

Infection Prevention and the Health Care Built Environment: Why Every Aspect Matters

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Objectives

- Justify** Justify design features that contribute to prevention of diseases transmitted through air, water or through surface contact
- Identify** Identify at least one pathogen for which the physical environment can play a significant role in preventing transmission
- Build** Build key practices during construction that can prevent the spread of infection.



We must accept human error as inevitable – and design around that fact.

Why is this important?

Healthcare Associated Infections (HAIs): The Unknown Killer

HAIs affect millions of people and add billions of dollars to healthcare costs in the U.S. annually. HAIs are an unintended consequence of care delivered in healthcare organizations. Scientific evidence suggests that most HAIs are preventable.

<https://www.healthcarefacilitytoday.com/posts/infographic-controlling-hais-22973>

The Physical Environment

Create a safe environment. Protecting patients from harm involves more than safe treatments and procedures. We must also consider where patients receive care, and minimize risks associated with the physical environment.

The Physical Environment

- Utility Systems - EC.02.05.01 +
- Means of Egress - LS.02.01.20 +
- Built Environment - EC.02.06.01 +
- Fire Protection - EC.02.03.05 +
- General Requirements - LS.02.01.10 +
- Protection - LS.02.01.30 +
- Automated Suppression - LS.02.01.35 +
- Life Safety Code

Joint Commission Top Findings Related to the Physical Environment

- NPSG.15.01.01, EP 1 (requires the suicide risk assessment of the physical environment)
- IC.02.01.01, EP 1 (a very basic requirement to implement your infection prevention practices)
- EC.02.05.01, EP 15 (deals with air pressure relationships in critical spaces such as operating rooms, sterile compounding, or central sterile supply areas)
- EC.02.06.01, EP 1 (another "catch all" EP where just about any defect in the environment from torn furniture to suicide hazards have been scored)
- EC.02.03.01, EP 5 (requires the organization to minimize risks associated with hazardous chemicals)
- IC.02.02.01, EP 4 (establishes infection prevention requirements for safe storage of medical equipment, devices, and supplies)

Impact of Healthcare Construction

- Optimal patient outcomes
- Enhanced work environment for healthcare providers
- Improved organizational performance

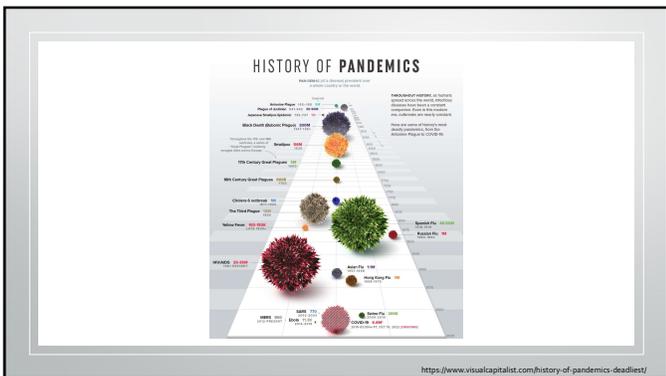


Just in time? Or just in case?

- Hospital Resilience
 - External Resiliency
 - Hurricanes, Tornadoes, Flooding, Earthquakes
 - Internal Resiliency
 - Massive influx of patients
 - Future Technology
 - Location (ability to grow)
 - Mobile/Modular solutions
 - Flexible spaces
- Value engineering



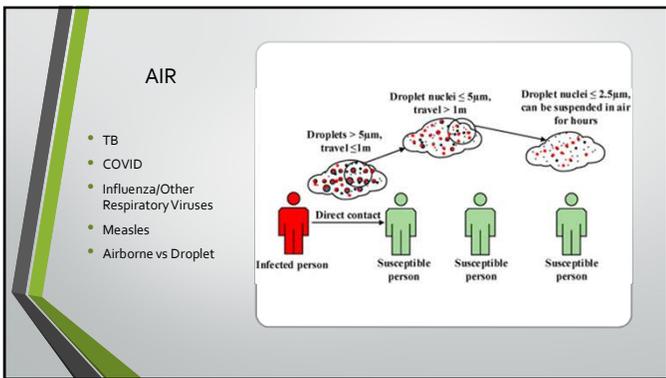
It takes less time to do a thing right, than it does to explain why you did it wrong.
- Henry Ford















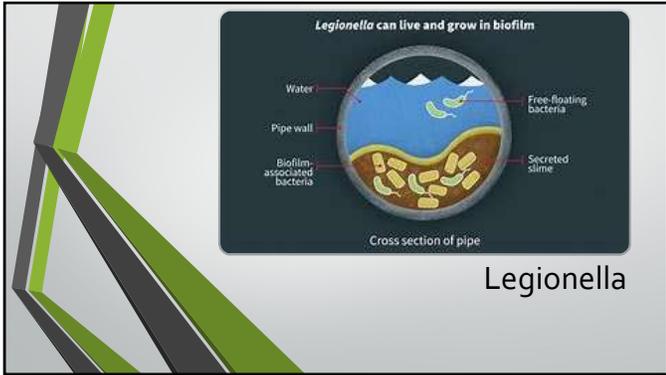
Everyone please stand up.

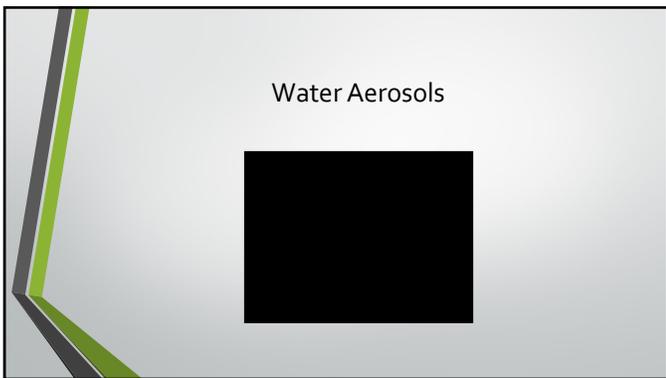


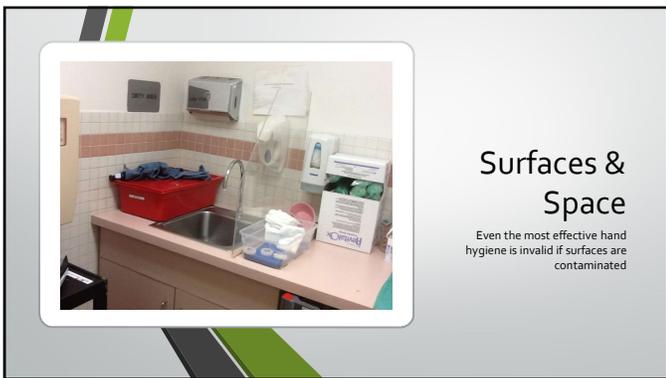
WATER

- Legionella
- Pseudomonas
- Acinetobacter
- NTM (dental clinics, heater/cooler)
- Pneumonia
- Wound Infections
- Polio
- Diarrheal illness

Water
Pipes and
Buildings
Waterworks
Census section of water







Hands Can Pick Up Pathogens From Everywhere

X = positive *Enterococcus* culture



Abstract: The Risk of Hand and Glove Contamination after Contact with a VRE (+) Patient Environment.
Hayden M. ICAAC, 2001, Chicago, IL.

Survival of Pathogens on Environmental Surfaces

Pathogen	Presence on Surfaces
C. Difficile	> 5 months
Staphylococci	7 months
VRE	4 months
Acinetobacter	5 months
Norovirus	3 weeks
Adenovirus	3 months
Rotavirus	3 months
MRSA	3 months
SARS, HIV	Days to week



Prevention by Design

Design elements to prevent infection





Air

Patient Protection

- Air quality
- Room pressurization
- Humidity control

Occupant Comfort

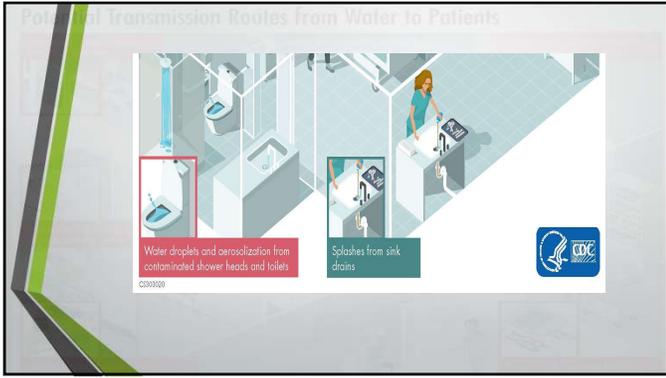
- Temperature & humidity control

Air Quality

Air Exchanges

To keep air in spaces fresh, and flush out airborne contaminants, minimum volumes of air exchange rates (measured in air changes per hour – ACH) and proportion of fresh outside air are required

In certain critical environments like OR's and Procedure Rooms, filtered airflow is designed to drive away contaminants from high risk areas, creating a sterile field of laminar air.







Surfaces & Space

- Material selection
 - Light fixtures
 - Copper
- Location – storage
 - PPE
 - Electrical Outlets
- Adequate spatial separation
- Separation of clean/ dirty
 - Soiled Utility/Decontamination
 - Reprocessing
- Workflow



Design Impacts RISK



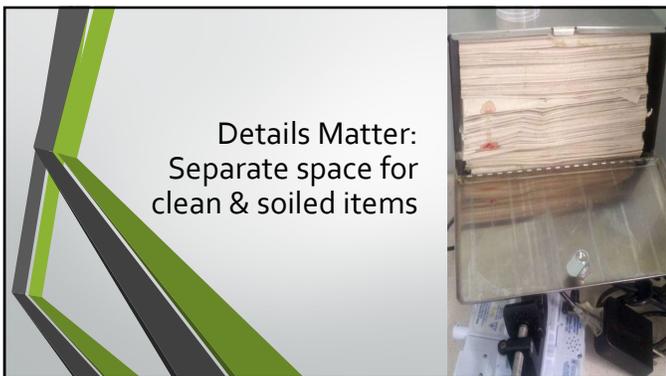
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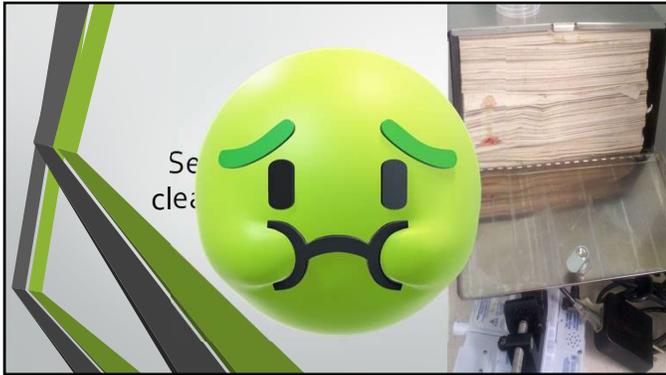


Label or separate for each patient





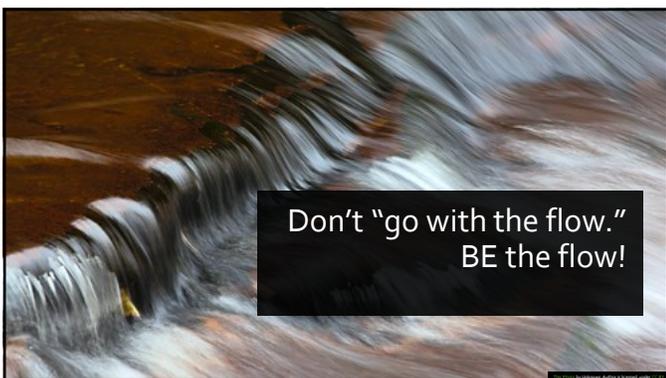




Anticipate the Future

- Providing support for new practices:
- Space for stocking product/Outlets
- Equipment that will be needed in future
- Connectivity for future devices

Teleoperated robot-assisted surgical system for minimally invasive procedures. © MIT, Intuitive Surgical, Inc.



Health Care Flows

- Flow of Staff
- Flow of Patients
- Flow of Families/Care Partners
- Flow of Information
- Flow of Medications
- Flow of Supplies
- Flow of Equipment
- Flow of Waste

• Designing for hospital efficiency | HFMA Health Facilities Management (hfma.org)
• Using evidence-based strategies to design safe, efficient, and adaptable patient rooms - HCQ Magazine (healthcaredesignmagazine.com)



Plan For Usability

Vs



Plan for Usability – Remember the Details





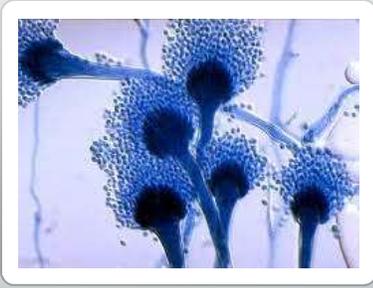






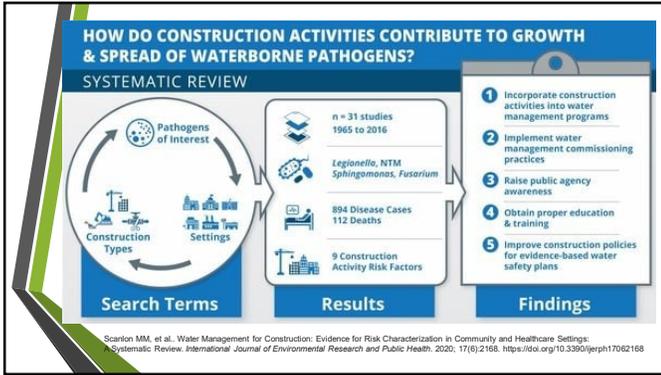
Aspergillus

- Fungus that is in dust and the environment
- 40% mortality rate for invasive cases
- Implicated in pneumonia and wound infections related to construction
- **Biggest risk of construction!**



ICRA 2.0

	TYPE A INSPECTION & Non-invasive activities	TYPE B Small-scale, short duration Minimal dust and debris	TYPE C Large-scale, longer duration Moderate dust and debris	TYPE D Major demolition & construction
LOW Risk Group Non-patient care areas	I	II	II	III
MEDIUM Risk Group Patient support areas	I	II	III	IV
HIGH Risk Group Patient care areas	I	III	IV	V
HIGHEST Risk Group Procedural, invasive, sterile support and highly compromised patient care	III	IV	V	V



Barriers

- Not all barriers are created equal!
- Unless the project is VERY short in duration, plastic zip walls are hard to maintain
- Human Behavior is hard to overcome – zipping up and down each time seldom happens

Vs

The left image shows a hallway with a plastic zip wall barrier. The right image shows a hallway with a physical door barrier.

Human Behavior Can = Danger

The left image shows a person climbing a ladder next to a large cart in a hallway. The right image is a close-up of a chair seat.

The names of the patients whose lives we save can never be known. Our contribution will be what did *not* happen to them. And, though they are unknown, we will know that mothers and fathers are at graduations and weddings they would have missed, and that grandchildren will know grandparents they might never have known, and holidays will be taken, and work completed, and books read, and symphonies heard, and gardens tended that, without our work, would never have been.

- Dr. Donald Berwick

Questions?

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