What’s Your Risk: Identifying Waterborne Pathogens and Associated Risks

Erika Baldry, MPH, CIC
ICP/HAI Section Supervisor

DEPARTMENT OF
PUBLIC HEALTH &
HUMAN SERVICES

Overview and Objectives

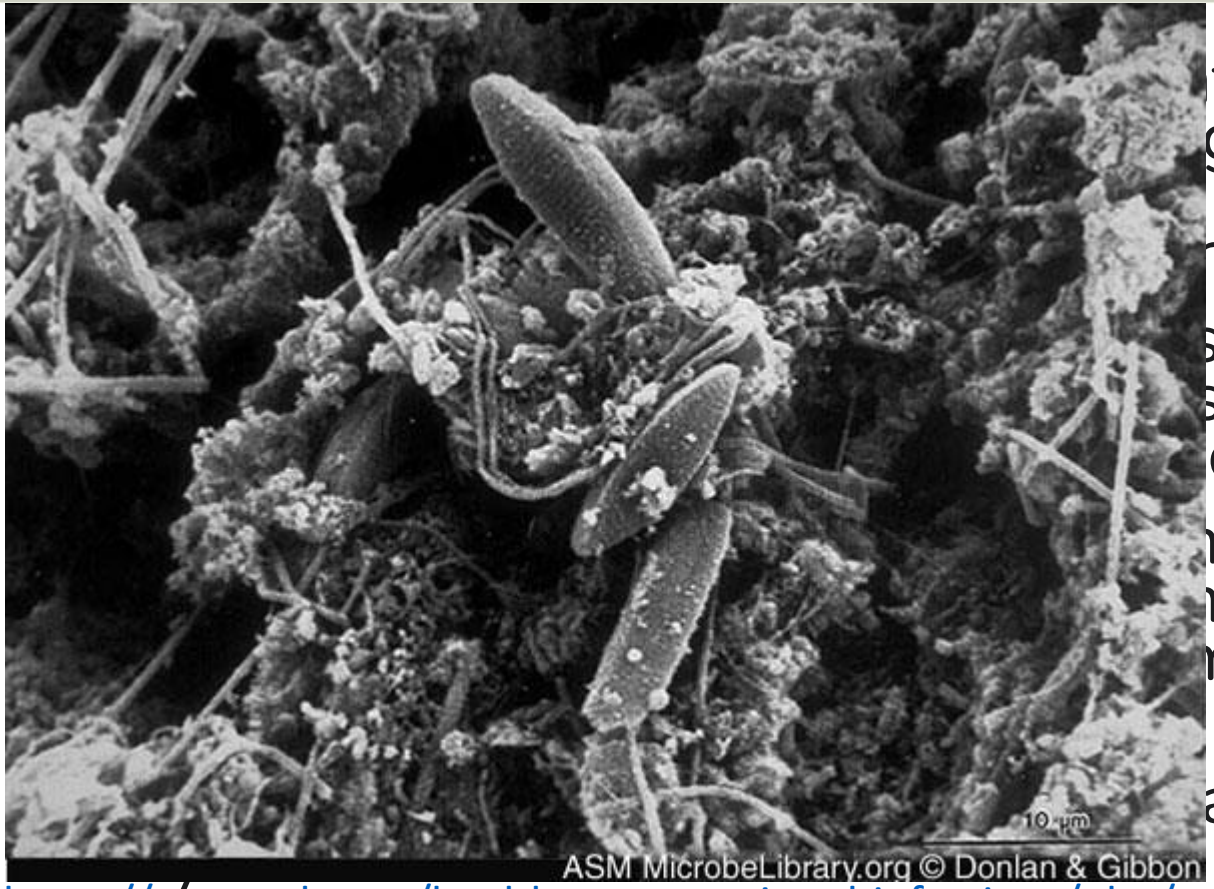
- This session will highlight ways that healthcare facilities can reduce risk from water
- By the end of this presentation, you should be able to:
  - Identify why water is a risk in healthcare settings
  - Identify ways to reduce the risk from water in healthcare settings through specific infection prevention practices

Water in Healthcare Facilities: Key Points

- Water can carry germs that threaten patient safety and spread antimicrobial-resistant pathogens or cause healthcare-associated infections (HAIs).
- Healthcare facilities can reduce water-based risks through infection prevention practices and management of the building premise plumbing system.

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

Water Lingo



ter system, including both hot
g., hot water heater, HVAC
faucets), and drains (e.g., sinks,
ribution system via service lines
se Plumbing (OPPP):
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Scanning electron micrograph of a native biofilm that developed on a mild steel surface in an 8-week period in an industrial water system.(https://wwwnc.cdc.gov/eid/article/8/9/02-0063-f1)

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

Plumbing to Patients

- Although tap water meets stringent safety standards in the US, it is not sterile. Due to this, germs may be present when water leaves the tap.
- In healthcare settings, water uses are varied, and patients are more vulnerable to infection.
- Certain plumbing conditions can even encourage microbial growth, leading to dangerously high levels of potential pathogens.
- Healthcare facilities must evaluate water use for its risk to harbor and transmit healthcare-associated pathogens.

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

Patient Safety and Considerations

- Water quality can be impacted through:
  - System disruptions or pressure drops
  - Loss of disinfection residual such as low chlorine levels
  - Water main breaks

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

Patient Safety and Considerations

- Premise Plumbing
  - Designed and maintained to minimize Opportunistic Pathogens of Premise Plumbing (OPPP) growth and spread in both the water supply and wastewater systems
- Considerations:
  - Age and overall design of the system
  - Additions and renovations
  - Water age
  - Assuring there are no ‘dead ends’ where water can stagnate

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

Water in Healthcare Facilities: Summary of Considerations

- Consideration 1: Maintain a water management program
- Consideration 2: Conduct a water infection control risk assessment
- Consideration 3a: Reduce exposure from sinks and drains
- Consideration 3b: Intentional sink design choices

Water in Healthcare Facilities: Maintain a Water Management Program

- Water management programs in healthcare facilities are important in helping to protect vulnerable patient populations as well as staff and visitors.
- Centers for Medicare and Medicaid Services, The Joint Commission, The Veterans Health Administration and CDC all consider it essential that hospitals and nursing homes have a water management program that is aligned with American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) industry standards
- Water management programs help to limit OPPP from growing and spreading in healthcare facilities

Elements of a Healthcare Water Management Program

- Multidisciplinary team that includes facility managers, infection prevention professionals, clinicians, administrators and/or a member from the local water utility
- Building water systems description with flow diagrams
- Evaluation of hazardous conditions where pathogens can grow and spread
- Control measures, their locations and how to monitor them
- Interventions when control limits are not met
- Ensure the program is running as designed and is effective
- Documentation and communication on all activities
- Healthcare facilities can use the “Healthcare Facility Water Management Program Checklist” and the “Tap Water Quality and Infrastructure Discussion Guide for Investigation of Potential Water-Associated Infections in Healthcare Facilities” to help their program if one does not already exist

Healthcare Facility Water Management Program Checklist

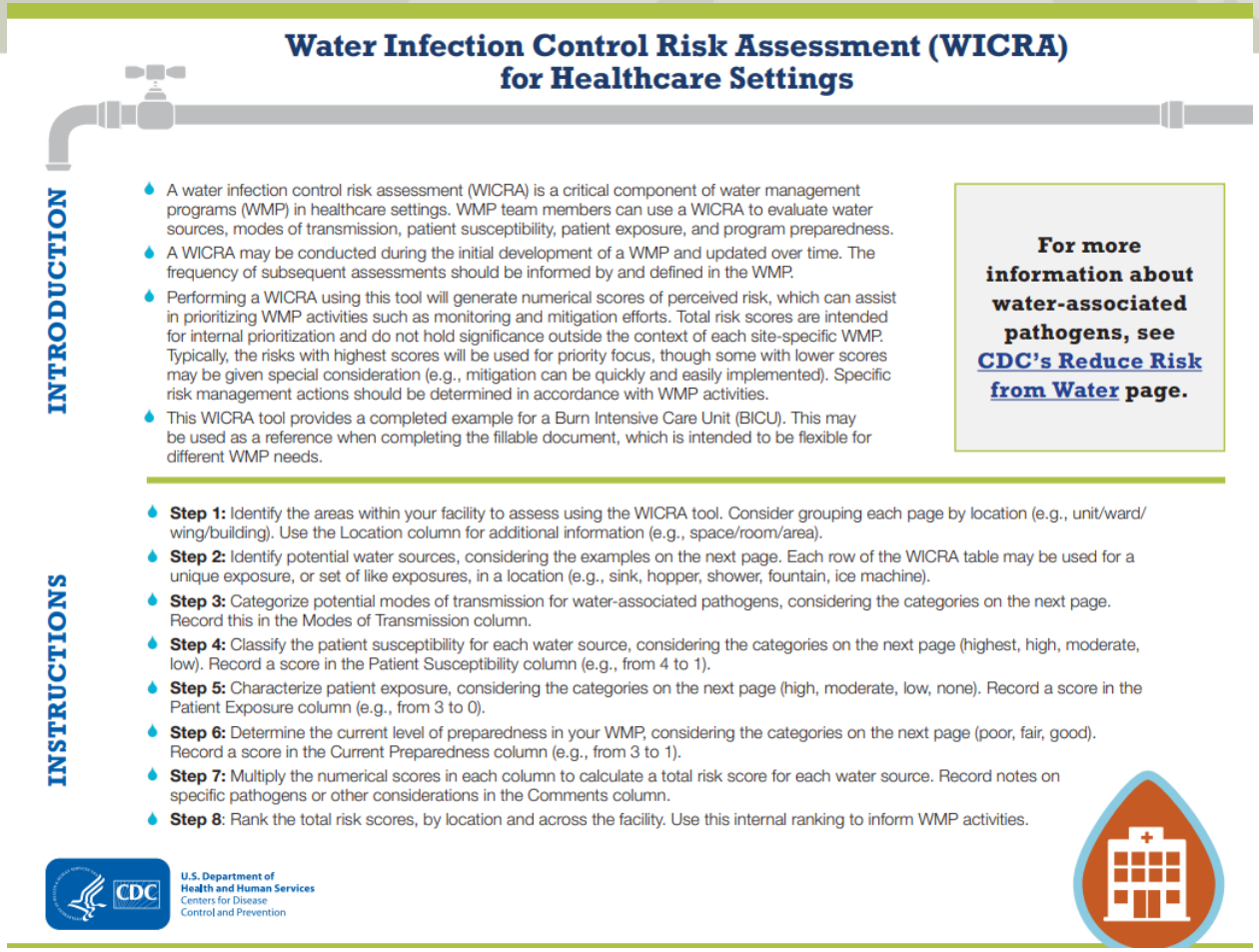
- Available here: https://www.cdc.gov/healthcare-associated-infections/media/pdfs/PHS-ReduceWaterRisk-ChecklistTool-508.pdf
- Checklist includes:
  - Establishing a water management program team (including membership, roles, responsibilities)
  - Describing your building water system
  - Identification of external hazards and creation of plans to mitigate or manage events (i.e., trace or no disinfectant residual upon entry into the building, water main breaks, service outages, or disruptions, low pressure events, flushing hydrants, boil water advisory, and nearby construction)
  - Identification of areas where biofilms might be present and identification of areas where opportunistic pathogens of premise plumbing may post a risk to patients
  - Conducting a Water Infection Control Risk Assessment (WICRA)
  - Describing how to monitor control measures (i.e., water temperature, residual disinfectant, heterotrophic plate count, total organic carbon, total dissolved solids, review trend data and report out of control results, determine frequency for monitoring)
  - Corrective actions
  - Outbreak and Contingency Response Plans
  - Establishing procedures to confirm that the implemented program is working
  - Documentation
  - Communication Plan
  - Program Review

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

- Available here: https://www.cdc.gov/healthcare-associated-infections/media/pdfs/PHS-ReduceWaterRisk-DiscussionGuideTool-508.pdf
- Purpose: For CDC and health departments to use as a guide when consulting with healthcare facilities when there is concern for the transmission of 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 could include surgical site, injection site, or bloodstream infections due to nontuberculous mycobacteria; *Pseudomonas aeruginosa* infections among NICU patients; and Legionnaires' disease

Conducting a Water Infection Control Risk Assessment

- Water management programs should consider the various pathways that might lead to patients becoming exposed to waterborne pathogens, in relation to ingestion, hygiene, and clinical care
- Healthcare facilities can use a WICRA to evaluate:
  - Water Sources
  - Modes of Transmission
  - Patient Susceptibility
  - Patient Exposure
  - Program Preparedness



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.

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

Conducting a Water Infection Control Risk Assessment: Steps

- 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).
- Step 2: Identify potential water sources (i.e., sink, hopper, shower, fountain, ice machine)
- Step 3: Categorize potential modes of transmission for water-associated pathogens (i.e., direct contact, ingestion of water, indirect contact, inhalation of aerosols dispersed from water sources, and aspiration of contaminated water)
- Step 4: Classify the patient susceptibility for each water source (high, moderate, low, none)
- Step 5: Characterize patient exposure (highest, high, moderate, low, none)
- Step 6: Determine the current level of preparedness in your WMP (poor, fair, good)
- Step 7: Multiply the numerical scores in each column to calculate a total risk score for each water source
- Step 8: Rank the total risk scores, by location and across the facility

Conducting a Water Infection Control Risk Assessment: Steps

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)*

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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

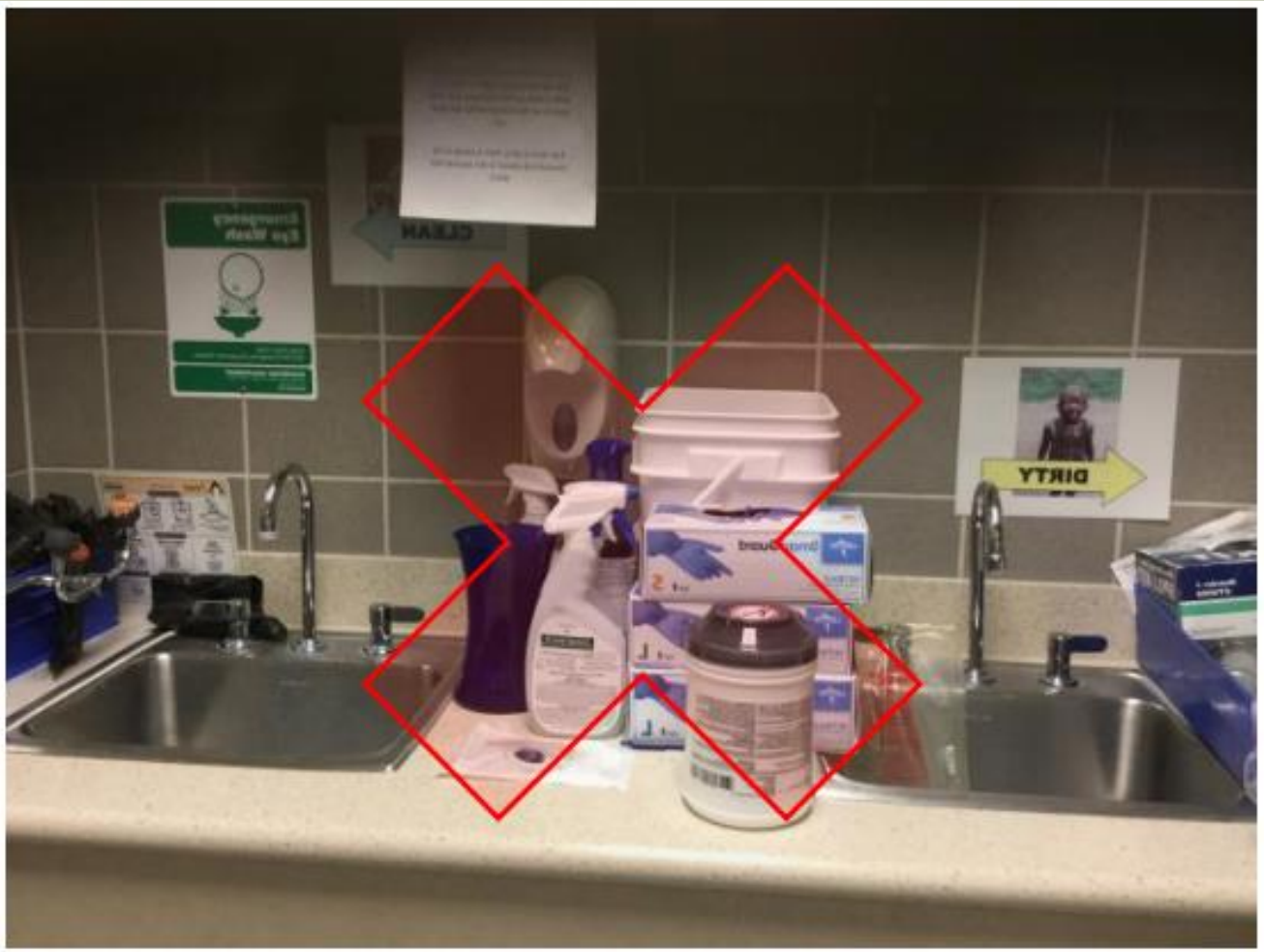
WMP Team Role(s) *(check all that apply):*

- ☑ 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 Highest = 4 High = 3 Moderate = 2 Low = 1	Patient Exposure High = 3 Moderate = 2 Low = 1 None = 0	Current Preparedness Poor = 3 Fair = 2 Good = 1	Total Risk Score = 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

Sinks and Drains

- Splashes can occur when water hits the contaminated drain cover, or a person flushes a toilet or hopper
- Splashes can spread droplets containing OPPP to the surrounding environment, patients and providers
- Reducing the risk through sinks and drains:
  - Avoid placing patient care or personal items on counters next to sinks
  - Do not discard patient waste down sinks and minimize discarding beverages down sinks or toilets
  - Clean and disinfect surfaces daily near the drain such as the:
    - Sink basin
    - Faucet
    - Faucet handles
    - Surrounding countertop
  - Consider using an EPA-registered biofilm disinfectant for wastewater drains **during an outbreak**
  - Close hopper and toilet lids before flushing; if lids are not available or allowed due to local plumbing codes, close any door that separates the hopper or toilet from other patient care areas



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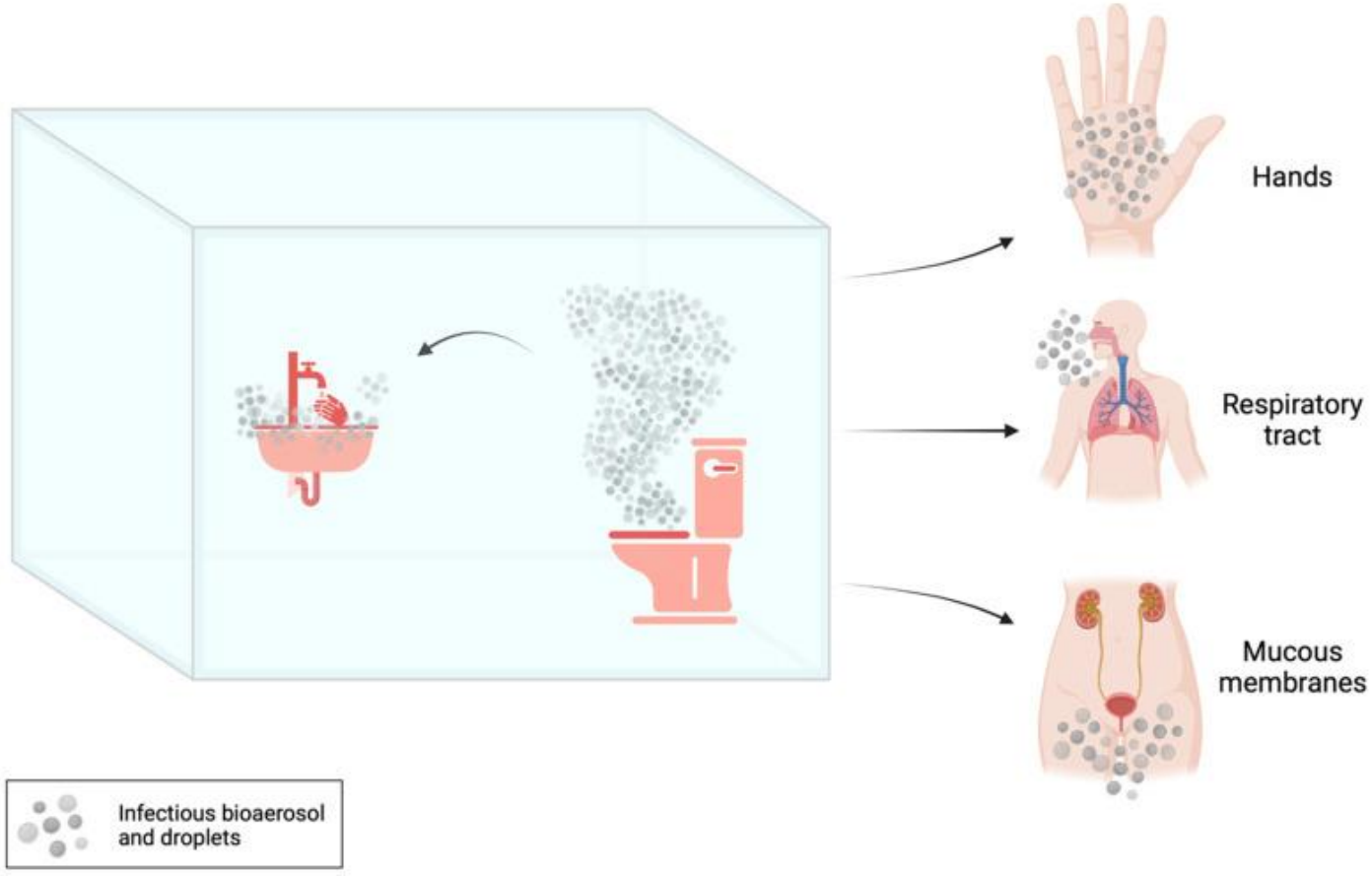
Splash zone cluttered - **Bad**

Splash zone empty – **Good**

https://icap.nebraskamed.com/wp-content/uploads/sites/2/2018/02/Splash-Zone-Around-Sinks.pdf

MDROs in Drains

- Recent evidence indicates sinks and other drains, such as toilets or hoppers, in healthcare facilities can become contaminated with multidrug-resistant organisms (MDROs).
- Because different types of bacteria may contaminate the same drain, drains can serve as sites where antimicrobial-resistant genes transfer between bacterial species.



“Transmission Risk of Multidrug-Resistant Bacteria Appears Highest in Hospital Sinks”

- https://apic.org/news/transmission-risk-of-multidrug-resistant-bacteria-appears-highest-in-hospital-sinks/
- A study published in the *American Journal of Infection Control* reports the infection prevention steps taken to control a months-long multispecies outbreak of carbapenemase-producing Enterobacterales that occurred in a pediatric ward at the Toho University Omori Medical Center in Tokyo in 2017.
- First detection of CPE in a single patient occurred in June 2016, which appears to have triggered an outbreak starting in March 2017 and ending October 2017.
- Outbreak involved 19 pediatric patients.

“Transmission Risk of Multidrug-Resistant Bacteria Appears Highest in Hospital Sinks”

- IP team sampled microbes from patients and the environment of the pediatric ward to better understand how the outbreak was spreading.
- Sampling identified 9 sinks that were contaminated with CPE
  - 6 were in hospital rooms; 3 in other locations (1: nurse center, 1: waste room, 1: ice machine)
  - The CPE+ sinks were found in rooms where +CPE patients had been treated; in rooms with –CPE cases, no sink contamination was detected.
- Resistance testing showed that all but one sample was most likely passed from one bacterial species to another within the hospital

“Transmission Risk of Multidrug-Resistant Bacteria Appears Highest in Hospital Sinks”

- IP Measures Taken
  - All sinks in the pediatric ward were replaced with new ones in June 2017, and the new sinks were thoroughly disinfected; however, CPE contamination continued even after this step.
  - Recommended hand disinfection after using sinks, using disposable tools for cleaning sinks, prohibiting mouth-washing with sink water, and enacted disinfection and drying procedures to any items exposed to sink water.
  - After October 2017, no further CPE contamination was identified in patient samples or environmental surveillance.

Sink Design

- When installing or modifying sinks, choose designs that prevent splashing and have adequate depth
- Angle/offset faucets so they do not pour directly into the drain
- Install splash guards on sinks next to medication preparation areas
- Provide easy access to hand cleaning supplies
- Facilities should monitor and regulate the water pressure in patient care area sinks so that splashing is minimized when the maximum water flow is used

Guidelines for Design and Construction of Health Care Facilities

- https://fgiguidelines.org/wp-content/uploads/2022/03/2010_FGI_Guidelines.pdf
- A2.1-7.2.4.1 (2)(b) The presence of water around hand-washing sinks has consistently proven to encourage the presence of opportunistic fungi and molds in the substrate materials if the countertops are not properly sealed and maintained. Integral backsplashes eliminate intersections that need to be caulked.
- (2) Sinks
- (a) Sinks in hand-washing stations shall be designed with deep basins to prevent splashing to areas where direct patient care is provided, particularly those surfaces where sterile procedures are performed and medications are prepared.
- (b) The area of the basin shall not be less than 144 square inches (365.76 square millimeters), with a minimum 9-inch (22.86-mm) width or length.
- (c) Hand-washing basins/countertops shall be made of porcelain, stainless steel, or solid surface materials. Basins shall be permitted to be set into plastic laminate countertops if, at a minimum, the substrate is marine-grade plywood (or equivalent) with an impervious seal.
- (d) Sinks shall have well-fitted and sealed basins to prevent water leaks onto or into cabinetry and wall spaces.
- (e) The discharge point of hand-washing sinks shall be at least 10 inches (25.40 centimeters) above the bottom of the basin.
- (f) The water pressure at the fixture shall be regulated.
- (g) Design of sinks shall not permit storage beneath the sink basin.

A Multicenter Investigation to Characterize the Risk for Pathogen Transmission from Healthcare Facility Sinks

- https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/multicenter-investigation-to-characterize-the-risk-for-pathogen-transmission-from-healthcare-facility-sinks/2278A5DEC4515A7BD5B35667A92D841E
- Demonstrated frequent dispersal of fluorescent tracer and fluroquinolone-resistant gram-negative bacilli from sink drains to sink bowls and to surfaces outside the bowl in 4 hospitals
- Fluorescent tracer dispersal correlated inversely with the depth of the sink bowl
- Placement of the faucet such that water flows directly onto the drain may increase the risk of organism dispersal
- 194 sets of sink cultures were obtained from the 4 study hospitals (138 in patient rooms; 56 in personnel work areas)

A Multicenter Investigation to Characterize the Risk for Pathogen Transmission from Healthcare Facility Sinks

Characteristic	Odds Ratio	95% Confidence Interval	*P* Value
Bowl depth (cm)[a]	0.69	0.59–0.79	.00
Faucet flow indirect versus direct relative to strainer	1.28	0.58–2.88	.54
Faucet goose neck versus other design	0.78	0.29–2.10	.62
Automatic versus manual sink	0.73	0.30–1.74	.48
Bowl circumference (cm)	1.01	0.99–1.04	.33

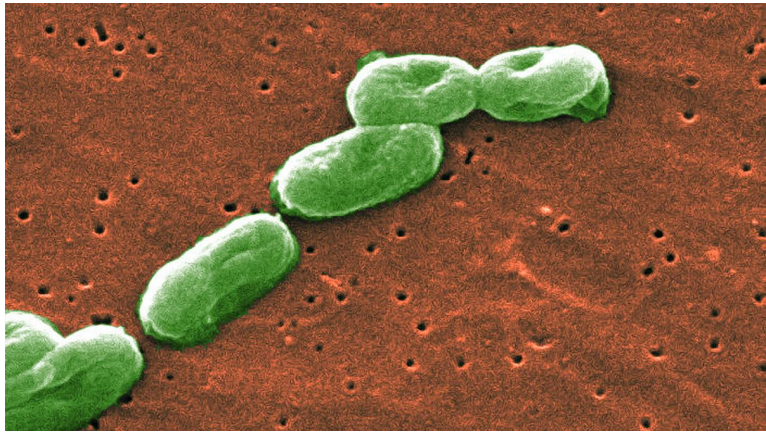
- In the study hospitals, 78% of sinks had relatively shallow bowl depths; modified designs with deeper sink bowls could reduce dispersal.
- Researchers did not find that sinks with offset faucets had significantly lower dispersal of fluorescent gel, suggesting that this modification alone is not sufficient to prevent pathogen dispersal.
- Avoiding high water flow rates by reducing water pressure might be beneficial.

Opportunistic Pathogens of Premise Plumbing

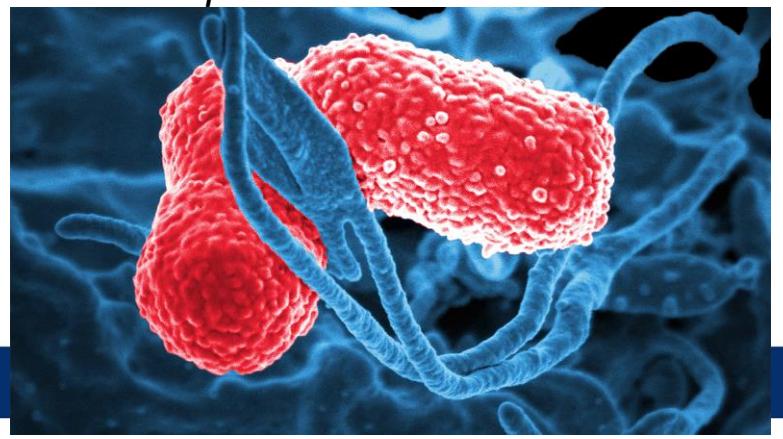
- Gram negative bacteria
- *Pseudomonas aeruginosa*
- *Burkholderia cepcia complex*
- *Acinetobacter baumannii*
- *Legionella pneumophila*
- Non-fecal coliforms
- *Enterobacter cloacae*
- *Klebsiella* spp.
- *Serratia marcescens*
- Nontuberculous mycobacteria (NTM or Environmental Mycobacteria)
- M. *abscessus*
- M. avium
- Other bacteria/actinomyces
- Fungi
- Yeasts
- *Aspergillus fumigatus*
- Protozoa

Pseudomonas aeruginosa

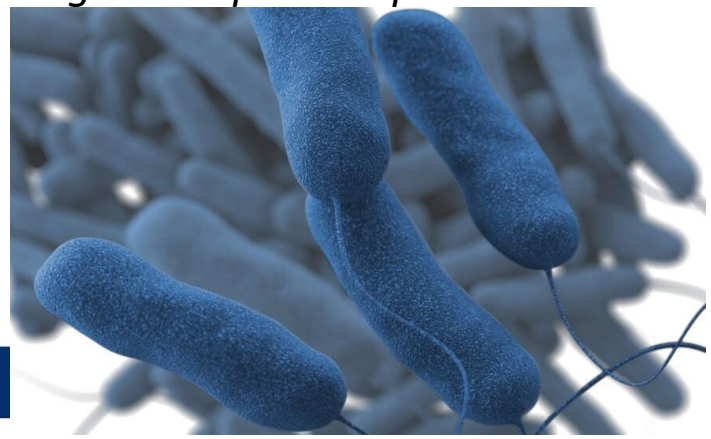
Burkholderia cepacia



Klebsiella pneumoniae

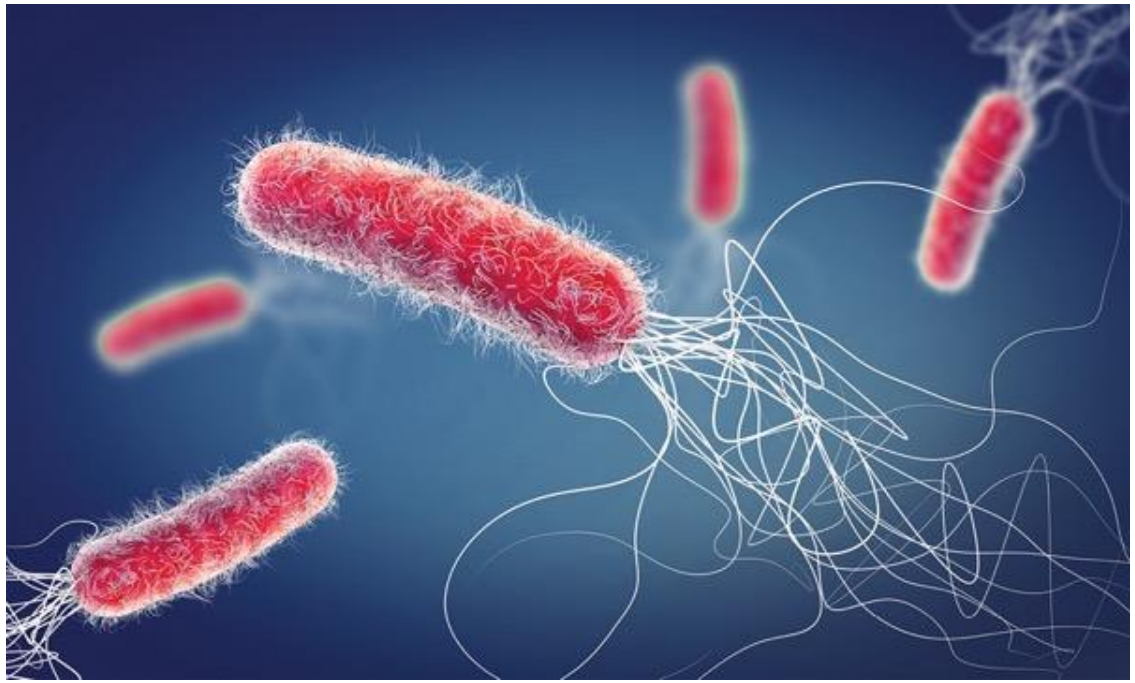


Legionella pneumophila



Pseudomonas aeruginosa

- Bacteria commonly found in the environment (soil and water)
- Typically occur in healthcare settings
- Can cause infections in the blood, lungs (pneumonia), urinary tract or other parts of the body after surgery
- Good hand hygiene and infection prevention and control can help to reduce the risk of infection
- Some types are resistant to nearly all antibiotics, including carbapenems
- In 2017, multidrug resistant *Pseudomonas aeruginosa* caused an estimated 32,600 infections among hospitalized patients and 2,700 estimated deaths in the United States.



https://www.idse.net/Antibiotic-Answers/Article/02-25/Antibiotic-Resistance-Pseudomonas-Aeruginosa/76268

https://www.cdc.gov/pseudomonas-aeruginosa/about/index.html

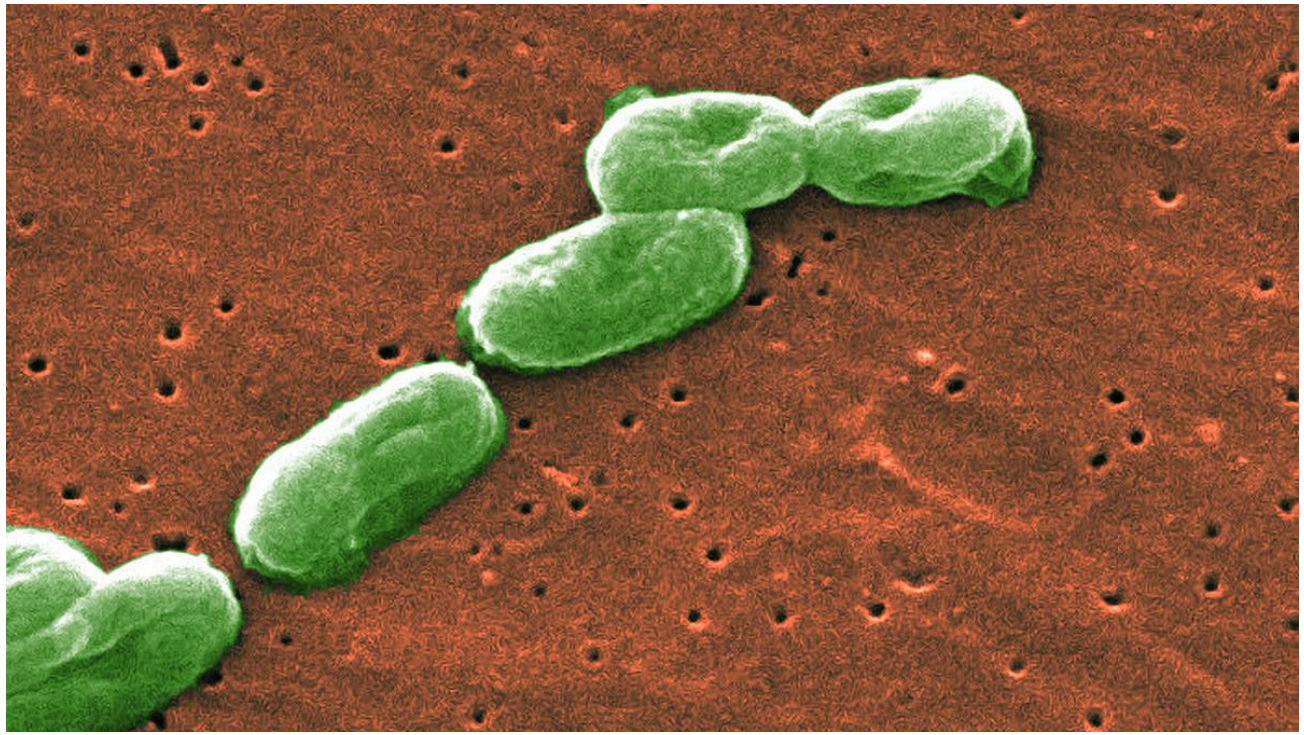
Pseudomonas aeruginosa

CRO	2024*	2025 YTD*
CRE	188	25
CRPA	85	22
CRAB	3	2
CP-CRE	7	1
CP-CRPA	0	0
CP-CRAB	1	2

- **At-risk populations**
  - Patients in healthcare settings are at highest risk, especially those who:
    - Are on breathing machines
    - Have devices, such as catheters
    - Have open wounds from surgery or burns
- **How it spreads**
  - Contact with contaminated surfaces or equipment
  - Exposure in the soil or water
  - Person-to-person contact, such as contaminated healthcare worker hands
- **Reducing risk**
  - Patients and caregivers should keep their hands clean, particularly before and after caring for wounds or touching a medical device
  - Clean patient/resident rooms daily
  - Follow core infection control practices
  - Have a water management plan in place
- **Testing Treatment and recovery**
  - Typically, perform antimicrobial susceptibility testing to determine the best treatment
- **What is public health doing?**
  - All CRPA isolates should be sent to the MTPHL for further testing
  - Tracking CRO data and responding to cases of significance

Burkholderia cepacia complex

- Also called *B. cepacia* or BCC
- Group of bacteria that can cause infections in healthcare settings
- Commonly found in soil and water
- Good infection control practices, including the use of water, can help reduce infection risk
- Can be resistant to antibiotics, making them difficult to treat



Burkholderia cepacia complex

- **Symptoms**
  - Symptoms vary, ranging from no symptoms to serious respiratory symptoms, especially in patients with cystic fibrosis or other chronic lung diseases. Symptoms may include fever or fatigue.
- **At-risk populations**
  - In the US, people in healthcare settings and those with weakened immune systems or chronic lung diseases, particularly cystic fibrosis, are at highest risk of infection; poses little medical risk to healthy people
- **How it spreads**
  - Exposure from water, soil or watery environments
  - Contact with contaminated surfaces
  - Contact with contaminated equipment
  - Person-to-person transmission, more commonly in patients with cystic fibrosis
- **Reducing risk**
  - Keep hands clean, particularly before and after caring for wounds or touching a medical device
  - Avoid exposing wounds and indwelling medical devices to nonsterile water
  - Allow healthcare staff to clean the patient/room daily
- **Testing Treatment and recovery**
  - Treatment decisions are typically made on a case-by-case basis, but generally include antibiotics
- **What is public health doing?**
  - Investigating and responding to outbreaks

Burkholderia cepcia complex: Notable Outbreaks

- Outbreak of Burkholderia stabilis Infections Associated with Contaminated Nonsterile, Multiuse Ultrasound Gel — 10 States, May–September 2021 | MMWR (cdc.gov)
- In 2021, a total of 119 BCC infections were associated with multiple lots of nonsterile ultrasound gel
- Use of contaminated gel before percutaneous procedures likely contributed to patient infections (i.e., likely introduced into sterile body sites during invasive procedures when needles were advanced through skin on which the contaminated gel had been applied before the procedure)
- Recommendation: Only single-use sterile ultrasound gel packets should be used for ultrasonography in anticipation of, preparation for, or during percutaneous procedures.
- Recommendation: Ultrasound probes and other related devices should be completely cleaned and disinfected according to manufacturer's instructions for use.

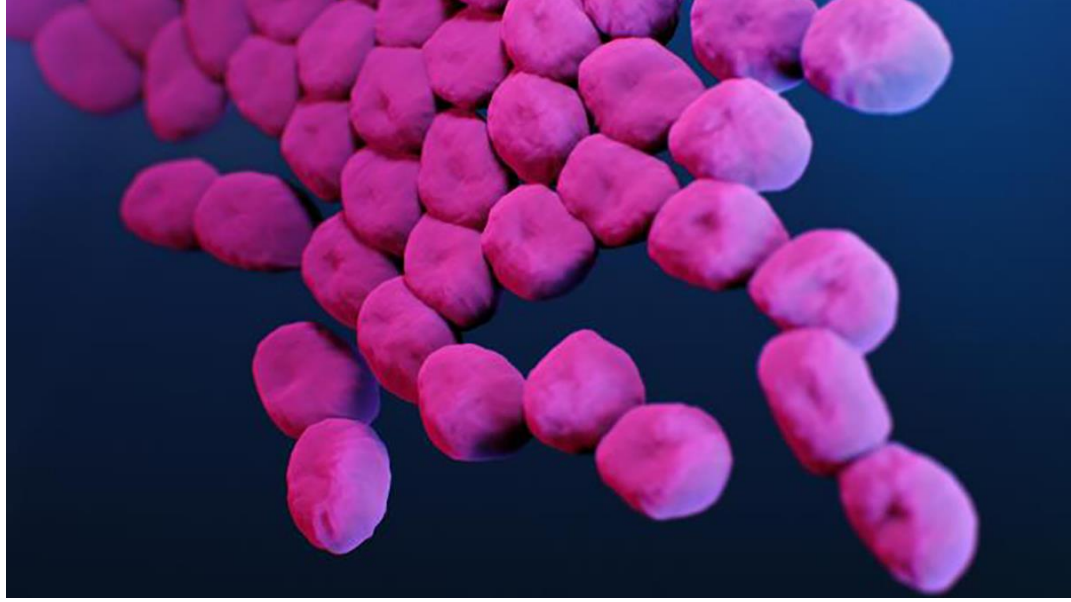
Burkholderia cepcia complex: Notable Outbreaks

- Multistate Outbreak of *Burkholderia cepacia* Infections Associated with Oral Liquid Docusate Sodium
- Infections primarily in ventilated patients without cystic fibrosis and who are being treated in intensive care units
- Total of 58 cases confirmed by molecular typing to match one of two outbreak strains identified from healthcare facilities in eight states
- FDA released statement re: voluntary recall of certain liquid docusate products
- June-October 2016

Burkholderia cepcia complex: Notable Outbreaks

- Multistate Outbreak of *Burkholderia cepacia* Bloodstream Infections Associated with Contaminated Prefilled Saline Flush Syringes
- On September 23, 2016, Maryland DOH alerted CDC to a cluster of bloodstream infections in a rehabilitation facility.
- Four additional states were subsequently identified as having clusters of infections among residents of long-term care or rehabilitation facilities.
- Infections were identified among persons who were receiving intravenous fluids and/or antibiotics through central venous catheters.
- Contaminated prefilled saline flush syringes manufactured by Nurse Assist, were identified as the source of the outbreak.

Acinetobacter baumannii



- Group of bacteria commonly found in the environment, like in soil and water
- Infections typically occur in healthcare settings (infections rarely occur outside of healthcare settings)
- Infections typically include, blood, urinary tract, lungs, or wounds. In some cases, people can carry the bacteria without being infected, known as colonization.
- Good hand hygiene and infection prevention practices can help reduce infection risk
- Can be resistant to antibiotics, making them difficult to treat

Acinetobacter baumannii

- **At-risk populations**
  - Patients in healthcare settings are at highest risk, especially those:
    - On breathing machines (ventilators)
    - Have devices such as catheters
    - Have open wounds from surgery
    - Are in intensive care units
    - Have prolonged hospital stays
- **How it spreads**
  - Contact with contaminated surfaces
  - Contact with contaminated equipment
  - Person-to-person contact, often via contaminated hands
- **Reducing risk**
  - Keep hands clean, particularly before and after caring for wounds or touching a medical device
  - Avoid exposing wounds and indwelling medical devices to nonsterile water
  - Allow healthcare staff to clean the patient/resident room daily
- **Testing and Treatment**
  - Perform antimicrobial susceptibly testing to determine the best treatment.
- **What is public health doing?**
  - All CRAB isolates should be sent to the MTPHL for further testing
  - Tracking CRO data and responding to cases of significance

Legionella pneumophila

- *Legionella* can cause Legionnaires' disease and Pontiac fever, collectively referred to as legionellosis
  - There are at least 60 different species of *Legionella*, most of which are considered to be pathogenic
  - Majority of disease is caused by *Legionella pneumophila*, particularly serogroup 1
- Being an older adult or having certain medical conditions puts people at increased risk for these infections

Legionellosis

- Risk Factors Include:
  - Age and Medical Conditions
    - Age ≥50 years
    - Chronic lung disease (such as emphysema or COPD)
    - Immune system disorders due to disease or medication
    - Smoking (current or historical)
    - Systemic malignancy
    - Underlying illnesses such as diabetes, renal failure, or hepatic failure
  - Settings or Exposures
    - Exposure to hot tubs
    - Recent care at a healthcare facility
    - Recent travel with an oversight stay outside of the home
    - Use of respiratory therapy equipment

Legionellosis

- How It Spreads
  - Sources
    - Can be found in natural, freshwater environments, but generally isn't present in sufficient numbers to cause disease
    - In human-made water systems, *Legionella* can grow and be transmitted to susceptible hosts via aerosolization. Human-made water systems include:
      - Large, complex plumbing systems
      - Showerheads and sink faucets
      - Hot tubs
      - Hot water tanks and heaters
      - Decorative fountains and water features
      - Cooling towers
  - Pathogenesis
    - Grows and multiplies within amoebae and ciliated protozoa, which are small one-celled organisms. Protozoa benefit *Legionella* by providing nutrients for replicating and growing and providing a shelter from adverse environmental conditions

Legionnaires' Disease

- Signs/Symptoms:
  - Chest discomfort
  - Headache
  - Malaise
  - Myalgia
  - Nausea, diarrhea, or abnormal pain
  - Shortness of breath
- Hospitalization is common
- Case-fatality rate is approximately 10%. For healthcare-associated infections, the case-fatality rate averages 25%.

Commons Sources of Infection

Outbreaks of Legionnaires' disease are most often associated with large or complex water systems, like those found in hospitals, long-term care facilities, hotels, and cruise ships.

The most likely sources of infection include:

Water used for showering (potable water)

Cooling towers (parts of large air conditioning systems)

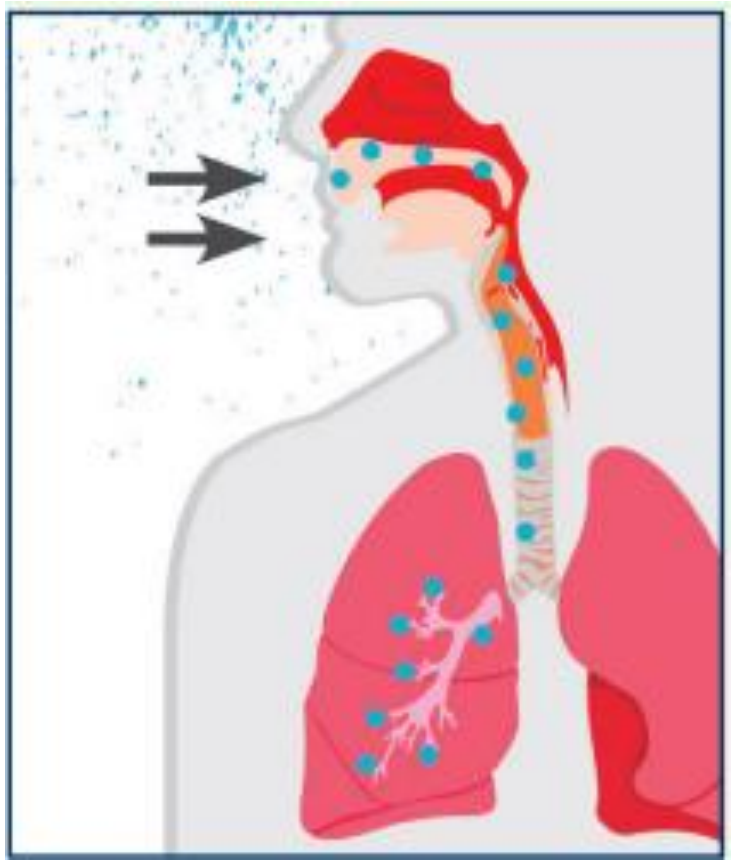
Decorative fountains

Hot tubs

Healthcare-Associated Legionnaires' Disease

- Testing for healthcare-associated Legionnaires' disease is especially important if any of the following are identified in a healthcare facility:
  - Healthcare-associated Legionnaires' disease diagnosis in the last year
  - Positive environmental tests for *Legionella*
  - Recent changes in water quality that may lead to *Legionella* growth
- Specimen Collection:
  - Preferred diagnostic tests for Legionnaires' disease are both a culture of lower respiratory secretions and *Legionella* urinary antigen test
- Treatment
  - Antibiotic treatment

Pontiac Fever



- Signs/Symptoms:
  - Chills
  - Fatigue
  - Fever
  - Headaches
  - Malaise
  - Myalgia
  - Nausea or vomiting
- Hospitalization is uncommon
- Case-fatality rate is extremely low
- Antibiotic treatment shouldn’t be prescribed as it’s usually a self-limited illness that doesn’t benefit from antibiotic treatment as patients usually recover within 1 week

Legionella Environmental Assessment Form

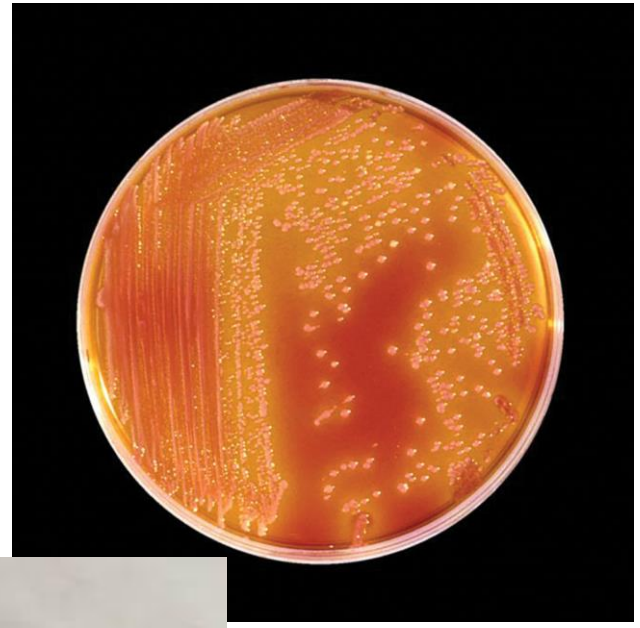
- https://www.cdc.gov/investigate-legionella/Legionella-Environmental-Assessment-Form.pdf
- Enables public health officials to gain a thorough understanding of a facility's water system and aerosolizing devices
- Used along with epidemiologic information to determine whether to conduct *Legionella* environmental sampling and to develop a sampling plan
- Findings from this assessment can be used to help develop a water management plan

Other *Legionella* Resources

- Toolkit: Controlling *Legionella* in Common Sources of Exposure: https://www.cdc.gov/control-legionella/php/toolkit/control-toolkit.html?CDC_AAref_Val=https://www.cdc.gov/legionella/wmp/control-toolkit/index.html
- *Legionella* Training: https://www.cdc.gov/control-legionella/php/training/?CDC_AAref_Val=https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
  - Training Topics Include:
    - Create a water management program team
    - Describe the building water systems using text and flow diagrams
    - Identify areas where *Legionella* could grow and spread
    - Decide where control measures should be applied and how to monitor them
    - Establish ways to intervene when control limits are not met
    - Make sure the program is running as designed and is effective (verification and validation)
    - Document and communicate all the activities of your water management program

Serratia marcescens

- Environmental gram-negative bacterium
- Opportunistic pathogen that in rare cases, causes invasive disease, including bacteremia and endocarditis
- Abundant in damp environments (bathrooms, showers, sinks)
- Appears as pink-orange-red discoloration
- Discovered in Italy in 1819 when it affected polenta
  - Named in honor of Serafina Serrati, who ran the first steamboat on the Arno River in 1795
  - The word *marcescens* was chosen from Latin for the species name meaning to decay

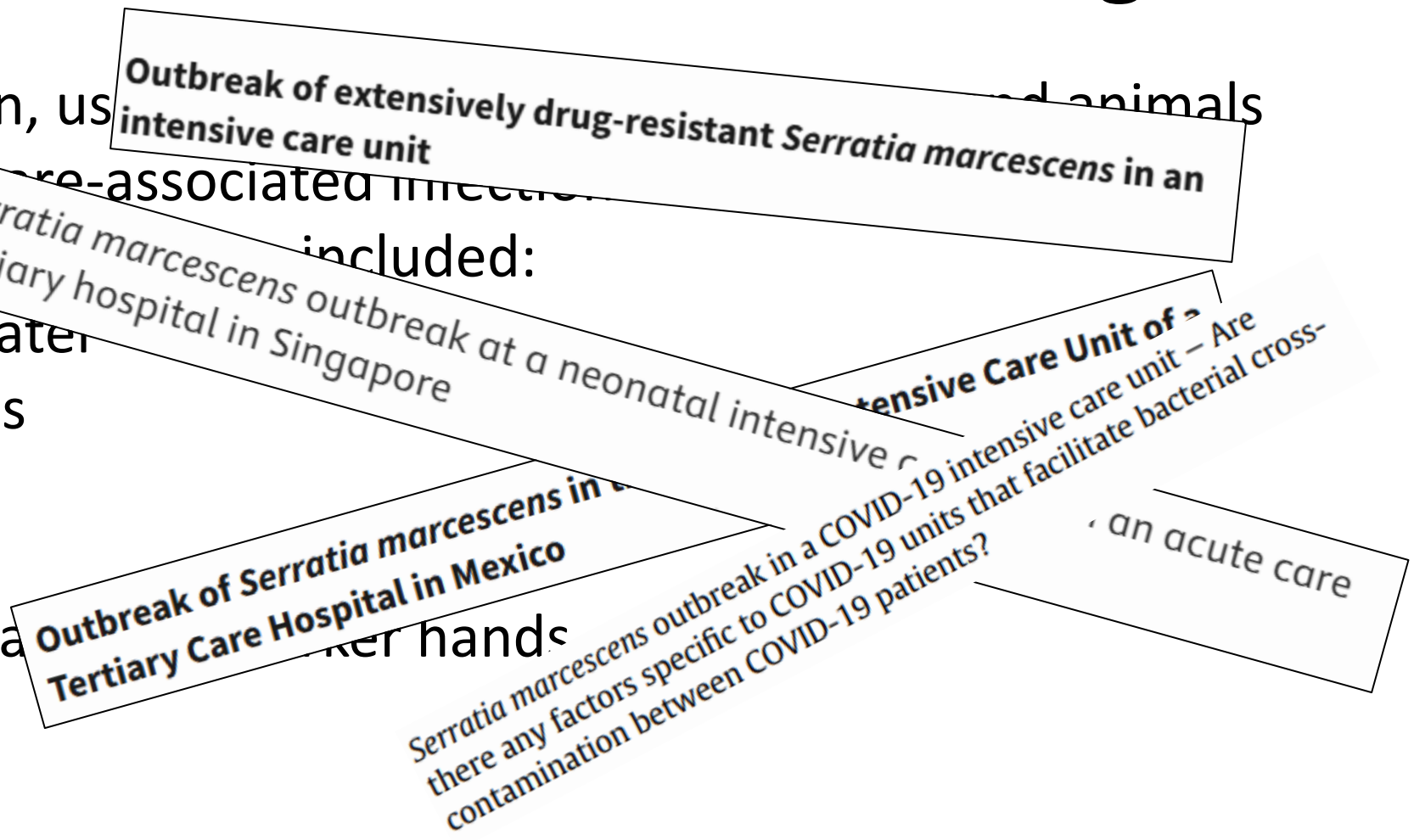


https://stacks.cdc.gov/view/cdc/83020

https://www.notlawaterauthority.org/post/facts-about-serratia-marcescens-the-pink-stuff-in-your-toilet-shower-or-sink

Serratia marcescens in Healthcare Settings

- Environmental pathogen, us… …d animals
- Known to cause heal… …re-associated infectio…
- Sources of hospital … …included:
  - Contaminated tap wate…
  - Disinfectant solutions
  - Soap
  - Therapeutic agents
  - Dissemination on hea… …ker hands



Nontuberculous mycobacterium (NTM)

- Found in soil, dust, and water
- Anyone can get an NTM infection but people with underlying lung disease or weakened immune systems are at an increased risk.
- There are more than 190 recognized species of NTM; some cause disease in humans
- Signs and Symptoms:
  - Blood in sputum
  - Cough
  - Decreased appetite
  - Fever
  - Loss of energy
  - Night sweats
  - Rashes
  - Shortness of breath
  - Weight Loss

Nontuberculous mycobacterium (NTM)

- Exposure Risks
  - Natural water sources (rivers and streams)
  - Municipal water sources (water that people drink or shower in)
  - Shower heads and sink faucets
  - Hydrotherapy equipment, such as jetted therapy baths
  - Ice machines
  - Decorative fountains and water features
- Settings with Increased Risk
  - Tattoo parlors
  - Nail salons
  - Hot tubs or spas
  - Healthcare settings (NTM outbreaks typically happen in healthcare settings if procedures expose patients to contaminated water)
- Who's At Risk:
  - Lung infections most commonly occur in patients who already have lung diseases
    - Cystic fibrosis
    - Bronchiectasis
    - Emphysema

Summary

- Water can carry germs that threaten patient safety and spread antimicrobial-resistant pathogens or cause healthcare-associated infections (HAIs).
- Healthcare facilities can reduce water-based risks through infection prevention practices and management of the building premise plumbing system.
- There are a lot of tools that a healthcare facility can use to help develop a water management plan and when responding to a water-related communicable disease event.

Resources

- https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html
- https://www.cdc.gov/healthcare-associated-infections/media/pdfs/PHS-ReduceWaterRisk-ChecklistTool-508.pdf
- https://www.cdc.gov/healthcare-associated-infections/media/pdfs/PHS-ReduceWaterRisk-DiscussionGuideTool-508.pdf
- https://www.cdc.gov/investigate-legionella/Legionella-Environmental-Assessment-Form.pdf

Questions?

Erika Baldry, MPH, CIC
Infection Control and Prevention/Healthcare-Associated Infections Section Supervisor
MT DPHHS
406-444-0275
Erika.Baldry@mt.gov