



# **Plumbing 201 for Infection Preventionists**

# Presenter



**David Pierre**

Director, Water Management Programs

[dpierre@liquitech.com](mailto:dpierre@liquitech.com)

# Objectives

- » Discuss the impact of plumbing materials used in healthcare.
- » Explain how plumbing design and material selection contribute to the risk of healthcare-associated infections (HAIs).
- » Identify maintenance practices for healthcare plumbing systems that can prevent the occurrence of HAIs.
- » Discuss the challenge associated with biofilm in healthcare drains.
- » Examine methods to manage and control biofilm development in healthcare facility drains.

# Why Plumbing?

- » During the surveillance period, 214 outbreaks associated with drinking water were reported.
- » Building plumbing systems was the most cited contributing factor for all bio-film-associated pathogen outbreaks.
- » Legionella caused 98% biofilm-associated outbreaks, followed by nontuberculous mycobacteria (NTM) at 1% and Pseudomonas at 0.5%.
- » Healthcare facilities were identified as the setting for exposure in 53% of outbreaks.
- Pipes and drains form the basis of plumbing systems, making it essential to grasp these fundamentals before delving into more complex topics like water systems (Plumbing 301).
- » Significant attention on drains as a potential source of HAIs in healthcare facilities.
- » An alarming rise in hospital outbreaks linked to hand-washing sinks underscores the widespread recognition that sinks serve as major reservoirs of antibiotic-resistant pathogens in patient care areas.

# Importance of Pipe Knowledge for IPs

- » **Infection Control:** Understanding how different pipe materials influence microbial growth helps develop strategies to prevent biofilm formation and waterborne infections.
- » **Material Selection:** Knowledge of pipe materials can inform decisions during facility construction and renovation to ensure the selection of materials that minimize infection risks and are capable with control measures.
- » **Maintenance Awareness:** Understanding the vulnerabilities of different piping systems ensures IPs can advocate for proper maintenance to prevent leaks and stagnation that can lead to HAIs.
- » **Risk Management:** IPs with pipe system knowledge can better assess and manage the risk of pathogen proliferation in water systems, which is crucial for patient safety.
- » **Collaborative Efforts:** IPs often work with environmental services and facility management; understanding plumbing is vital for effective communication and joint infection control efforts.
- » **Regulatory Compliance:** IPs involved in ICRA must ensure that plumbing systems comply with health and safety regulations to prevent HAIs.
- » **Outbreak Investigation:** In the event of an infection outbreak, IPs with knowledge of the plumbing infrastructure can quickly identify potential sources and pathways of infection.
- » **Educational Role:** IPs can educate healthcare staff about the risks associated with plumbing systems and the importance of reporting potential issues promptly.

# Key Words in Plumbing and Infection Control

## » **Leaching:**

- » *Definition:* The process by which materials, such as metals or chemicals, dissolve or are washed out from the pipe material into the water due to contact with the water over time. In healthcare settings, leaching can introduce potentially harmful substances into the water supply, affecting water quality and patient safety.

## » **Corrosion:**

- » *Definition:* The gradual destruction or deterioration of materials (metals, alloys, plastics, etc.) caused by chemical reactions with their environment. In pipes, corrosion can lead to reduced water flow, leaks, and the release of metals into the water, which can serve as nutrients for microbial growth, including biofilms.

## » **Biofilm:**

- » *Definition:* A complex aggregation of microorganisms, including bacteria, fungi, and protozoa, that adhere to each other and surfaces, encased in a protective and adhesive matrix. Biofilms in plumbing systems can harbor pathogens, making them resistant to disinfection and posing a significant risk for HAIs.

# **Types of Plumbing Lines in Healthcare Facilities**

# Supply Lines

## » Definition:

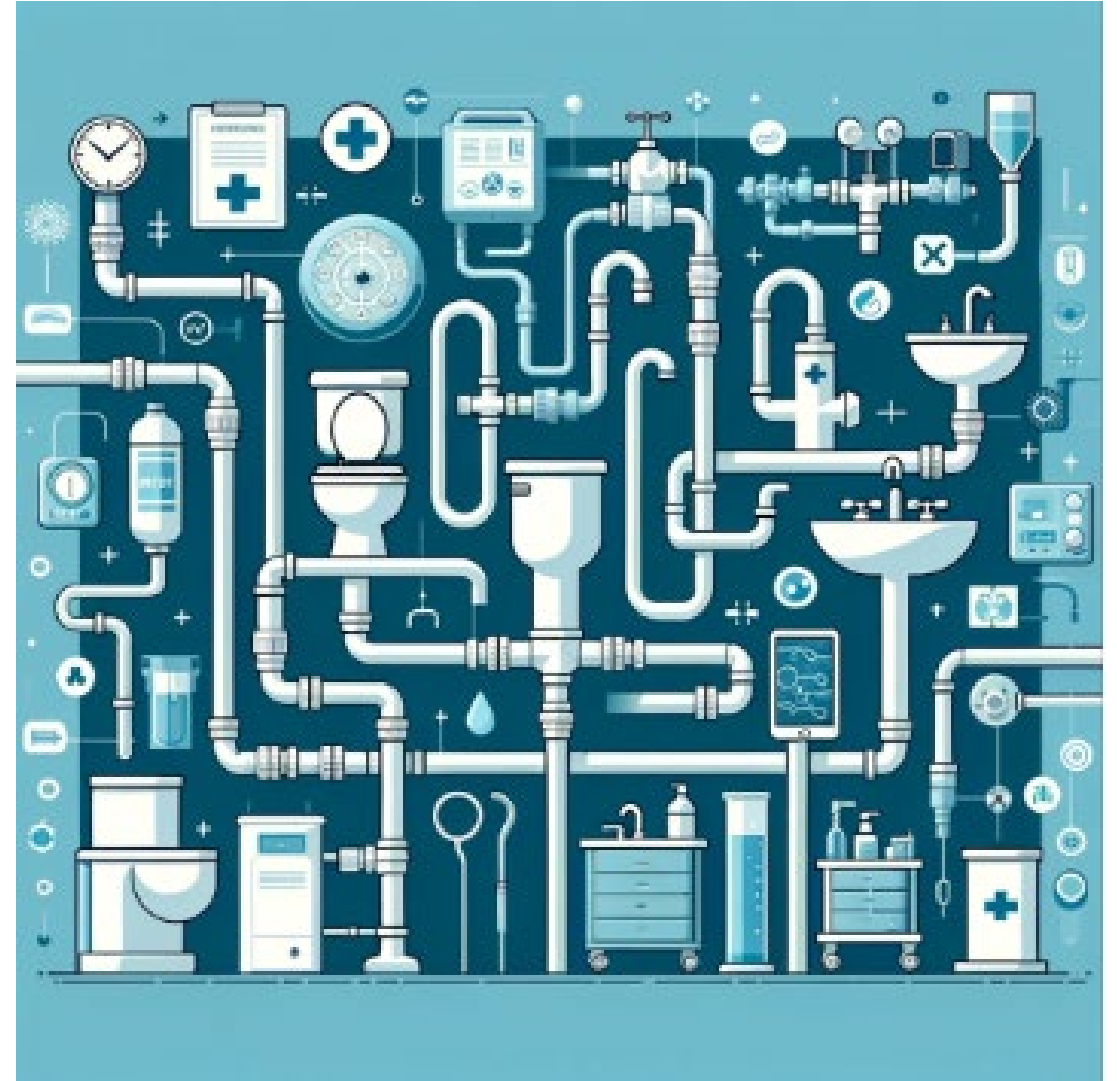
- » Pipes that deliver fresh, potable water from the municipal water supply or an onsite well to the healthcare facility.

## » Importance:

- » Ensure a constant flow of clean water for drinking, handwashing, sterilization, and patient care.

## » Materials:

- » Often made from copper, cross-linked polyethylene (PEX), or chlorinated polyvinyl chloride (CPVC) for their durability and water quality preservation properties.





# Return Lines

## » Definition:

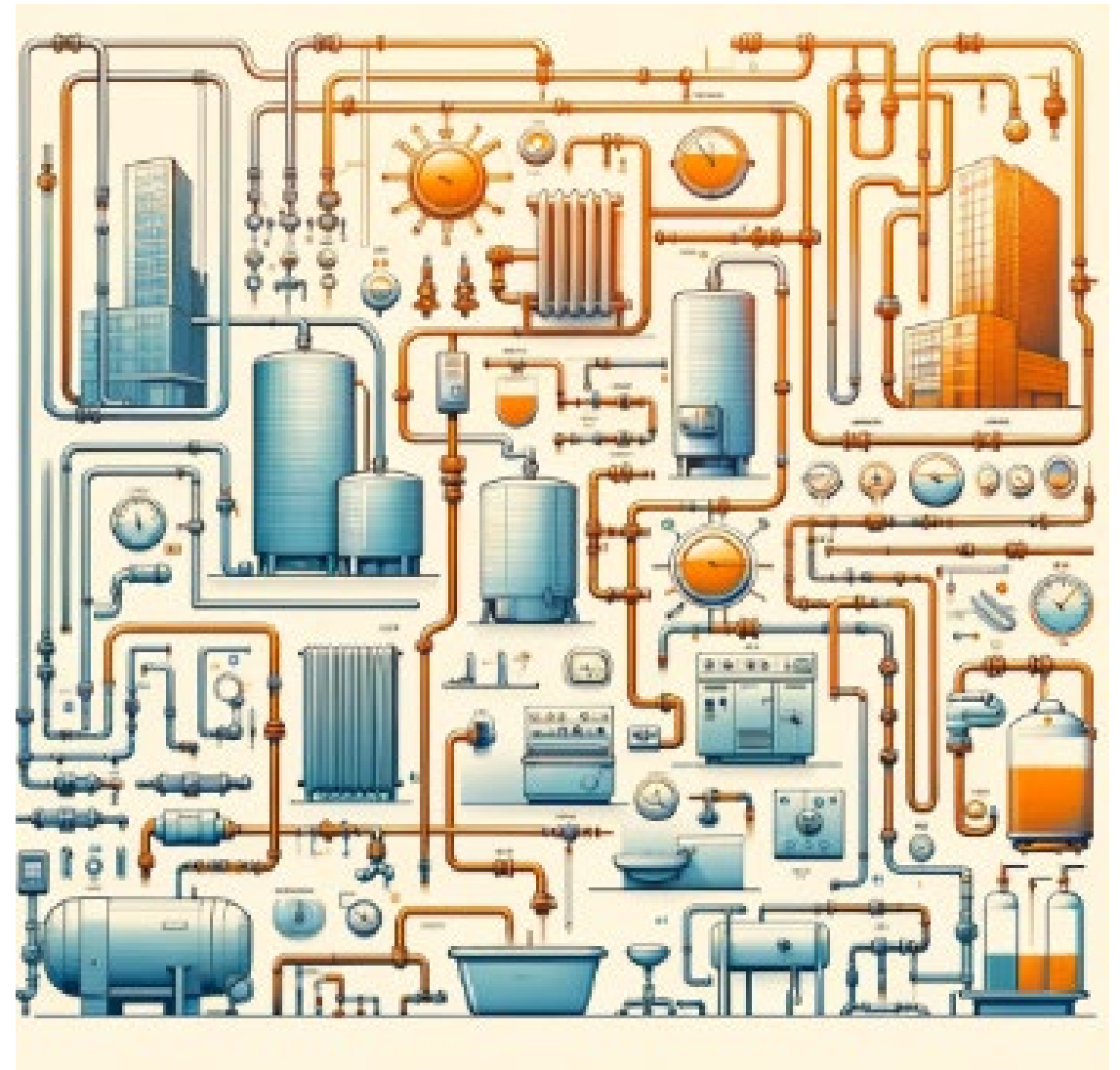
- » Specific to heating and cooling systems, return lines bring back water or coolant to be re-heated or re-cooled.

## » Importance:

- » Essential for maintaining the climate control systems within healthcare settings, contributing to patient comfort and infection control.

## » Materials:

- » Materials can vary, but metals like copper or steel are often used for their temperature resilience.



# Drain and Waste Lines

## » **Definition:**

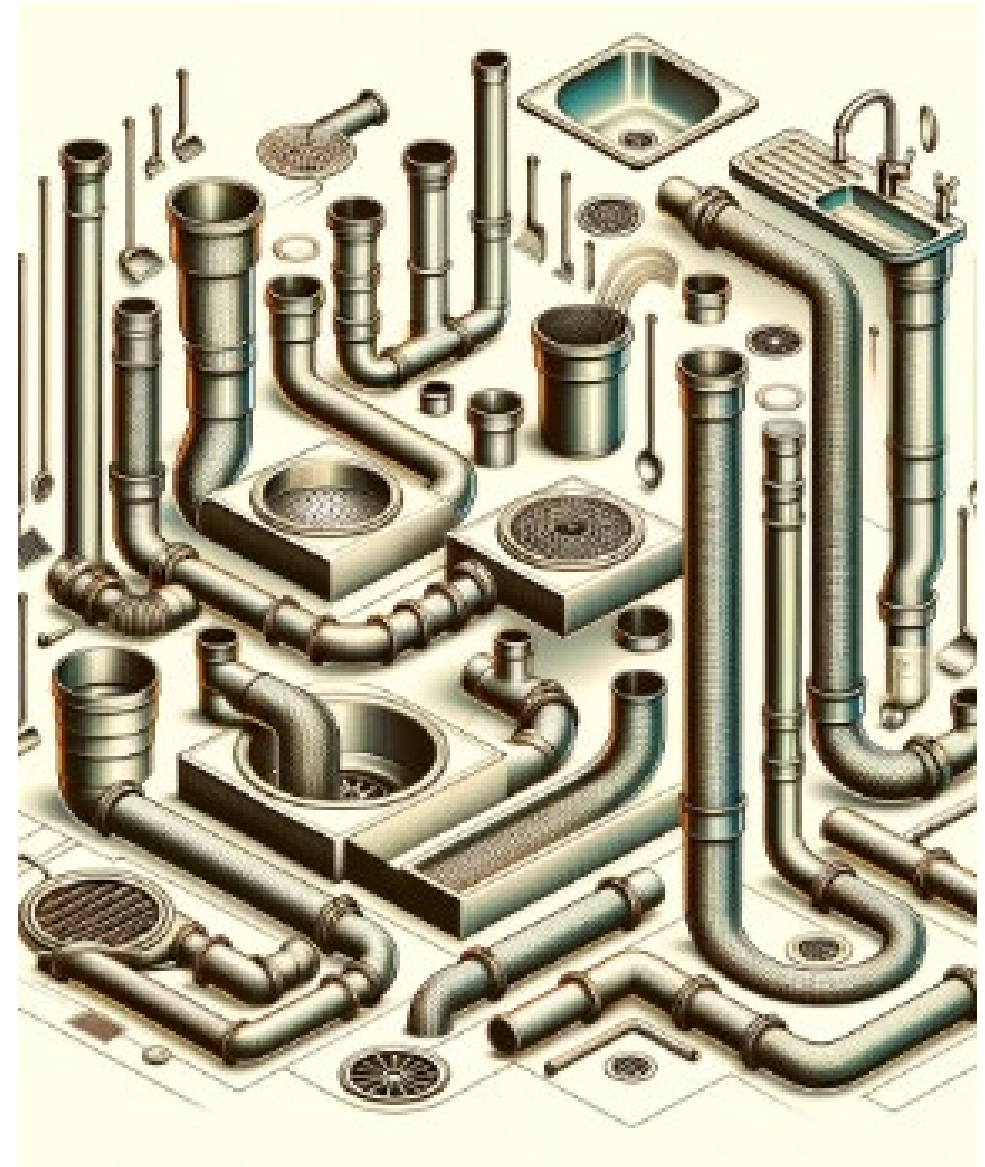
- » Pipes that remove wastewater and materials from sinks, toilets, and drains in the healthcare facility.

## » **Importance:**

- » Properly functioning drain lines are crucial for sanitation, preventing backflow and the spread of pathogens.

## » **Materials:**

- » Typically made from polyvinyl chloride (PVC) or cast iron due to their resistance to corrosion and ability to handle waste material.



# Flexible Water Supply Pipes

## » **Definition:**

- » Flexible water supply pipes are pliable pipes used to connect the water supply to fixtures and appliances, offering ease of installation in tight spaces and accommodating movements and vibrations.

## » **Importance:**

- » They provide a versatile and efficient solution for plumbing connections, reducing installation time, and are ideal for areas with limited space or where rigid piping is impractical.

## » **Materials:**

- » Made from various materials, including stainless steel (often braided over a core), PVC, and braided nylon, stainless steel is a popular choice for its durability and corrosion resistance.



# **Types of Pipe Material in Healthcare and Patient Safety Implications**

# Copper: Introduction

## » Why Copper?

- » **Natural Antimicrobial Properties:** Copper surfaces kill a wide range of pathogens, significantly reducing the microbial burden in water systems.

## » Key Advantages:

- » **Durability:** Resists corrosion and lasts for decades, providing a reliable infrastructure for healthcare facilities.
- » **Water Quality:** Maintains high water quality, with minimal risk of leaching harmful substances, ensuring safe water for patient care.

## » In Healthcare Settings:

- » **Applications:** Widely used for potable water lines, including hot and cold water systems, due to its health and safety benefits.
- » **Patient Safety:** The antimicrobial nature of copper directly contributes to reducing HAIs



# Copper: Patient Safety Implications

## » **Safety Profile:**

- » **Antimicrobial Efficacy:** Utilizes the oligodynamic effect to inhibit pathogen growth.
- » **Leaching Management:** Copper levels are assessed to prevent toxicity, with testing recommended, particularly if corrosion indicators are present.

## » **Usage Considerations:**

- » **Hospital Infrastructure:** Selected for critical areas requiring sterile conditions due to its germicidal capabilities.
- » **Cost & Health Benefits:** Copper piping offers durability and health advantages, which can outweigh the initial investment over time.

## » **Maintenance and Longevity:**

- » **Corrosion Management:** Water treatments prevent pipe degradation and ensure longevity.
- » **Proactive Monitoring:** Regular inspections for potential corrosion and leaching safeguard ongoing patient health.
- » **Ongoing Upkeep:** Consistent maintenance is vital to avoid bacterial contamination from compromised pipes.



# Stainless Steel: Introduction

## » Why Stainless Steel?

- » **Corrosion Resistance:** Highly resistant to corrosion, ensuring longevity and reliability of plumbing systems in healthcare environments.

## » Key Advantages:

- » **Hygienic Material:** Its non-porous surface makes it less conducive to bacterial growth and biofilm formation, which is crucial for maintaining sterile conditions.
- » **Durability:** Strong and durable, capable of withstanding the rigorous demands of healthcare facility operations.

## » In Healthcare Settings:

- » **Applications:** Ideal for areas requiring the highest level of hygiene, including water supply lines and critical care areas.
- » **Patient Safety:** Contributes to preventing HAIs by reducing potential sites for pathogen proliferation.



# Stainless Steel: Patient Safety Implications

## » **Safety Profile:**

- » **Non-Reactive Surface:** Minimizes bacterial growth and biofilm formation, offering a cleaner water supply.
- » **Chemical Stability:** Low risk of leaching harmful substances, maintaining water purity for patient care.

## » **Usage Considerations:**

- » **Hygiene-Critical Areas:** Ideal for high-risk environments due to its resistance to corrosion and ease of sterilization.
- » **Long-Term Investment:** Higher initial costs are balanced by durability and reduced need for replacement.

## » **Maintenance Practices:**

- » **Regular Inspection:** Necessary to spot early signs of pitting or crevice corrosion, especially in chlorinated environments.
- » **Preventive Measures:** Use of proper cleaning agents and techniques to maintain surface integrity and prevent damage.
- » **Professional Upkeep:** Ensuring that maintenance staff is trained in handling stainless steel systems to avoid inadvertent damage during repairs.



# PVC: Introduction

## » Why PVC?

- » **Chemical Resistance:** PVC pipes are highly resistant to various chemicals, making them suitable for various applications in healthcare facilities.

## » Key Advantages:

- » **Cost-Effective:** Offers a budget-friendly solution for plumbing needs without compromising quality and reliability.
- » **Low Maintenance:** PVC is durable, with a long lifespan and minimal maintenance requirements, reducing long-term costs.

## » In Healthcare Settings:

- » **Applications:** Commonly used for wastewater, vent lines, and non-potable water systems due to its durability and resistance to corrosion.
- » **Safety Considerations:** Non-toxic and safe for transporting water when used within its operational parameters.



# PVC: Patient Safety Implications

## » Safety Profile:

- **Chemical Resistance:** PVC is resistant to various chemicals, reducing the risk of pipe degradation and related infections.
- **Non-Toxic:** When used as intended, PVC does not leach toxic substances, supporting a safe environment for patient care.

## » Usage Considerations:

- **Non-Potable Systems:** Commonly used for waste and drainage where water is not consumed, minimizing direct patient exposure.
- **Cost-Effective Solution:** Provides a budget-friendly option for extensive healthcare facility plumbing needs.

## » Maintenance Practices:

- **Regular Monitoring:** Essential to check for material integrity, especially in systems exposed to fluctuating temperatures and UV light.
- **Careful Installation:** To prevent joint leaks, which can harbor bacteria and lead to potential infection risks.
- **Avoidance of Hot Water:** Ensuring PVC is not used in applications where hot water can cause the leaching and release of chemicals. Most standard PVC can handle temperatures up to 140 F.

# CPVC: Introduction

## » Why CPVC?

- » **Enhanced Chemical and Heat Resistance:** CPVC offers superior resistance to many chemicals and can handle higher temperatures (up to 200 F) than PVC, making it suitable for hot water lines.

## » Key Advantages:

- » **Safety:** CPVC does not corrode, rust, or scale, which reduces the risk of bacterial growth and contamination, crucial for patient safety.
- » **Durability:** With a higher thermal degradation and chemical exposure resistance, CPVC pipes have a long service life in healthcare environments.

## » In Healthcare Settings:

- » **Applications:** Ideal for hot and cold water distribution, including use in areas requiring sterile conditions due to its antimicrobial properties.
- » **Contributing to Infection Control:** The material's stability and resistance to biofilm formation support the broader infection prevention goals.



# CPVC: Patient Safety Implications

## » **Safety Profile:**

- » **Low Biofilm Adhesion:** Smooth interior surface reduces biofilm development, a key factor in preventing HAIs.
- » **Chemical Inertness:** CPVC does not react with most therapeutic and cleaning agents, ensuring water integrity.

## » **Usage Considerations:**

- » **Hot Water Applications:** Suitable for higher water temperatures, essential for certain healthcare facility operations.
- » **Chlorine Resistance:** CPVC can handle chlorinated water, making it suitable for disinfection practices.

## » **Maintenance Practices:**

- » **Thermal Stability:** Regular checks to ensure that CPVC is not exposed to temperatures beyond its threshold to prevent warping or damage.
- » **Joint Integrity:** Proper installation and periodic inspection of joints to prevent leaks that can lead to contamination.
- » **Degradation Monitoring:** CPVC is less prone to degradation but should still be monitored for any signs of brittleness or cracking over time.



# PEX: Introduction

## » Why PEX?

- » **Flexibility and Ease of Installation:** PEX's flexibility allows for easier installation and fewer connections, reducing potential leak points.

## » Key Advantages:

- » **Corrosion Resistance:** PEX does not corrode, unlike metal piping, reducing the risk of leaks and water contamination.
- » **Reduced Biofilm Formation:** The smooth interior of PEX pipes limits biofilm development, an essential factor in controlling waterborne pathogens.

## » In Healthcare Settings:

- » **Applications:** Suitable for hot and cold water distribution, including drinking water and radiant heating systems, thanks to its versatility and safety profile.
- » **Enhancing Infection Prevention:** PEX plays a role in maintaining water quality and reducing HAIs by minimizing the risk of leaks and biofilm.



# PEX: Patient Safety Implications

## » **Safety Profile:**

- » **Low Corrosion Risk:** PEX does not corrode, reducing the risk of contamination from corroded metals.
- » **Chemical Leaching:** Potential for leaching exists, but it is low; ensuring the material meets appropriate health standards is vital.

## » **Usage Considerations:**

- » **Flexibility in Installation:** It can be used in various healthcare facility layouts due to its flexibility.
- » **Temperature Resilience:** Suitable for hot and cold water applications, accommodating various healthcare needs.

## » **Maintenance Practices:**

- » **Inspection for Damage:** Although PEX is durable, it should be inspected regularly for mechanical damage or UV exposure degradation.
- » **Water Quality Monitoring:** Ongoing water testing for any signs of leaching or contamination is critical.
- » **Correct Installation:** Ensuring that PEX is not exposed to chemicals or conditions that could compromise its integrity, such as excessive chlorine levels or direct sunlight.



# Cast Iron: Introduction

## » Why Cast Iron?

- » **Durability and Strength:** Cast iron pipes are known for their durability, high crush strength, and long lifespan, making them suitable for major underground installations.

## » Key Advantages:

- » **Sound Dampening:** Excellent at reducing water and waste flow noise, contributing to a quieter healthcare environment.
- » **Corrosion Resistance:** While susceptible to corrosion over time, cast iron can be very durable with proper coatings and maintenance.

## » In Healthcare Settings:

- » **Applications:** Primarily used for drainage and venting systems, taking advantage of its durability and sound-dampening properties.
- » **Infection Control Considerations:** The rough interior surface can promote biofilm formation if not properly maintained, necessitating regular inspection and cleaning.





# Cast Iron: Patient Safety Implications

## » **Safety Profile:**

- » **Durability:** Cast iron is strong and can last decades when maintained properly.
- » **Risk of Corrosion:** Prone to corrosion and scaling, which can harbor bacteria and lead to water contamination.

## » **Usage Considerations:**

- » **High Crush Strength:** Suitable for underground installations with high durability.
- » **Sound Dampening:** Effective in reducing noise from wastewater, an often-overlooked aspect of patient comfort.

## » **Maintenance Practices:**

- » **Regular Inspection:** Necessary to check for corrosion, particularly on the inner surfaces where it can go unnoticed.
- » **Corrosion Control:** Use of linings or coatings and water treatment to protect against corrosion and prolong the lifespan of the pipes.
- » **Replacement Planning:** Due to the risk of corrosion over time, having a plan for eventual replacement is important to maintain safety standards.

# Galvanized Steel: Introduction

## » Why Galvanized Steel?

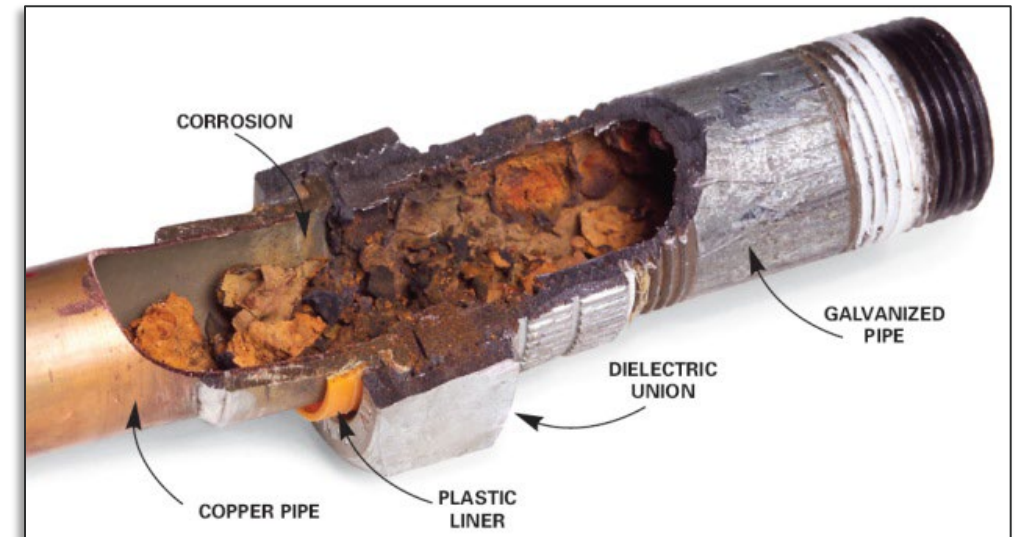
- » **Historical Use:** Galvanized steel was widely used for water supply pipes due to its durability and corrosion resistance provided by the zinc coating.

## » Key Advantages:

- » **Cost-Effective:** Initially chosen for being an economical option with a reasonable lifespan.
- » **Moderate Corrosion Resistance:** The zinc coating offered protection against rust and corrosion, extending the pipe's service life.

## » In Healthcare Settings:

- » **Legacy Systems:** While new installations in healthcare facilities are not recommended, galvanized steel pipes are still present in some older buildings.
- » **Infection Control Challenges:** Over time, the zinc coating can degrade, leading to corrosion inside the pipe, which can harbor bacteria and affect water quality.



# Galvanized Steel: Patient Safety Implications

## » **Safety Profile:**

- » **Zinc Coating:** Provides initial protection against corrosion, which is important in minimizing water contamination.
- » **Rust Over Time:** As the zinc erodes, rusting can occur, potentially releasing iron into the water and fostering bacterial growth.

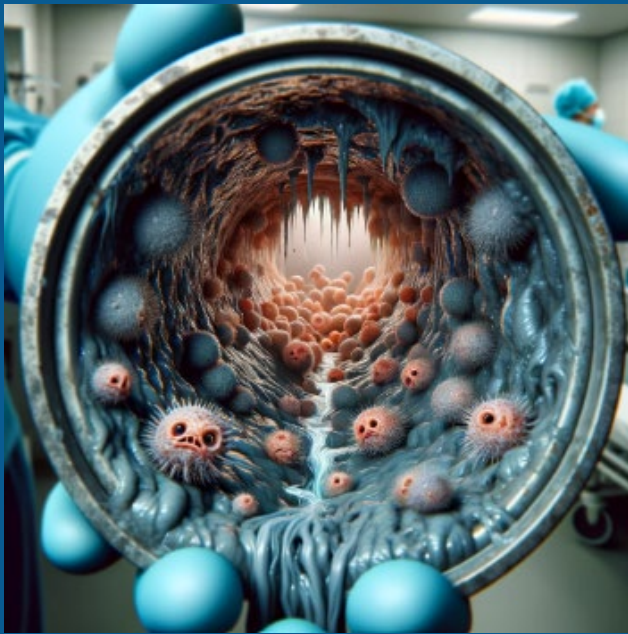
## » **Usage Considerations:**

- » **Not Ideal for Drinking Water:** Due to the potential for rust over time, galvanized steel is less commonly used for drinking water systems in healthcare settings.
- » **Historical Use:** Commonly found in older buildings, modern healthcare facilities may opt for alternative materials.

## » **Maintenance Practices:**

- » **Corrosion Monitoring:** Essential to routinely check for signs of zinc erosion and rust, especially at joints and welds.
- » **Water Testing:** Regular testing for iron and other heavy metals is crucial to ensure water quality is not compromised.
- » **Replacement Strategy:** Proactive planning for replacement with more inert materials can prevent future patient safety issues.

# Navigating the Hidden Danger: Biofilm in Drains and the Threat to Patient Safety



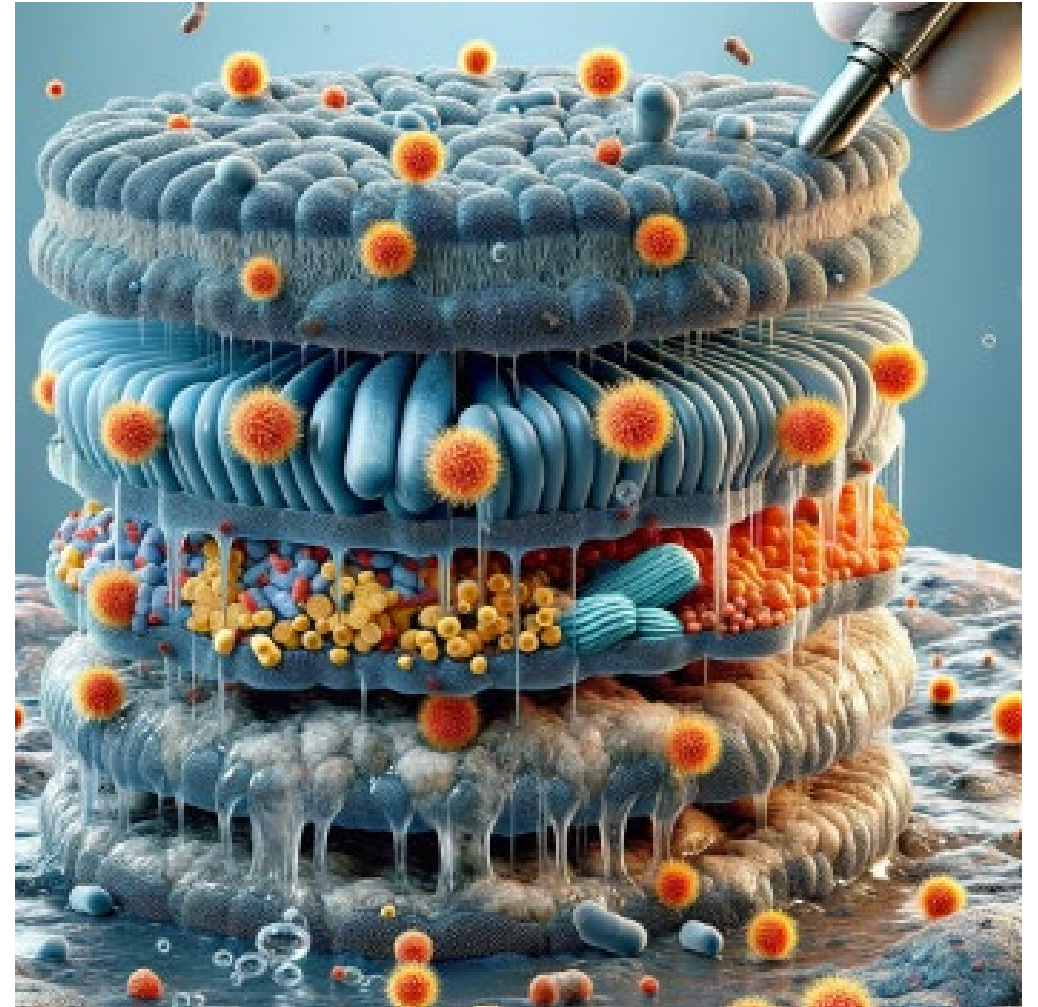
# Transitioning to Drain Hygiene: Addressing Biofilm in Healthcare Plumbing

- » **Sink Drains as Reservoirs:** Sink drains in patient care environments are increasingly acknowledged as potential reservoirs of multidrug-resistant healthcare-associated pathogens.
- » **Urgent Need for Understanding:** With increasing antimicrobial resistance limiting therapeutic options for patients, there is a pressing need for a better understanding of how pathogens disseminate from sink drains to hospitalized patients.
- » **Interventions:** Once the knowledge gap is addressed, interventions can be developed to reduce or eliminate transmission from hospital sink drains to patients.



# Biofilm: A Closer Look

- » **Biofilm Formation:** Layers of microbial cells, primarily bacteria, embedded within a self-produced matrix of extracellular polymeric substances (EPS) on surfaces.
- » **Complex Structure:** Biofilms contain a diverse microbial community encapsulated in EPS, which protects from environmental stresses and treatments.
- » **Healthcare Concern:** Biofilms on medical devices, water pipes, and hospital surfaces can harbor pathogens, contributing to HAIs
- » **Resistance Mechanism:** The EPS matrix shields bacteria from antibiotics and disinfectants, complicating infection treatment and eradication efforts.



# **What are Extracellular Polymeric Substances?**

# Extracellular Polymeric Substances (EPS): The Foundation of Biofilms

- » **EPS Composition:** A complex mixture of polysaccharides, proteins, nucleic acids (DNA and RNA), and lipids produced by microbial cells within a biofilm.
- » **Role in Biofilm Formation:** Acts as a glue that binds biofilm cells together and to surfaces, providing structural integrity and defining the biofilm's architecture.
- » **Protection Provided by EPS:** Offers a protective barrier against environmental stresses, including desiccation, antimicrobials, and the host immune response, enhancing microbial survival and resistance.
- » **Nutrient Retention and Recycling:** EPS matrix facilitates nutrient capture and retention, serving as a reservoir for the growth and survival of biofilm communities.
- » **Communication Network:** Facilitates cell-to-cell communication within the biofilm through signaling molecules essential for biofilm development and behavior.
- » **Implications for Healthcare:** EPS's protective functions contribute to the persistence of biofilms on medical devices and surfaces, complicating infection control and treatment of HAIs.

# Wet Biofilm

- » **Formation:** Thrives in moist environments, commonly found in pipes, sinks, toilets, and drains.
- » **Characteristics:** Sticky, slimy layer that strongly adheres to surfaces, protecting bacteria within a hydrated matrix.
- » **Risks:** Ideal for microbial growth, including bacteria, fungi, and protozoa, which can lead to HAIs through direct contact or aerosolization.
- » **Control Measures:** Regular flushing and mechanical cleaning can prevent biofilm accumulation, but targeted disinfectants may be required for mitigation.



# Dry Biofilm

- » **Formation:** Develops in less moist environments and can survive on dry surfaces like doorknobs, countertops, and medical equipment.
- » **Characteristics:** Less cohesive than wet biofilm but can protect microorganisms against desiccation and disinfection.
- » **Risks:** Can be a source of HAIs due to surface-to-hand-to-patient transmission.
- » **Control Measures:** Regular cleaning and disinfection protocols, with particular attention to high-touch surfaces.

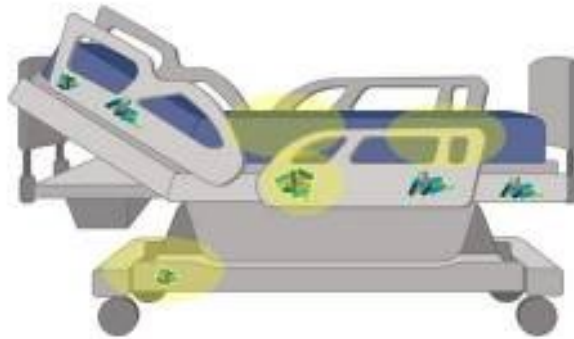




**Drain Biofilms**



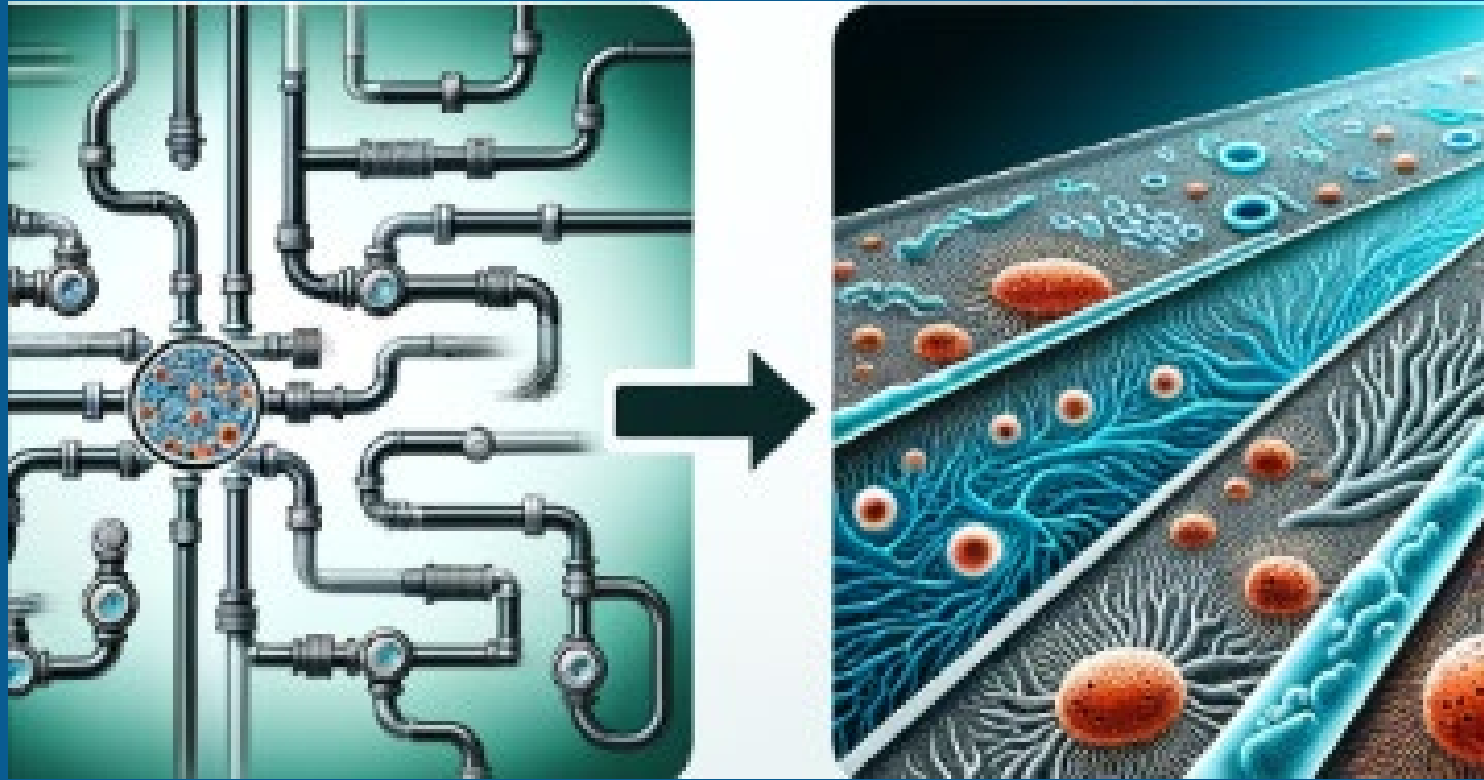
**Dry Surface Biofilms**



**Medical device biofilms**



Sourced from Maillard &  
Centeleghe, 2023



# From Pathways to Pathogens: Understanding Drains and the Biofilm Risk

# Critical Junctions: High-Risk Drains and Biofilm Challenges in Healthcare Facilities

- » **Sink Drains:** Especially in patient rooms, bathrooms, and near treatment areas are at high risk because they are frequently used, providing ample nutrients for biofilm formation. The proximity to patients and healthcare workers also increases the risk of splash-back, which can disseminate pathogens.
- » **Shower Drains:** Warm, moist environments are ideal for biofilm growth, and showering can cause significant splash-back, potentially aerosolizing pathogens.
- » **Floor Drains:** Found in operating rooms, isolation rooms, and utility areas, floor drains can accumulate biofilms due to standing water and can be a splash-back source during cleaning or spill management.
- » **Drains Near High-Touch Areas:** Drains located close to high-touch surfaces such as doorknobs, bedrails, and medical equipment can indirectly contribute to pathogen transmission if splash-back occurs and healthcare workers or patients subsequently touch these surfaces.
- » **Bathtub Drains:** Similar to shower drains, they are prone to biofilm because of the frequent exposure to soaps and organic materials, combined with the potential for splash-back during patient baths.

# Beneath the Surface: P-Traps, Biofilm, and the Hidden Risks in Healthcare Drains

- » **Stagnant Water:** P-traps are designed to hold a small amount of water to create a seal that prevents sewer gases from entering the building. This stagnant water can be a breeding ground for biofilm if not flushed regularly.
- » **Organic Material:** They often collect debris and organic material that can serve as a nutrient source for bacteria, facilitating biofilm growth.
- » **Aerosolization During Use:** When fixtures are used, water disturbance in the P-trap can lead to aerosolization of the water, potentially spreading pathogens within biofilms if they have formed.
- » **Difficult to Clean:** Because of their location and the nature of their design, P-traps can be more challenging to clean effectively compared to other parts of the drain system.

# The Invisible Threat: Biofilm in P-Traps and Patient Room Risks

- » **Harboring Pathogens:** Biofilms in P-traps can harbor dangerous pathogens resistant to common disinfectants, increasing the risk of HAIs.
- » **Aerosolization Risk:** High-pressure usage can dislodge biofilm, causing aerosolization and potential inhalation or surface contamination and exposing patients to infection.
- » **Difficult Detection:** Biofilms can develop deep within P-traps, often going undetected during routine cleaning, persisting as a hidden reservoir for infection.





# Biofilm Producers

- » **Legionella:** Waterborne gram-negative bacteria responsible for 98% of biofilm-associated outbreaks.
- » **Pseudomonas aeruginosa:** Common gram-negative bacterium known for robust biofilm formation in hospital settings due to EPS production.
- » **Staphylococcus aureus (including MRSA):** Gram-positive bacterium capable of forming biofilms on medical devices and tissues, facilitated by EPS production.
- » **Escherichia coli:** Gram-negative bacterium forming biofilms in various environments, including the human gut, with EPS involvement.
- » **Klebsiella pneumoniae:** Gram-negative bacterium with EPS production, leading to biofilm formation on surfaces and tissues.
- » **Acinetobacter baumannii:** Gram-negative bacterium surviving in hospital settings via biofilm formation, aided by EPS.
- » **Nontuberculous Mycobacteria (NTM):** Environmental bacteria associated with waterborne outbreaks, capable of biofilm formation in plumbing systems.

# Combating Biofilm in Patient Room Drains: Strategies for Prevention and Treatment

- » **Routine Drain Maintenance:** Periodically clear out drains using hot water to remove biofilm and hinder its accumulation. Be mindful of potential splashing during this process.
- » **Mechanical Cleaning:** Brushes or other mechanical tools scrub inside the drain, physically removing biofilm build-up.
- » **Chemical Disinfectants:** Apply EPA-registered chemical disinfectants or biofilm-disruptive solutions according to manufacturer instructions, ensuring they are suitable for use in healthcare settings.
- » **Enzymatic Cleaners:** Consider using enzymatic cleaners that can break down the organic components of biofilms, making them easier to remove.
- » **Dry and Clean Surrounding Areas:** Keep the area around drains dry and clean to reduce the nutrients available for biofilm growth.
- » **Preventive Maintenance:** Schedule regular maintenance checks to ensure drains function properly and address any issues that could promote biofilm formation.

# Measures to Reduce the Risk

- » Clean and disinfect surfaces near the drains daily, including the sink basin, faucet, handles, and surrounding countertop at least daily.
- » Keep personal and patient care items away from counters near sinks. Ensure handwashing stations are conveniently accessible for staff preparing patient medications, but position sinks away from medication preparation zones or install barriers to block splashes into these areas.
- » Avoid positioning faucets to release water directly over the drain to reduce splashing—either divert the water flow from the drain or place the faucet off-center. For new sink installations, opt for designs that minimize the risk of water splashing.
- » Use sinks in patient care areas with adequate depth and the maximum water flow as regulated to prevent splashing
- » Fit hoppers and toilets with covers and ensure they are shut before flushing. In situations where covers are not permitted or available due to local regulations or codes, make sure to close the door separating the toilet or hopper from other areas of patient care before flushing to prevent environmental contamination.
- » Do not discard patient waste down sinks and minimize discarding liquid nutritional supplements or other beverages down sinks or toilets.

# **SHEA/IDSA/APIC Practice Recommendations: Strategies to Prevent HAIs Through Hand Hygiene: 2022 Update**

## **» Steps to Reduce Environmental Contamination Associated with Sinks and Sinks Drains**

- » Do not keep medications or patient care supplies on countertops or mobile surfaces that are within 1m (3 feet) of sinks.
- » Educate HCP to refrain from disposing substances that promote growth of biofilms (eg, intravenous solutions, medications, food, or human waste) in handwashing sinks.
- » If possible, dedicate sinks to handwashing.
- » Include handwashing sinks in water infection control risk assessments for healthcare settings.
- » Ensure that handwashing sinks are constructed according to local administrative codes.
- » Provide disposable or single-use towels to dry hands. Do not use hot air dryers in patient care areas.
- » Consult with state or local public health officials when investigating confirmed or suspected outbreaks of healthcare-associated infections due to waterborne pathogens of plumbing in the facility.



**Applying Knowledge  
to Action!**

# Action Plan for Infection Preventionists: Implementing Plumbing 201 Insights

- » **Conduct Regular Assessments:** To improve infection prevention in plumbing systems, consider conducting regular assessments and environmental testing for biofilm-producing pathogens.
- » **Collaborate with Facilities Management:** Work closely with facilities and engineering teams to ensure plumbing materials and designs adhere to infection prevention best practices.
- » **Implement Biofilm Control Protocols:** Establish routines for regularly treating drains and P-traps with foam-based cleaners or other effective biofilm-removing agents.
- » **Supplemental disinfection:** Implement supplemental disinfection to mitigate the risk of pathogens in potable water pipes, which can contribute to biofilm formation and contamination in drains.
- » **Focus on High-Risk Drain Maintenance:** Prioritize cleaning and monitoring high-risk drains in patient care areas to prevent biofilm-related HAIs.
- » **Educate Healthcare Staff:** Train staff on the importance of proper disposal, sink use, and the risks associated with biofilm and splashing in patient care areas.



# Action Plan for Infection Preventionists: Implementing Plumbing 201 Insights, Cont.

- » **Advocate for Safe Plumbing Practices:** Promote splash guards, appropriate sink placement, and installing devices that reduce aerosolization from drains.
- » **Monitor and Respond to Water Quality Issues:** Stay vigilant about water quality, including temperature and pH, to prevent conditions that favor pathogen growth.
- » **Stay Informed on New Technologies:** Keep abreast of advancements in plumbing materials and biofilm treatment methods to enhance infection control measures continually.
- » **Develop Comprehensive Plumbing Policies:** Create or update existing policies to include specific plumbing system maintenance and infection prevention protocols.
- » **Foster a Culture of Infection Prevention:** Encourage a hospital-wide commitment to maintaining plumbing hygiene as a critical component of overall patient safety.

# Summary

- » **Material Matters:** Understanding the impact of plumbing materials on water quality and pathogen proliferation highlights the importance of selecting materials that minimize infection risks.
- » **Design with Care:** The design and placement of plumbing fixtures, especially sinks and drains, require careful consideration to prevent splashing and reduce biofilm formation.
- » **Biofilm Vigilance:** Regularly treating biofilm in drains is crucial, with foam-based cleaners offering effective coverage and penetration to disrupt and remove biofilms.
- » **High-Risk Areas:** Identifying and monitoring high-risk drains, including sink, shower, and floor drains, for biofilm and pathogen presence helps target infection prevention efforts.
- » **Effective Maintenance:** Implementing a comprehensive maintenance regimen, including mechanical cleaning and chemical disinfectants, is essential for preventing HAIs.
- » **Collaborative Approach:** Infection prevention requires collaboration between infection preventionists, facilities management, and environmental services to develop and adhere to best practices.
- » **Continuous Education:** Ongoing education and training for all healthcare facility staff on the importance of plumbing hygiene play a vital role in infection control.

Questions?

# References

- » Centers for Disease Control and Prevention. (n.d.). Reduce risk from water. [Reduce Risk from Water | HAI | CDC](#)
- » Douterelo, I., Husband, S., Loza, V., & Boxall, J. (2016). Dynamics of Biofilm Regrowth in Drinking Water Distribution Systems. *Applied and environmental microbiology*, 82(14), 4155–4168. <https://doi.org/10.1128/AEM.00109-16>
- » Glowicz, J. B., Landon, E., Sickbert-Bennett, E. E., Aiello, A. E., deKay, K., Hoffmann, K. K., Maragakis, L., Olmsted, R. N., Polgreen, P. M., Trexler, P. A., VanAmringe, M. A., Wood, A. R., Yokoe, D., & Ellingson, K. D. (2023). SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. *Infection control and hospital epidemiology*, 44(3), 355–376. <https://doi.org/10.1017/ice.2022.304>
- » Maillard, J. Y., & Centeleghe, I. (2023). How biofilm changes our understanding of cleaning and disinfection. *Antimicrobial resistance and infection control*, 12(1), 95. <https://doi.org/10.1186/s13756-023-01290-4>

# References

- » Mendhe, S., Badge, A., Ugemuge, S., & Chandi, D. (2023). Impact of Biofilms on Chronic Infections and Medical Challenges. *Cureus*, 15(11), e48204. <https://doi.org/10.7759/cureus.48204>
- » Williams, M. M., Armbruster, C. R., & Arduino, M. J. (2013). Plumbing of hospital premises is a reservoir for opportunistically pathogenic microorganisms: a review. *Biofouling*, 29(2), 147–162. <https://doi.org/10.1080/08927014.2012.757308>