **Highest** *(e.g., BMT, solid-organ transplant, hematology, medical oncology, burn unit, NICU)*
- **High** *(e.g., non-transplant ICUs, ORs)*
- **Moderate** *(e.g., general inpatient units)*
- **Low** *(e.g., waiting rooms, administrative office areas)*

### PATIENT EXPOSURE

In order to characterize patient exposure to water sources, consider a categorization scheme that encompasses factors such as the frequency (how often), magnitude (how much), and duration (how long) of exposure:

- **High** *(e.g., high frequency, magnitude, and duration)*
- **Moderate** *(e.g., combination of high and low frequency, magnitude, and duration)*
- **Low** *(e.g., low frequency, magnitude, and duration)*
- **None** *(e.g., patients are not exposed to the water source)*

### CURRENT PREPAREDNESS

Consider how your WMP addresses different water sources, as determined by factors such as policies and procedures already in place, relevant staff practice, and implemented mitigation strategies.

- **Poor** *(e.g., limited policies and procedures, staff practice, and mitigation strategies)*
- **Fair** *(e.g., some policies and procedures, staff practice, and mitigation strategies)*
- **Good** *(e.g., robust policies and procedures, staff practice, and mitigation strategies)*

WATER INFECTION CONTROL RISK ASSESSMENT (WICRA) FOR HEALTHCARE SETTINGS

# Water Infection Control Risk Assessment (WICRA) for Healthcare Settings

**Facility Name:** Hospital A **Assessment Location:** Burn ICU

**Performed By (names):** Jane Smith and John Doe **Assessment Date:** 10/01/2020

**WMP Team Role(s)** *(check all that apply):*

- ☑ Hospital Epidemiologist/Infection Preventionist
- ☐ Risk/Quality Management Staff
- ☐ Equipment/Chemical Acquisition/Supplier
- ☑ Facilities Manager/Engineer
- ☐ Infectious Disease Clinician
- ☐ Other *(please specify):*
- ☐ Environmental Services
- ☐ Consultant
- ☐ Compliance/Safety Officer

| Location | Water Source | Modes of Transmission | Patient Susceptibility<br>Highest = 4<br>High = 3<br>Moderate = 2<br>Low = 1 | Patient Exposure<br>High = 3<br>Moderate = 2<br>Low = 1<br>None = 0 | Current Preparedness<br>Poor = 3<br>Fair = 2<br>Good = 1 | Total Risk Score<br>= Patient Susceptability *x* Patient Exposure *x* Preparedness | Comments |
|---|---|---|---|---|---|---|---|
| BICU Inpatient Rooms | Sink counter storage of patient care supplies | Indirect contact; splashing onto supplies | 4 | 3 | 3 | 36 | Install splash guards; QI for sink hygiene; and flushing |
| BICU Inpatient Rooms | Toilets without lid | Direct contact | 4 | 3 | 2 | 24 | Place lid on toilet if in patient room |
| BICU Soiled Utility | Hopper, no lid, behind closed door | Indirect contact | 4 | 2 | 1 | 8 | Automatic door closure; appropriate soiled equipment storage |
| BICU Medication Preparation Room | Sink with aerator, no splash guard | Aerosolization, and potential for splashing | 4 | 2 | 3 | 24 | Install splash guards; evaluate removing aerator |
| BICU Hydrotherapy Room | Debridement showers | Direct contact | 4 | 3 | 1 | 12 | Monthly EVS audits room indicating 95% adherence to policies |
| BICU Nurses Station | Sink closest to door | Indirect contact; HCW hands; devices | 4 | 2 | 3 | 24 | Install splash guards or move IV bags storage |



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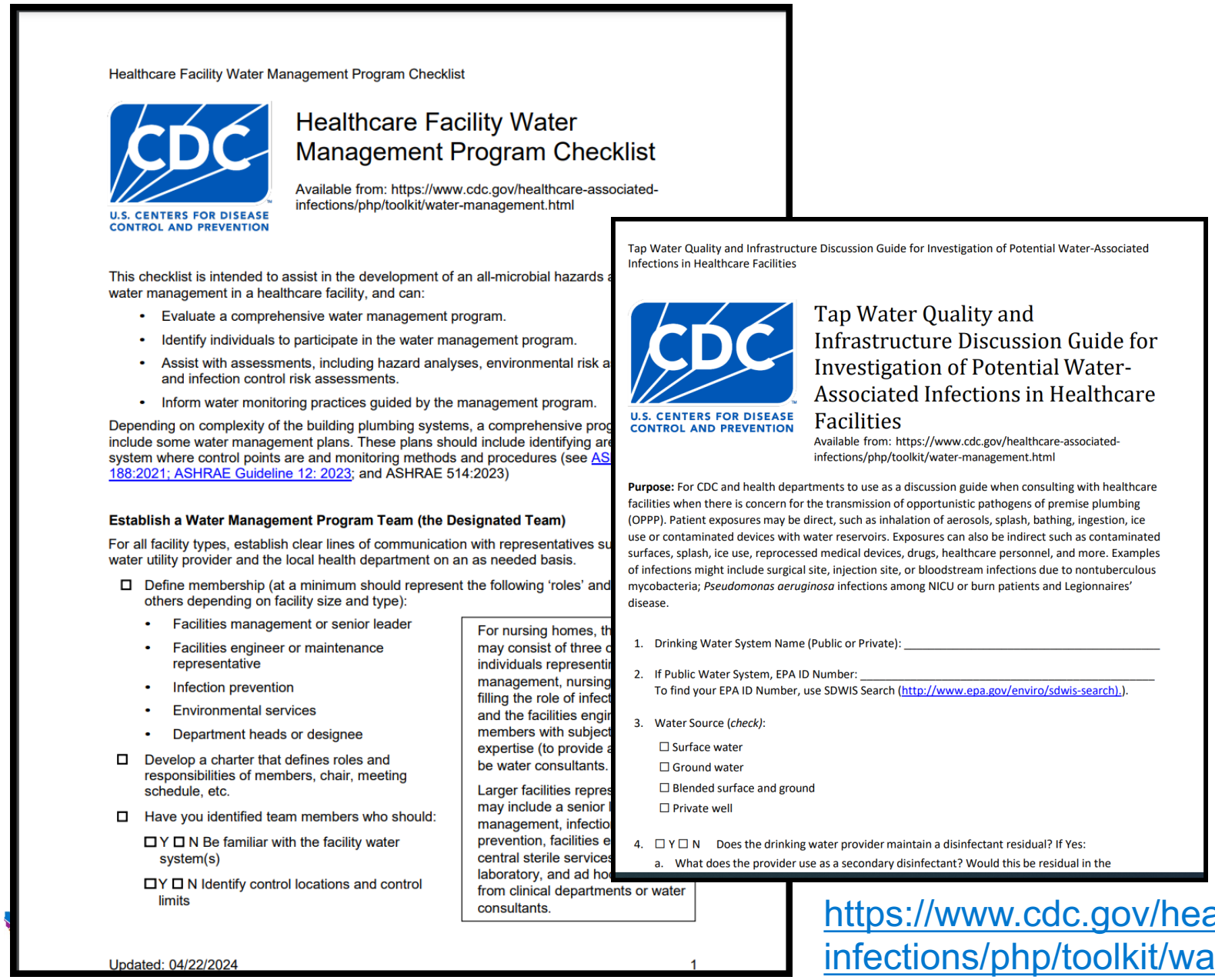


Healthcare Facility Water Management Program Checklist

U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

Healthcare Facility Water Management Program Checklist

Available from: https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

This checklist is intended to assist in the development of an all-microbial hazards a water management in a healthcare facility, and can:

- Evaluate a comprehensive water management program.
- Identify individuals to participate in the water management program.
- Assist with assessments, including hazard analyses, environmental risk a and infection control risk assessments.
- Inform water monitoring practices guided by the management program.

Depending on complexity of the building plumbing systems, a comprehensive prog include some water management plans. These plans should include identifying are system where control points are and monitoring methods and procedures (see AS 188:2021; ASHRAE Guideline 12: 2023; and ASHRAE 514:2023)

**Establish a Water Management Program Team (the Designated Team)**

For all facility types, establish clear lines of communication with representatives su water utility provider and the local health department on an as needed basis.

☐ Define membership (at a minimum should represent the following 'roles' and others depending on facility size and type):

- Facilities management or senior leader
- Facilities engineer or maintenance representative
- Infection prevention
- Environmental services
- Department heads or designee

☐ Develop a charter that defines roles and responsibilities of members, chair, meeting schedule, etc.

☐ Have you identified team members who should:

☐ Y ☐ N Be familiar with the facility water system(s)

☐ Y ☐ N Identify control locations and control limits

For nursing homes, th may consist of three c individuals representi management, nursing filling the role of infect and the facilities engi members with subject expertise (to provide a be water consultants.

Larger facilities repres may include a senior l management, infectio prevention, facilities e central sterile services laboratory, and ad hoc from clinical departments or water consultants.

Updated: 04/22/2024 1

Tap Water Quality and Infrastructure Discussion Guide for Investigation of Potential Water-Associated Infections in Healthcare Facilities

U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

Tap Water Quality and Infrastructure Discussion Guide for Investigation of Potential Water-Associated Infections in Healthcare Facilities

Available from: https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

**Purpose:** For CDC and health departments to use as a discussion guide when consulting with healthcare facilities when there is concern for the transmission of opportunistic pathogens of premise plumbing (OPPP). Patient exposures may be direct, such as inhalation of aerosols, splash, bathing, ingestion, ice use or contaminated devices with water reservoirs. Exposures can also be indirect such as contaminated surfaces, splash, ice use, reprocessed medical devices, drugs, healthcare personnel, and more. Examples of infections might include surgical site, injection site, or bloodstream infections due to nontuberculous mycobacteria; *Pseudomonas aeruginosa* infections among NICU or burn patients and Legionnaires' disease.

1. Drinking Water System Name (Public or Private): _____
2. If Public Water System, EPA ID Number: _____
   To find your EPA ID Number, use SDWIS Search (http://www.epa.gov/enviro/sdwis-search).
3. Water Source (*check*):
   - ☐ Surface water
   - ☐ Ground water
   - ☐ Blended surface and ground
   - ☐ Private well
4. ☐ Y ☐ N Does the drinking water provider maintain a disinfectant residual? If Yes:
   a. What does the provider use as a secondary disinfectant? Would this be residual in the

# Facility WMP Checklist

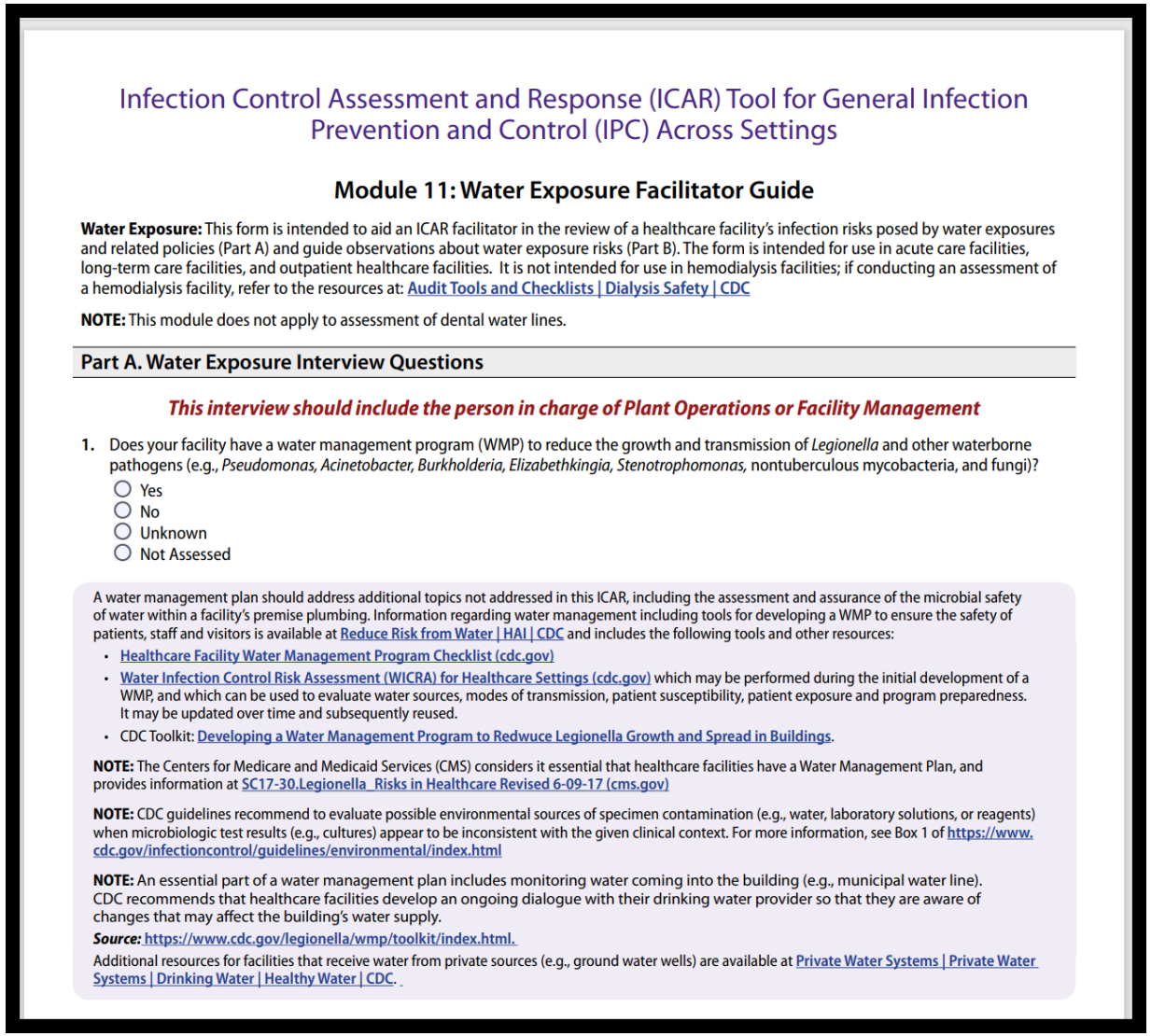
- Use to develop or evaluate a WMP for Legionella and OPPP
- Adapted from the Legionella WMP toolkit.
- Aligns with applicable ASHRAE standards (188 & 514) and guidelines 2-2020
- Use Tap Water Quality and Infrastructure Guide: for investigating outbreaks of OPPP in healthcare where water exposure is potential source.

https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

# CDC Water Exposure ICAR

- ICAR Tools Module 11
- Part A: Reviews policy on infections risks and prevention measures from water exposure.
- Part B: Guides observations on water exposure in healthcare

https://www.cdc.gov/infection-control/media/pdfs/IPC-mod11-water-exposure-508.pdf



Infection Control Assessment and Response (ICAR) Tool for General Infection Prevention and Control (IPC) Across Settings

**Module 11: Water Exposure Facilitator Guide**

**Water Exposure:** This form is intended to aid an ICAR facilitator in the review of a healthcare facility's infection risks posed by water exposures and related policies (Part A) and guide observations about water exposure risks (Part B). The form is intended for use in acute care facilities, long-term care facilities, and outpatient healthcare facilities. It is not intended for use in hemodialysis facilities; if conducting an assessment of a hemodialysis facility, refer to the resources at: Audit Tools and Checklists | Dialysis Safety | CDC

**NOTE:** This module does not apply to assessment of dental water lines.

**Part A. Water Exposure Interview Questions**

***This interview should include the person in charge of Plant Operations or Facility Management***

1. Does your facility have a water management program (WMP) to reduce the growth and transmission of *Legionella* and other waterborne pathogens (e.g., *Pseudomonas, Acinetobacter, Burkholderia, Elizabethkingia, Stenotrophomonas,* nontuberculous mycobacteria, and fungi)?
   - ○ Yes
   - ○ No
   - ○ Unknown
   - ○ Not Assessed

A water management plan should address additional topics not addressed in this ICAR, including the assessment and assurance of the microbial safety of water within a facility's premise plumbing. Information regarding water management including tools for developing a WMP to ensure the safety of patients, staff and visitors is available at Reduce Risk from Water | HAI | CDC and includes the following tools and other resources:

- Healthcare Facility Water Management Program Checklist (cdc.gov)
- Water Infection Control Risk Assessment (WICRA) for Healthcare Settings (cdc.gov) which may be performed during the initial development of a WMP, and which can be used to evaluate water sources, modes of transmission, patient susceptibility, patient exposure and program preparedness. It may be updated over time and subsequently reused.
- CDC Toolkit: Developing a Water Management Program to Redwuce Legionella Growth and Spread in Buildings.

**NOTE:** The Centers for Medicare and Medicaid Services (CMS) considers it essential that healthcare facilities have a Water Management Plan, and provides information at SC17-30.Legionella_Risks in Healthcare Revised 6-09-17 (cms.gov)

**NOTE:** CDC guidelines recommend to evaluate possible environmental sources of specimen contamination (e.g., water, laboratory solutions, or reagents) when microbiologic test results (e.g., cultures) appear to be inconsistent with the given clinical context. For more information, see Box 1 of https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html

**NOTE:** An essential part of a water management plan includes monitoring water coming into the building (e.g., municipal water line). CDC recommends that healthcare facilities develop an ongoing dialogue with their drinking water provider so that they are aware of changes that may affect the building's water supply.

***Source:*** https://www.cdc.gov/legionella/wmp/toolkit/index.html.

Additional resources for facilities that receive water from private sources (e.g., ground water wells) are available at Private Water Systems | Private Water Systems | Drinking Water | Healthy Water | CDC.

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# Infection Prevention and Control Strategies

## Sinks, Drains, and Ice Machines

# CDC Reduce Risk of OPPP Exposure: Sink Design

- When modifying/ installing sinks, choose designs that prevent splashing and have adequate depth.*
- Choose fixtures with angle/ offset faucets so the faucet stream does not pour directly onto drain.
- Install splash guards on sinks next to medication preparation areas
- Provide easy access to hand cleaning supplies
- Monitor/ regulate water pressure in sinks in patient care areas so splashing is minimized when maximum water flow.*

*Refer to Facility Institute Guidelines 2010 for specifications.

www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

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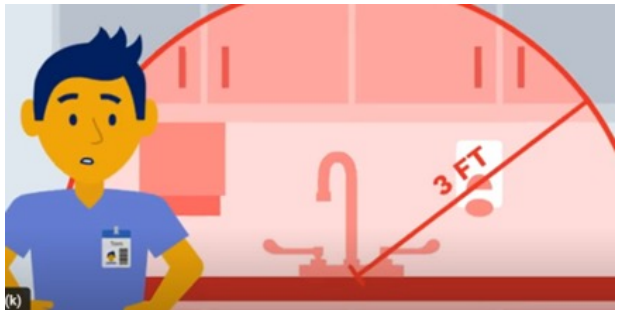
# CDC Reduce Risk of OPPP Exposure: Sink Hygiene

- Avoid placement patient care or personal items on counters near sinks. 3 ft. rule.
- Do not discard patient waste down sinks
- Minimize discarding beverages down sinks or toilets
- Clean and disinfect surfaces daily near sink and drain
  - Clean to dirty: Neary by counters → fixtures → sink/ drain last




- Consider using an EPA-registered biofilm disinfectant for wastewater drains during an outbreak.
- Close hopper and toilet lids before flushing. If lids not available or allowed, close door that separates hopper or toilet from patient care areas.

www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

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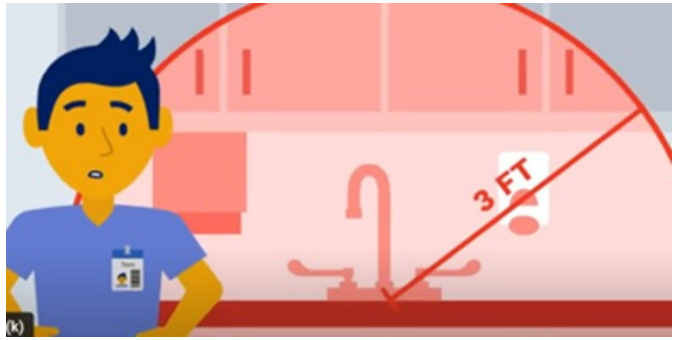
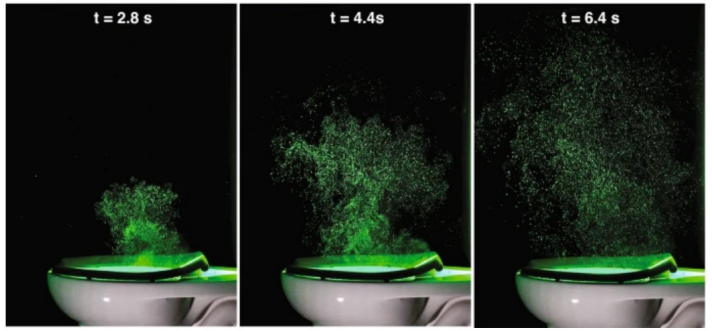
# Reduce Risk of OPPP: Exposure from aerosols contaminate surfaces

- Be aware of exposures from aerosols
  - The 3 ft rule




- Close hopper and toilet lids before flushing. If lids not available or allowed, close door that separates hopper or toilet from patient care areas.




Crimaldi et al. Sci Rep.
https://pubmed.ncbi.nlm.nih.gov/36481924/

www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

# Best IPC Practices: Sinks, Drains, and Plumbing

Why?

- Sinks and drains can become contaminated with water-associated MDROs.
- P-traps in the plumbing can be an environment for antimicrobial- resistant genetic elements between micro-organisms
- Patients can become exposed to these organisms via water splashes.

## Best Practices for Sinks

- Select sinks with offset drains and sufficient depth to prevent splashing
- Remove aerators (mesh covering) if present
- Ensure patient supplies or personal items are not stored under or in the sink "splash zone" (about 3 feet surrounding sink)
- Don't put blood, body fluids, medications, or liquid nutrition down the sink (use appropriate waste receptacle)

## Best Practices for Toilets and Hoppers

- Install and use toilet and hopper covers
- Close covers on toilets and hoppers before flushing
- If you can't use a cover, close the door before flushing

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# Ice & Ice Machines

## Microorganisms and their sources in ice and ice machines

**From potable water**

- *Legionella* spp. [684, 685, 857, 858]
- Nontuberculous mycobacteria (NTM) [602, 603, 859]
- *Pseudomonas aeruginosa* [859]
- *Burkholderia cepacia* [859, 860]
- *Stenotrophomonas maltophilia* [860]
- *Flavobacterium* spp. [860]

**From fecally-contaminated water**

- Norwalk virus [861–863]
- *Giardia lamblia* [864]
- *Cryptosporidium parvum* [685]

**From hand-transfer of organisms**

- *Acinetobacter* spp. [859]
- Coagulase-negative staphylococci [859]
- *Salmonella enteriditis* [865]
- *Cryptosporidium parvum* [685]

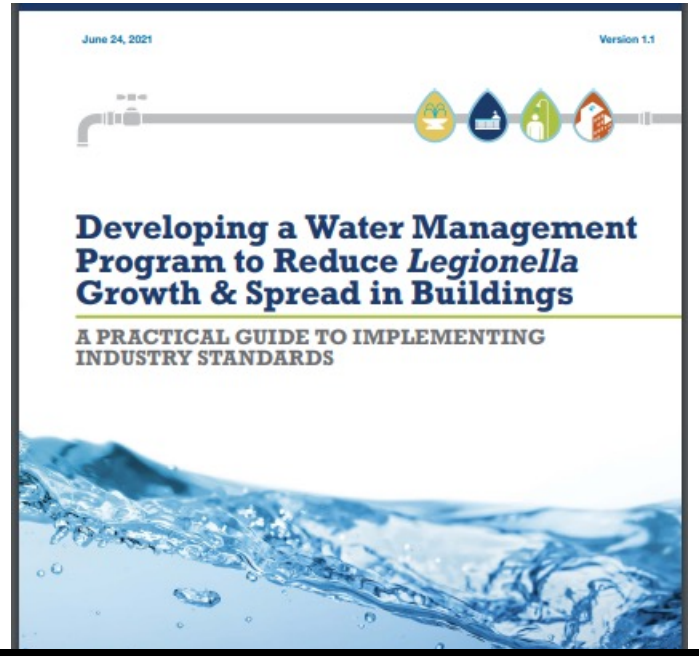
Slide courtesy of M Arduino CDC.

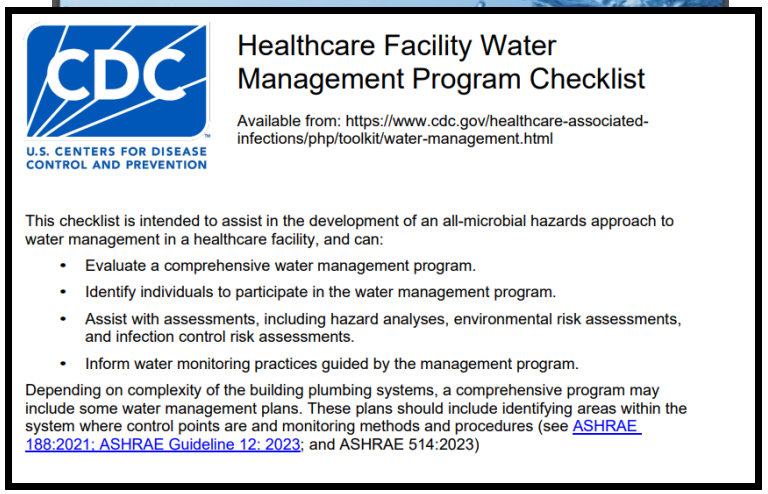
## Mitigation Strategies

- Clean and disinfect machine
- Increase rate of filter replacement
  - No charcoal filters
- Replace ice machine
- Eliminate ice use
  - Bronchoscope
  - Chill saline syringes, medication products, cool water bed-baths

Consider 0.22 micron filters

# Infection Prevention and Control Strategies




- Water management program (WMP).
  - Incoming water should meet  drinking water standards
  - Premise plumbing should be designed and maintained to minimize growth of *Legionella* and other OPPP
  - Exposure to infectious risks from water is minimized
  - Use a Water Infection Control Risk Assessment (WICRA) to develop and update your WMP.
- Implement water-specific infection control practices
  - Investigate clusters of OPPP pathogens for potential sources of water exposure.
  - Monitor/ maintain water temperature at key locations
  - Maintain disinfectant residuals/ pH
  - Avoid stagnation (flushing program), Follow IFU and maintain equipment (hot water heaters, ice machines, etc.)
  - Promote sink and drain hygiene

# What can you do now as an IP in your hospital?

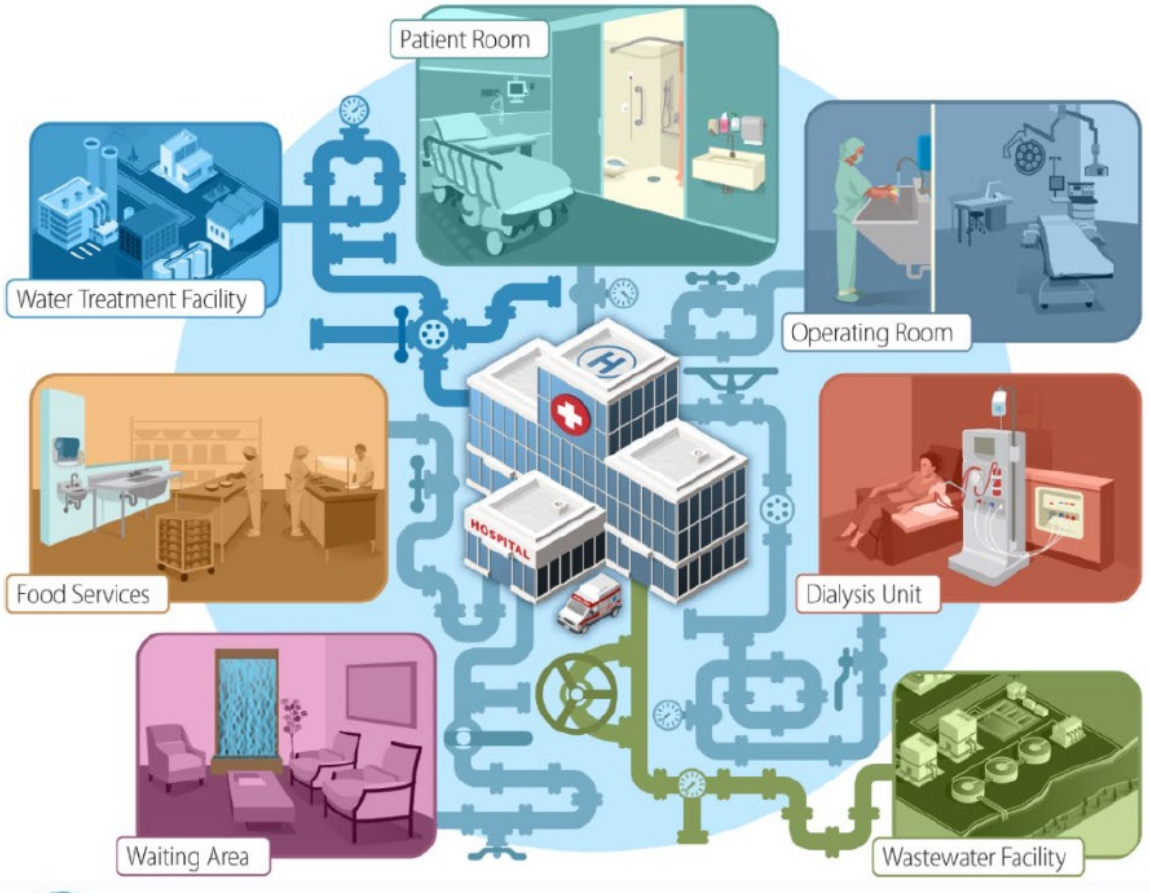
- Identify clusters of OPPP and investigate
  - Involve  microbiology lab director and IPC champions in your BMT-oncology, NICUs, burn units, ICUs.
- Choose a high-risk unit and perform a WICRA. Discuss mitigation with members of the WMP team.
- Work with clinicians and lab director to optimize testing for Legionnaires' disease (LD): UAT and a lower respiratory tract(LRT) specimen for Legionella for culture OR Legionella PCR with reflex to culture.
- When conducting Environment of Care rounds
  - Supplies and equipment near sinks
  - Ask your facilities engineers about disinfectant residuals in high-risk units.

# Water-related Outbreaks in Healthcare: Summary

- Water-related outbreaks are common
- Many possible sources of water exposure in a facility
- Immunocompromised and ICU patients at increased risk

Strategies to reduce risk of exposure to water-related pathogens include:

- Developing and implementing a robust WMP
- WMP includes reduction of risks of potential exposures from sinks, drains, and ice machines

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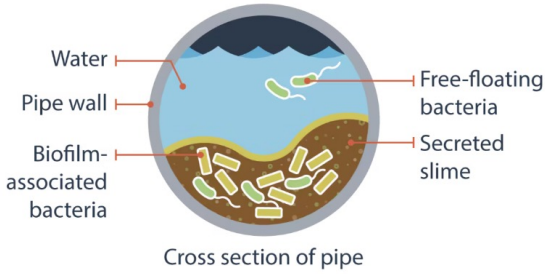
# Water, Water, Everywhere



Cross section of pipe


## What Infection Preventionists Need to Know About Sinks, Drains, and Plumbing

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Sinks and drains can become contaminated with water-associated organisms, such as through the formation of biofilm (germs that stick together). Patients can become exposed to these organisms via water splashes.

### Best Practices for Sinks

- Select sinks with offset drains and sufficient depth to prevent splashing
- Remove aerators (mesh covering) if present
- Ensure patient supplies or personal items are not stored under or in the sink "splash zone" (about 3 feet surrounding sink)
- Don't put blood, body fluids, medications, or liquid nutrition down the sink (use appropriate waste receptacle)

### Best Practices for Toilets and Hoppers

- Install and use toilet and hopper covers
- Close covers on toilets and hoppers before flushing
- If you can't use a cover, close the door before flushing

Scan to access the Water Infection Control Risk Assessment (WICRA)

Scan to learn more about reducing risk of MDRO spead from water

1

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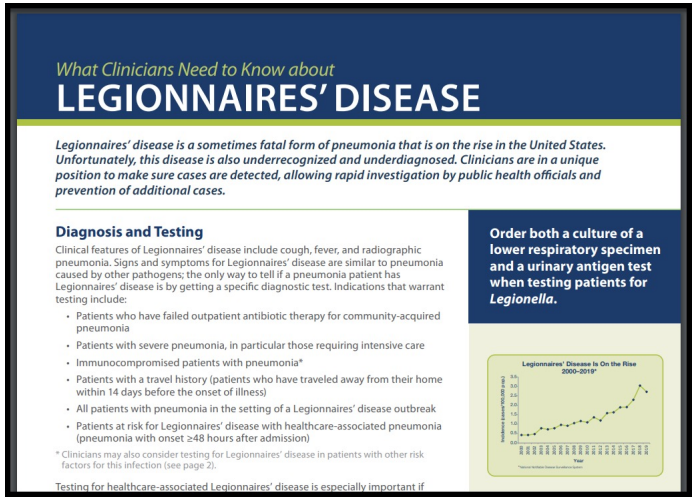
# Healthcare-Onset LD Resources

- Clinical Guidance for Legionella Infections www.cdc.gov/legionella/hcp/clinical-guidance/index.html
- For clinicians www.cdc.gov/legionella/downloads/fs-legionella-clinicians.pdf
- Investigating HA-LD Cases and Outbreaks: www.cdc.gov/investigate-legionella/php/healthcare-resources/index.html
  - **Healthcare-Onset PNA, especially if severe (ICU)**
  - **HA-LD in the past 12 month**
  - **Positive environmental tests for Legionella**
  - **Current change in water quality** that may lead to Legionella growth
- CDPH HA-LD Quicksheet. Guidance for local public health investigations of HA-LD. https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/HA_LegionnairesDiseaseQuicksheet_12.20.19_final.pdf



*What Clinicians Need to Know about*

**LEGIONNAIRES' DISEASE**

***Legionnaires' disease is a sometimes fatal form of pneumonia that is on the rise in the United States. Unfortunately, this disease is also underrecognized and underdiagnosed. Clinicians are in a unique position to make sure cases are detected, allowing rapid investigation by public health officials and prevention of additional cases.***

**Diagnosis and Testing**

Clinical features of Legionnaires' disease include cough, fever, and radiographic pneumonia. Signs and symptoms for Legionnaires' disease are similar to pneumonia caused by other pathogens; the only way to tell if a pneumonia patient has Legionnaires' disease is by getting a specific diagnostic test. Indications that warrant testing include:

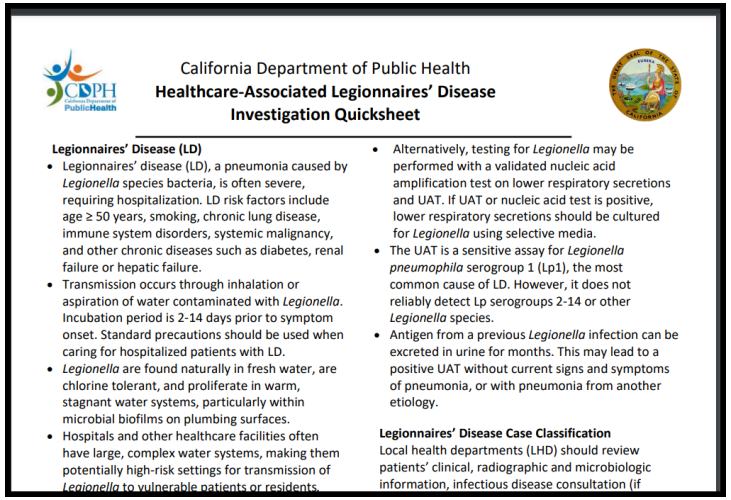
- Patients who have failed outpatient antibiotic therapy for community-acquired pneumonia
- Patients with severe pneumonia, in particular those requiring intensive care
- Immunocompromised patients with pneumonia*
- Patients with a travel history (patients who have traveled away from their home within 14 days before the onset of illness)
- All patients with pneumonia in the setting of a Legionnaires' disease outbreak
- Patients at risk for Legionnaires' disease with healthcare-associated pneumonia (pneumonia with onset ≥48 hours after admission)

* Clinicians may also consider testing for Legionnaires' disease in patients with other risk factors for this infection (see page 2).

Testing for healthcare-associated Legionnaires' disease is especially important if

**Order both a culture of a lower respiratory specimen and a urinary antigen test when testing patients for *Legionella*.**



California Department of Public Health

**Healthcare-Associated Legionnaires' Disease Investigation Quicksheet**

**Legionnaires' Disease (LD)**

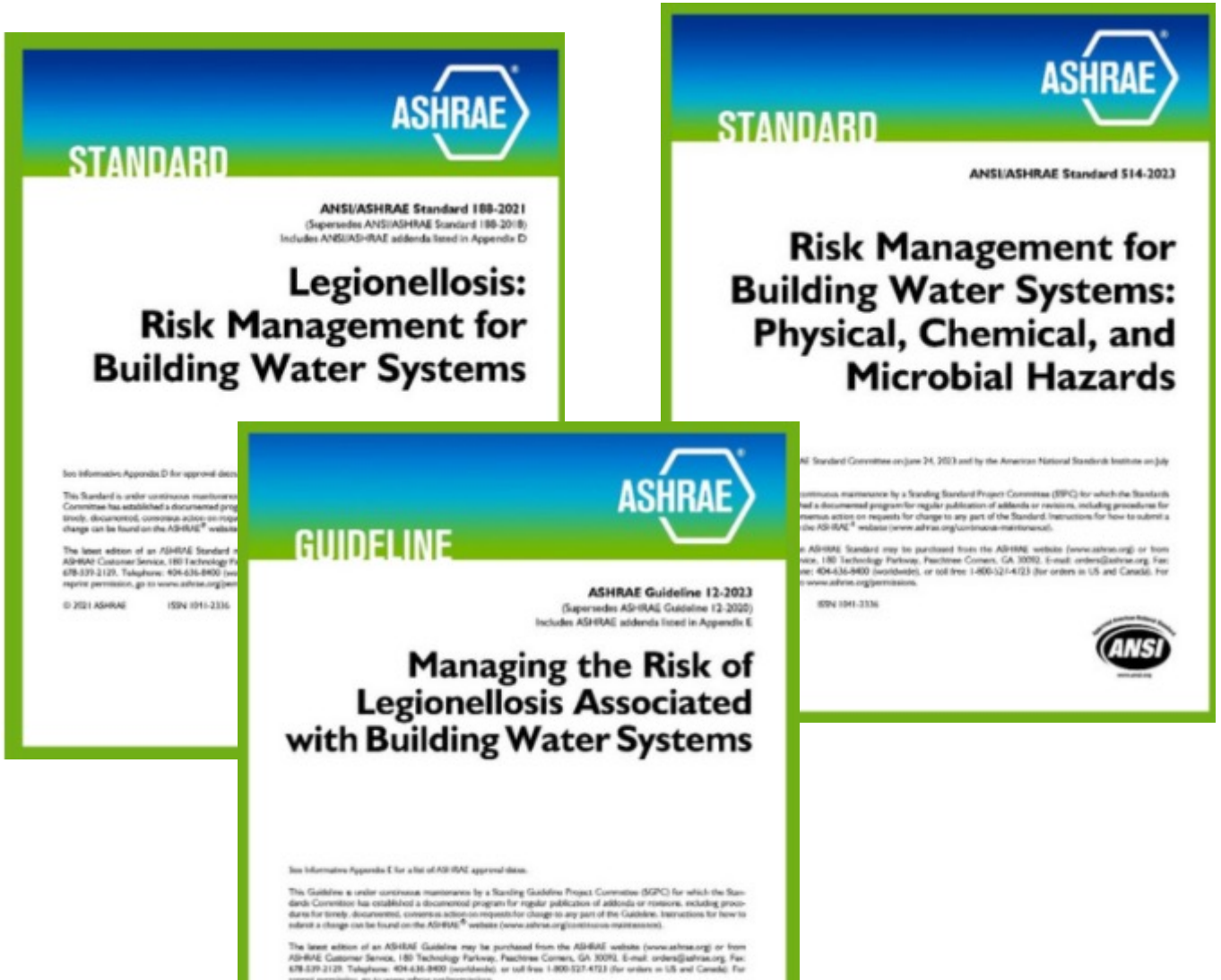
- Legionnaires' disease (LD), a pneumonia caused by *Legionella* species bacteria, is often severe, requiring hospitalization. LD risk factors include age ≥ 50 years, smoking, chronic lung disease, immune system disorders, systemic malignancy, and other chronic diseases such as diabetes, renal failure or hepatic failure.
- Transmission occurs through inhalation or aspiration of water contaminated with *Legionella*. Incubation period is 2-14 days prior to symptom onset. Standard precautions should be used when caring for hospitalized patients with LD.
- *Legionella* are found naturally in fresh water, are chlorine tolerant, and proliferate in warm, stagnant water systems, particularly within microbial biofilms on plumbing surfaces.
- Hospitals and other healthcare facilities often have large, complex water systems, making them potentially high-risk settings for transmission of *Legionella* to vulnerable patients or residents.
- Alternatively, testing for *Legionella* may be performed with a validated nucleic acid amplification test on lower respiratory secretions and UAT. If UAT or nucleic acid test is positive, lower respiratory secretions should be cultured for *Legionella* using selective media.
- The UAT is a sensitive assay for *Legionella pneumophila* serogroup 1 (Lp1), the most common cause of LD. However, it does not reliably detect Lp serogroups 2-14 or other *Legionella* species.
- Antigen from a previous *Legionella* infection can be excreted in urine for months. This may lead to a positive UAT without current signs and symptoms of pneumonia, or with pneumonia from another etiology.

**Legionnaires' Disease Case Classification**

Local health departments (LHD) should review patients' clinical, radiographic and microbiologic information, infectious disease consultation (if

# ASHRAE Standards and Guidelines for Building Water Systems

- ASHRAE 188- 2021 Legionellosis Risk Management
- ASHRAE Guideline 12-2023 Guidelines on compliance with ASHRAE 188.
- ASHRAE 514-2023 published August 2023
- Is an all-hazards approach to water management in buildings and takes into account that facilities are already in compliance with ASHRAE 188.

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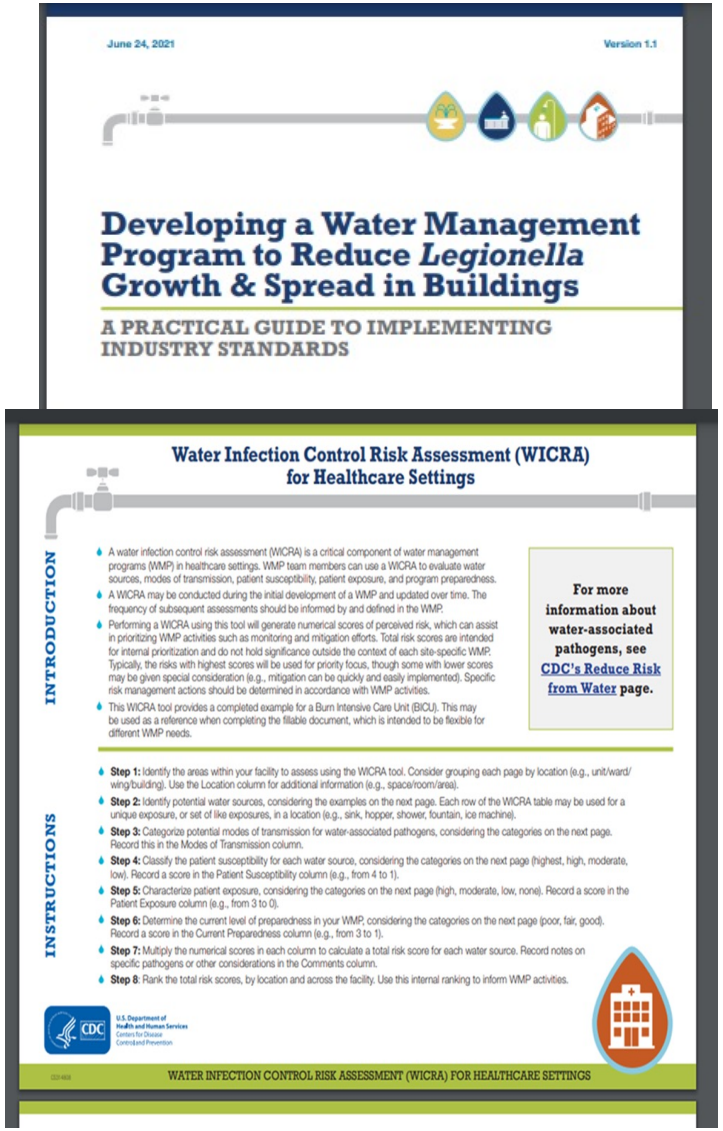
# Resources I

- CDC: Guidelines for Environmental Infection Control in Healthcare Facilities: www.cdc.gov/infection-control/hcp/environmental-control/index.html
- CDC: Considerations for Reducing Risk: Water in Healthcare Facilities: www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html
- Developing a Legionella Water Management Program and Controlling Legionella in Common Sources of Exposure www.cdc.gov/control-legionella/media/pdfs/toolkit.pdf
- CDC Water Infection Control Risk Assesment (WICRA) for Healthcare Settings: www.cdc.gov/healthcare-associated-infections/media/pdfs/water-assessment-tool-508.pdf

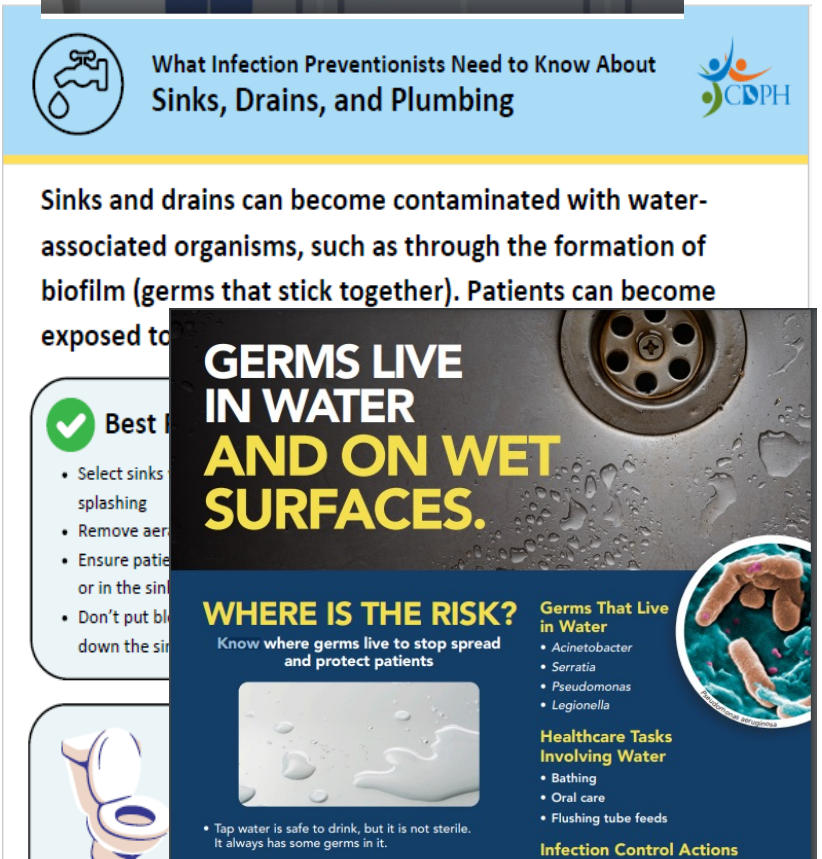


# Resources II

- CDC: Healthcare Facility Water Management Program Checklist
  - www.cdc.gov/healthcare-associated-infections/media/pdfs/PHS-ReduceWaterRisk-ChecklistTool-508.pdf
- CDC: Discussion Guide for Investigation of Potential Water-Associated Infections in Healthcare Facilities
  - www.cdc.gov/healthcare-associated-infections/media/pdfs/PHS-ReduceWaterRisk-DiscussionGuideTool-508.pdf
- CDC ICAR Tool : Module 11: Water Exposure Facilitator Guide & Observation Form www.cdc.gov/healthcare-associated-infections/php/toolkit/icar.html

# Resources III

- Joint Commission: Requirement, Rationale, Reference, Issue 32 October 27 2021. New water management standard (EC.02.05.02, EPs 1 through 4) January 1, 2022 www.jointcommission.org/standards/r3-report/r3-report-issue-32-new-standard-for-water-management-program/ .
- Staying Safe in the Splash Zone (video). Virginia Infection Prevention Training Center. www.youtube.com/watch?v=mjScWmtQt5Q
- CDPH: What Infection Preventionists Need to Know about Sinks, Drains, and Plumbing. (flyer) Email CDPH HAI to request flyer: HAIProgram@cdph.ca.gov
- CDC Project First Line: Trainings and Posters: Germs live in water and on wet surfaces www.cdc.gov/project-firstline/hcp/training/index.html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# THANK YOU!

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CDPH

# CDPH

California Department of
Public Health

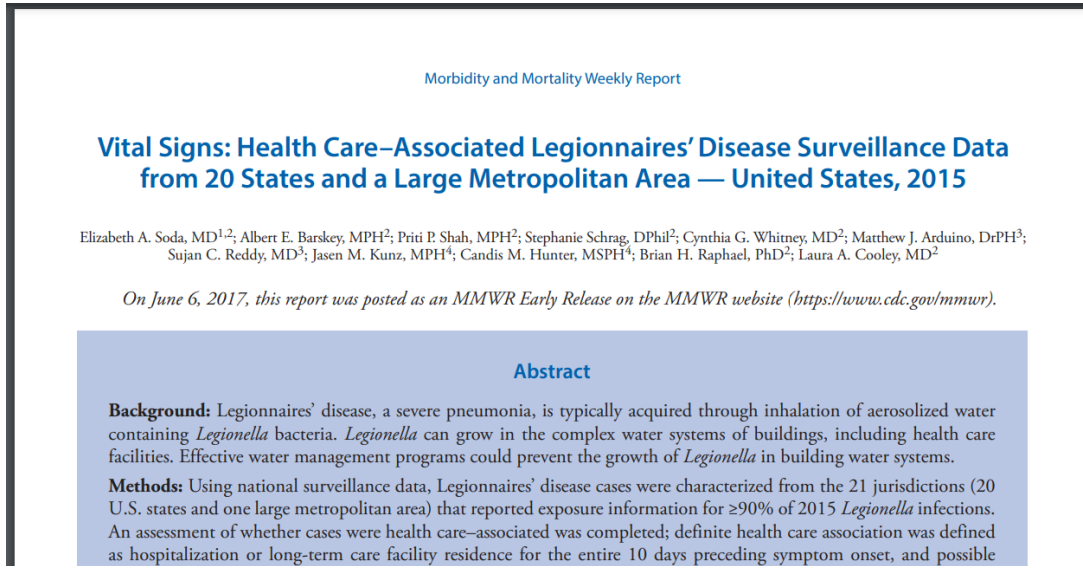
# Healthcare-Associated Legionnaires' Disease (HA-LD)

Presumptive

- **Duration**: ≥10 days of continuous stay during 14-day exposure period in a healthcare facility

Possible

- Duration:  <10 days during 14-day exposure period
- CDC Vital Signs, 2015
  - 25% presumptive→ 80% SNF; 10% possible
- Hospital-onset cases continue to occur
  - Recent outbreak 13 cases.
  - Copper-silver ion disinfection. Stopped cultures
  - Upgrades to disinfection system & water distribution contributed to this outbreak
  - Kessler et al. AJIC 2021 https://pubmed.ncbi.nlm.nih.gov/33631307/



Morbidity and Mortality Weekly Report

**Vital Signs: Health Care–Associated Legionnaires' Disease Surveillance Data from 20 States and a Large Metropolitan Area — United States, 2015**

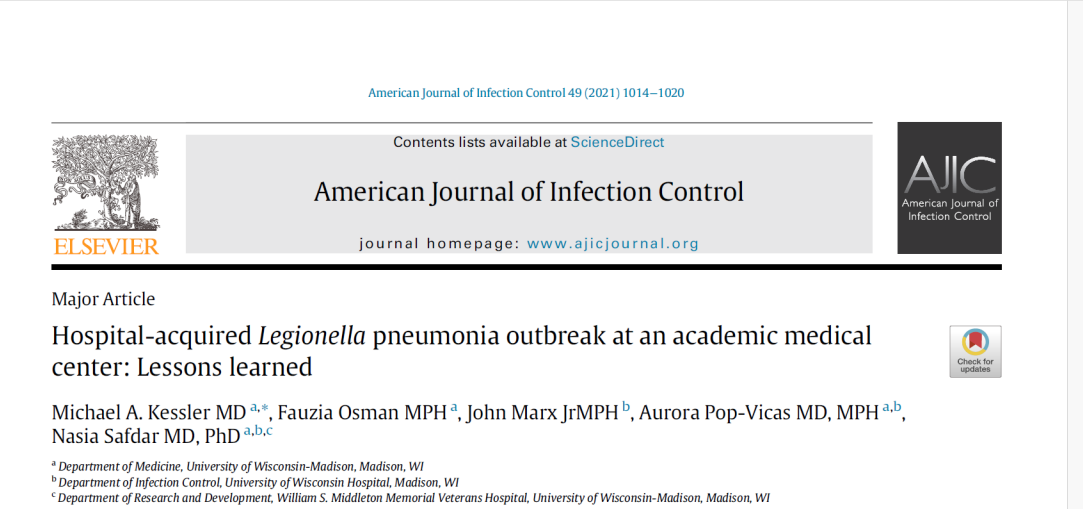
Elizabeth A. Soda, MD[1,2]; Albert E. Barskey, MPH[2]; Priti P. Shah, MPH[2]; Stephanie Schrag, DPhil[2]; Cynthia G. Whitney, MD[2]; Matthew J. Arduino, DrPH[3]; Sujan C. Reddy, MD[3]; Jasen M. Kunz, MPH[4]; Candis M. Hunter, MSPH[4]; Brian H. Raphael, PhD[2]; Laura A. Cooley, MD[2]

*On June 6, 2017, this report was posted as an MMWR Early Release on the MMWR website (https://www.cdc.gov/mmwr).*

**Abstract**

**Background:** Legionnaires' disease, a severe pneumonia, is typically acquired through inhalation of aerosolized water containing *Legionella* bacteria. *Legionella* can grow in the complex water systems of buildings, including health care facilities. Effective water management programs could prevent the growth of *Legionella* in building water systems.

**Methods:** Using national surveillance data, Legionnaires' disease cases were characterized from the 21 jurisdictions (20 U.S. states and one large metropolitan area) that reported exposure information for ≥90% of 2015 *Legionella* infections. An assessment of whether cases were health care–associated was completed; definite health care association was defined as hospitalization or long-term care facility residence for the entire 10 days preceding symptom onset, and possible



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Major Article

Hospital-acquired *Legionella* pneumonia outbreak at an academic medical center: Lessons learned

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

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

# Potential Transmission Routes of Potable Water to Patients


## Domestic Water Use

Water droplets and aerosol-ization from contaminated shower heads and toilets

Splashes from sink drains


Using poor quality water for immunocompromised patients

Improper oral care in immunocompromised patients

## Clinical care

Preparing injections and medications near sinks

medical devices