

**Strategies for Mitigating Risks in the Environment of Care:
A Look Into the Future**

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Disclosures


Dr. Garrett:

- Consultant: Clorox

Dr. Carrico:

- Honorarium: Nanosonics


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Objectives

- Identify core and adjunctive approaches and technologies that serve to address risks associated with the clinical environment of care
- Describe strategies to foster a interprofessional approach to integrating an environment of care program into the infection control program
- Explore the impact of emerging pathogens, the changing healthcare environment, and healthcare interventions of the future and their impact across the healthcare continuum of care

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MUCH OPPORTUNITY!!!!

- Many HAIs are preventable with current recommendations
- Failure to use proven interventions is unacceptable
- Only 30%-38% of U.S. hospitals are in full compliance
- Just 40% of healthcare personnel adhere to hand hygiene
- Less understood role of the healthcare environment in transmission

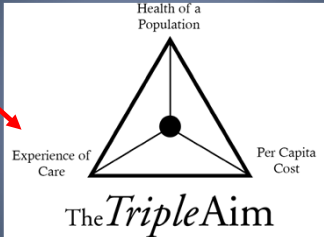
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The Future of Healthcare

Clinical Environment of Care



Health of a Population


Experience of Care

Per Capita Cost

The Triple Aim

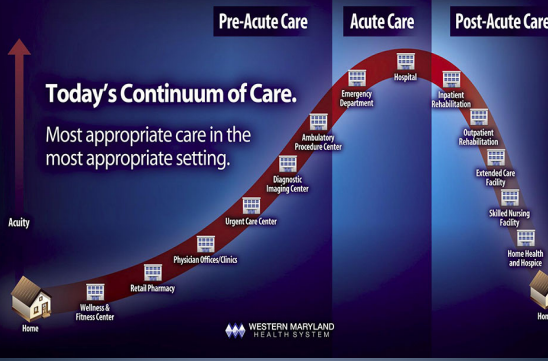
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Today's Continuum of Care.

Most appropriate care in the most appropriate setting.



Acuity


Home

Home

WESTERN MARYLAND HEALTH SYSTEM

Source: Image Courtesy of Western Maryland Health System


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What is the Perception of the Patients about the Environment?

- Are all Infections preventable?
- Is my environment clean?
- What should I do to prevent infection?
- What is responsible for keeping my environment clean during my stay?

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These are Changing Times



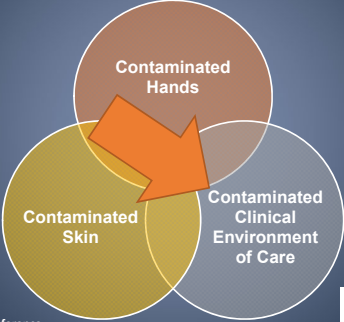
The Death of the Healthcare "Housekeeper"
Published on November 3, 2016

Reference: <https://www.linkedin.com/pulse/death-healthcare-housekeeper-garrett-jr-phd-mos-mp-h-fnp-va-bc>


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How Does Transmission Occur?



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Fundamental Question

5-10 Years Ago Today

What role does the Environment play in transmission of HAIs?

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We'll Look at Recent News

A B



Source: Centers for Disease Control and Prevention

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What do these have in common?

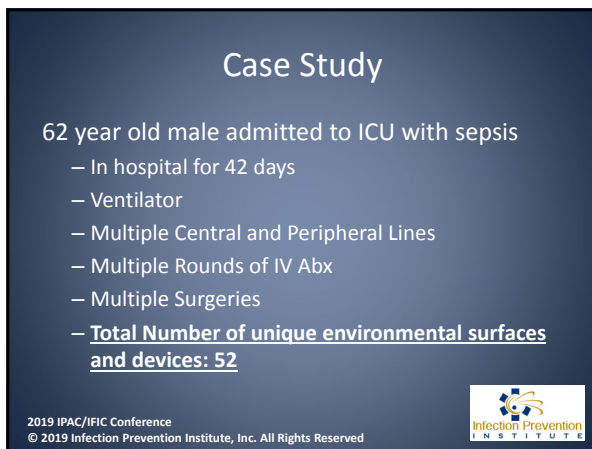


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Interdisciplinary Care Team

- RNs: 63
- MD/DOs: 21
- PA/NPs: 13
- PharmDs: 6
- CNAs: 16
- **EVS: 5**
- Total: 124 Personnel Interacting with Pt

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Transmission of Infection Role of the Environment




Clinical Staff

Environmental Services

Patient's Family

Engineering/Architects/
Interior Designers

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Survivability in the Environment


Environmental Contamination

Environmental survival of key pathogens on hospital surfaces

Pathogen	Survival Time
S. aureus (including MRSA)	7 days to >12 months
Enterococcus spp. (including VRE)	5 days to >46 months
Acinetobacter spp.	3 days to 11 months
Clostridium difficile (spores)	>5 months
Norovirus (and feline calicivirus)	8 hours to >2 weeks
Pseudomonas aeruginosa	6 hours to 16 months
Klebsiella spp.	2 hours to >30 months

Source: <https://image.slidesharecdn.com/newtechnologiesinenvironmentalcleaning-160330051223/95/new-technologies-in-environmental-cleaning-7-638.jpg?cb=1459114857>

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13,000 People Exposed, & Already Dead Due to Big Pharma Shots Contaminated with Rare Fungal Meningitis

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The Inanimate Environment Can Facilitate Transmission

X represents VRE culture positive sites

~ Contaminated surfaces increase cross-transmission ~

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

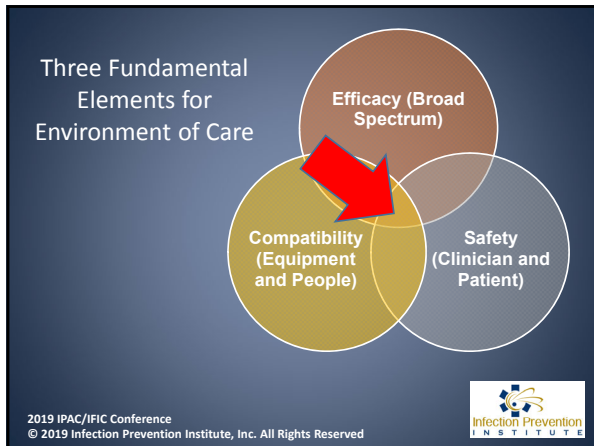
Infection Control Imperatives

Proactive Approach Reactive Approach

Prevent the Microorganism Prevent the Contamination Prevent the Transmission Recognize the Infection

Environmental Interventions

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Learn From The Past
Prepare for the Future

Prevention of Transmission

Prevention of the Pathogen

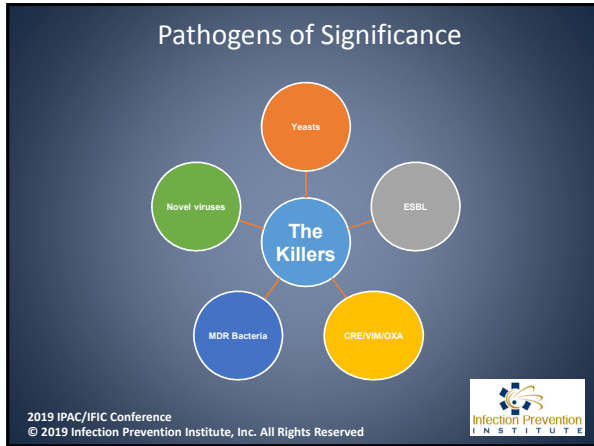
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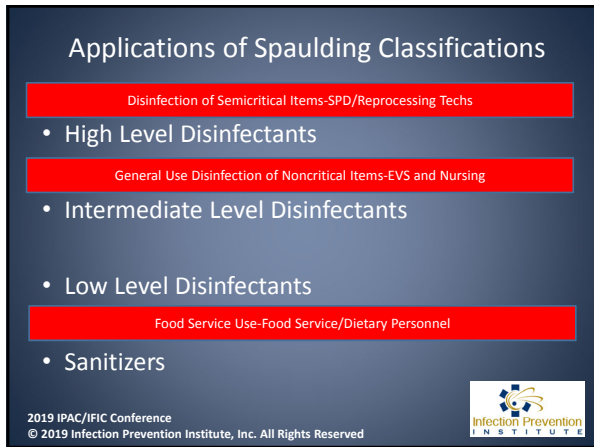
Infected

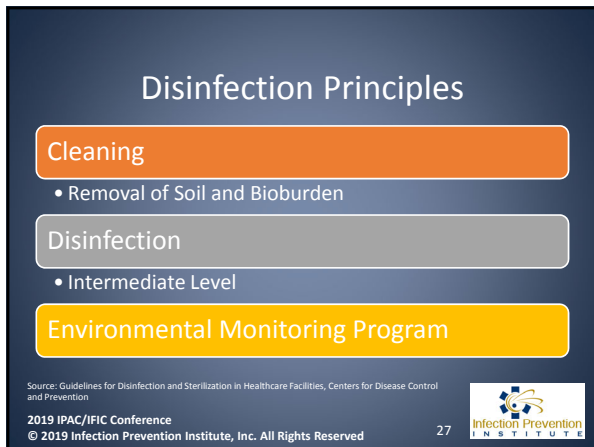
Colonized

Where is the biggest environmental risk?
Patients?
Environmental Surfaces?
Medical Devices?
HCPs?

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Critical Claims for Healthcare Disinfection

- Broad Spectrum for bacteria
- Viruses (non-enveloped and enveloped)
- Multi-Drug Resistant Organisms (Drug Resistant Strains)
- Pathogenic Fungi (Candida)
- Bloodborne Pathogens (HIV, HBV, HCV)
- Emergent and Emerging Pathogens (Novel viruses, new MDROs)

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Approach to Emergent Pathogens: High Consequence Organisms

Source: Hierarchy of Pathogens for Disinfection White Paper, Environmental Protection Agency.


Figure 1. Microbiological disinfection hierarchy. Examples of microorganisms in each category are provided.

Microbiological Hierarchy*

- **Spore formers:** Bacterial spores: *Bacillus subtilis*, *Clostridium sporogenes*
- **Mycobacteria:** *M. tuberculosis*, *M. bovis*, *M. fortis*
- **Small non-enveloped viruses:** Picornaviruses, noroviruses, feline caliciviruses, rhinovirus
- **Fungi:** *Trichophyton* spp., *Cryptosporidium* spp., *Candida* spp.
- **Vegetative bacteria:**
 - Gram-negative bacteria: *Pseudomonas* spp., *Escherichia coli*, *Enterobacter* spp.
 - Gram-positive bacteria: *Staphylococcus*, *Streptococcus*, *Enterococcus*
- **Enveloped viruses:** HIV, HSV, influenza, Hantavirus, Ebola virus

*Adapted from McVannell & Burke (2011) and LIDHSC/CCOAH (2008)

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CDC Core Elements of Hospital Antibiotic Stewardship Programs

- Leadership Commitment
- Accountability
- Drug Expertise
- Action
- Tracking
- Reporting
- Education

What about Environment of Care Expertise for Antimicrobials?

Source: Core Elements of Antimicrobial Stewardship, Centers for Disease Control and Prevention

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Moving Testimony to Importance of HAI Prevention:
HHS Partnering to Heal



Partnering to Heal Instructions for Use
Skip the Introduction
View the Credits
Get Adobe Reader

Teaming-Up Against Health Care-Associated Infections

START Click here to begin the training

U.S. Department of Health and Human Services
A Virtual Experience Immersed Learning Simulation (VELS®)
U.S. Patent No. 5,813,863 All Rights Reserved

Source: Partnering to Heal, Department of Health and Human Services

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Antibiotic Stewardship



Know When Antibiotics Work


“Antimicrobial Stewardship”



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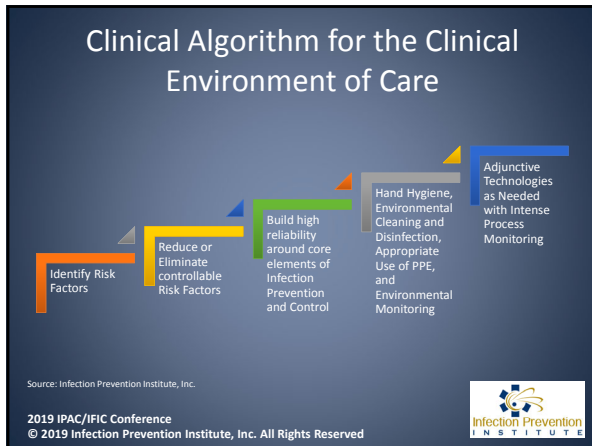
Core vs. Adjunctive Technologies

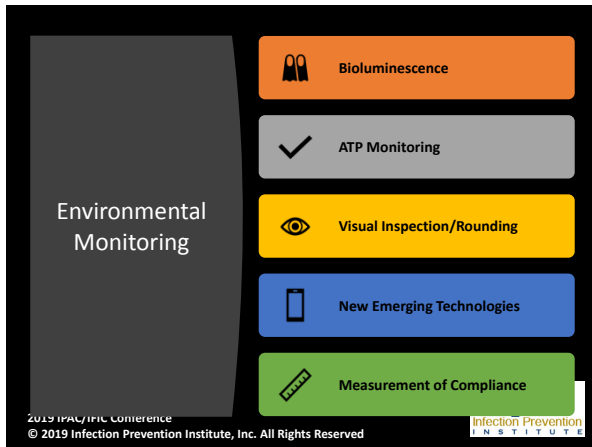
Core Measures		Adjunctive Technologies
<ul style="list-style-type: none">• Cleaning• Disinfection• Process Monitoring• Process Validation• Training and Retraining		<ul style="list-style-type: none">• UV• Gas/Fogging/Electrostatic• Novel Technologies• Antimicrobial Environmental Surfaces• Self-disinfecting Surfaces• Environmental Monitoring

Source: Infection Prevention Institute, Inc.

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New Medscape Training Resources

CME from CDC: What You Need to Know About Infection Control

Each year in the United States, at least 2 million people become infected with bacteria resistant to antibiotics and at least 23,000 people die as a direct result of these infections. It's critical that all healthcare workers understand proper infection control procedures and use them every day.

The Centers for Disease Control and Prevention and Medscape are launching a series of six CME/CE activities addressing the key issues surrounding infection prevention in healthcare facilities.

The series includes:

1. **Risk Recognition in Healthcare Settings (Available Now)**
2. **May: Environmental Services and Infection Prevention**
3. **June: Recognizing Infection Risks in Medical Equipment**
4. **July: Infection Transmission Risks Associated with Nonsterile Glove Use**
5. **August: Infection Prevention: A Hierarchy of Controls Approach**
6. **September: Injection Safety: A System Approach**

These CME/CE-certified activities are available at: <http://www.medscape.org/viewcollection/340447>
<http://www.medscape.org/viewcollection/340447>. You must be a registered Medscape member to access these CME/CE activities, and registration is free. The first activity, Risk Recognition in Healthcare Settings is available now. A new activity will be added each month.

To access the programs, visit: <http://www.infectionprevention.org/2019ipac/ific-conference>

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What are the environmental threats of the future?

Are we ready to respond?


Back to the Basics Approach

CDC Core Elements of Infection Control for Healthcare Providers


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"The patient in the next bed is highly infectious. Thank God for these curtains."

Summary

- Collaborate and Communicate with all stakeholders about “**antimicrobial stewardship**” relative to the clinical environment of care
- Reduce the risk for the clinical environment of care to serve as a **vector** for transmission across the continuum of care
- Integrate **EVS** into the **clinical care** team
- Focus on **basic core** infection control practices before deploying adjunctive technologies
- **Training** is critical and emphasize **back to the basics**

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References

Centers for Disease Control and Prevention. (2007). Guidelines for isolation precautions: Preventing transmission of infectious agents in healthcare settings 2007. Retrieved January 5, 2010 from <http://www.cdc.gov/dhqp/pdf/isopn/2007.pdf>

Centers for Disease Control and Prevention. (2006). Guidelines for Control of Multidrug-Resistant Organisms in Healthcare Settings. Retrieved January 5, 2010 from <http://www.cdc.gov/dhqp/pdf/gy/microGuideline2006.pdf>

CDC Guidelines for environmental infection control in healthcare facilities. MMWR 2003;52(RR 10):1-42. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm>


Centers for Disease Control and Prevention. (September, 2004). *Overview of Drug-resistant Acinetobacter Infections in Healthcare Settings*. Retrieved January 5, 2010 from <http://www.cdc.gov/dhqp/pdf/rr/acinetobacter.html>

Dijkshoorn, L., Nemeec, & Seifert, H. (2007). An increasing threat in hospitals: Multidrug-resistant Acinetobacter baumannii. *Nature Reviews Microbiology* 5, 939-951


5 Million Lives Campaign (2008). Getting Started Kit: Sustainability and spread. Cambridge, MA: Institute for Healthcare Improvement. Available at <http://www.ihc.org>

Association for the Healthcare Environment Practice Guidance for Environmental Cleaning (2013).


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Antimicrobial Stewardship: The Clinical Environment of Care




Physician, Nurse Practitioner, Physician Assistants: responsible for selecting right drug (pathogen specific), right duration, right route, right dose, for the right human patient



Environmental Services: responsible for selecting the right germicide (pathogen specific), right duration (contact/dwell time), right route (application methods), right dose (dilution), right patient environment


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Clinical Environment of Care

- Living environment
- Multiple components acting in concert and interdependent
- Each has specific and unique components but with a distinct relationship to other components
- Difficult to study, improve, or "take up the slack" for other components if there is failure or inadequacy
- Successful approaches begin with a look at the collective clinical environment of care

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Improving the environment of care involves identification of new 'truths'

- Truth
- Confounder
- Bias
- Chance

Clinical Environment of Care

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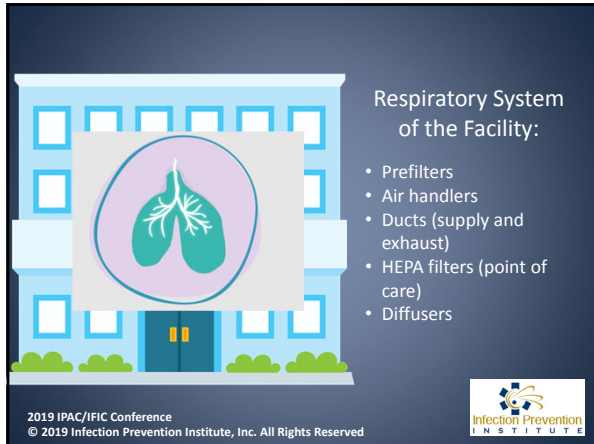


The "Patient"



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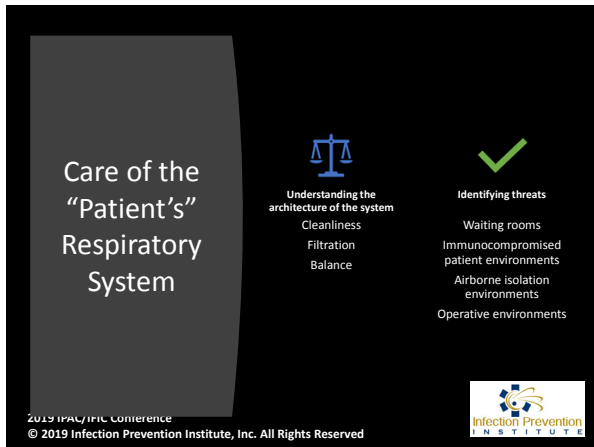


Respiratory System of the Facility:



- Prefilters
- Air handlers
- Ducts (supply and exhaust)
- HEPA filters (point of care)
- Diffusers

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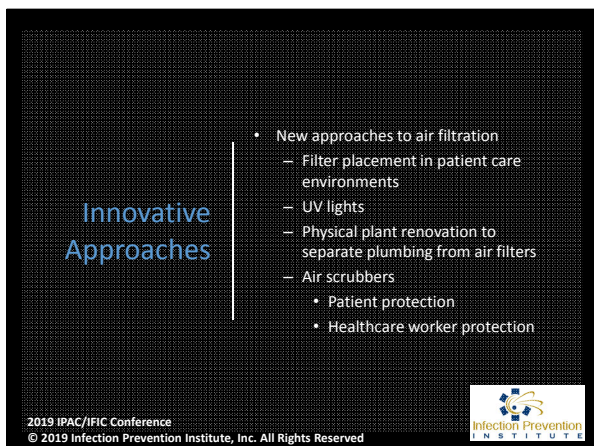


Care of the "Patient's" Respiratory System

 Understanding the architecture of the system	 Identifying threats
Cleanliness	Waiting rooms
Filtration	Immunocompromised patient environments
Balance	Airborne isolation environments
	Operative environments

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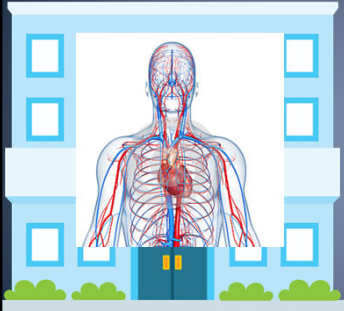


Innovative Approaches

- New approaches to air filtration
 - Filter placement in patient care environments
 - UV lights
 - Physical plant renovation to separate plumbing from air filters
 - Air scrubbers
 - Patient protection
 - Healthcare worker protection

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Circulatory System of the Facility:

- Water is the “blood” of the facility
 - handwashing
 - laboratory
 - food preparation
 - showering/bathing
 - drinking
 - ice

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Care of the “Patient’s” Circulatory System

 <p>Understanding the architecture of the system Condition of the plumbing Configuration of the sink structures and locations Biofilm</p>	 <p>Identifying threats Aging facilities Products exposing the architecture Impact of how the ‘circulatory system’ moves organisms, organic matter, and biofilm</p>
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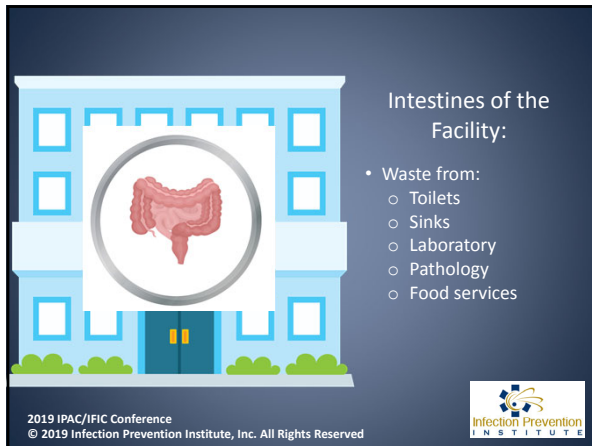


Innovative Approaches

- New approaches to water management
 - Broader water management plans
 - Identifying low use areas
 - Fountains, faucets, ice machines and their routine care and enhanced care are performed

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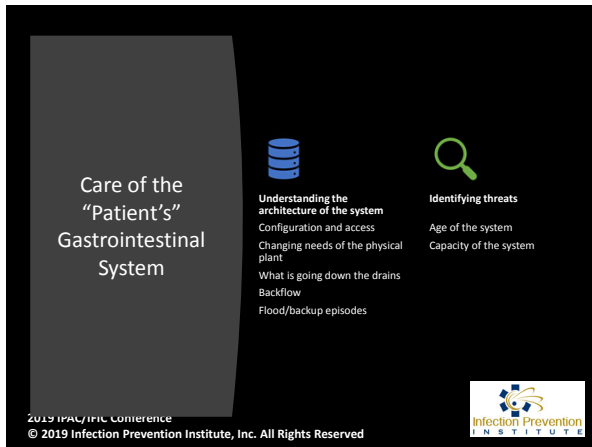


Intestines of the Facility:

- Waste from:
 - Toilets
 - Sinks
 - Laboratory
 - Pathology
 - Food services

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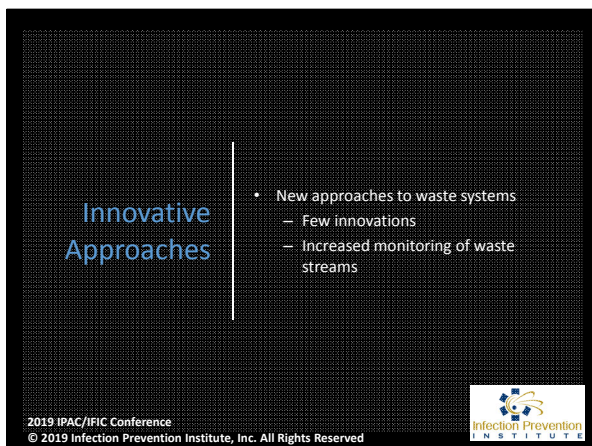


Care of the "Patient's" Gastrointestinal System

- Understanding the architecture of the system
 - Configuration and access
 - Changing needs of the physical plant
 - What is going down the drains
 - Backflow
 - Flood/backup episodes
- Identifying threats
 - Age of the system
 - Capacity of the system

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Innovative Approaches

- New approaches to waste systems
 - Few innovations
 - Increased monitoring of waste streams

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Integument of the Facility:

- Surfaces, coverings
 - Types of surfaces
 - Interruptions in surfaces (cracks, seams)
 - Location of surfaces
 - Types of contact between surfaces and chemicals

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Care of the "Patient's" Integument



Understanding the architecture of the system


- Surfaces and composition of surface materials
- Remaining tension between facility appearance, patient satisfaction, surfaces and furnishings, and germicide capabilities
- Flexed needs of the physical environment



Identifying threats

- Few new germicide options
- Conflicts between manufacturer instructions for use and disinfection needs
- Surface biofilms
- Emergence of new MDROs with abilities to communicate and share resistance information
- Concerns about resistance to current germicides
- Movement of care and procedures to alternate care settings


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Innovative Approaches

- New approaches to care of the integument (surfaces)
 - Self-disinfecting surfaces
 - Germicides and delivery methods
 - New chemicals
 - New application methods (e.g., electrostatic delivery)
 - New applications of existing technologies (UV)
 - New applications of monitoring processes (ATP, fluorescent powders)

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Clinical Environment of Care Concerns

- Recognizing the risks associated with the facility "systems"
- Identifying risk mitigation strategies
- Considering impact of mitigation strategies
- Monitoring for adverse outcomes or events
- Interpreting the evidence
- Applying the evidence
- Confronting the unknown


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Altering the Paradigm

- Does the answer involve new technologies or does the answer involve a deeper dive into the epidemiology of pathogen transmission?
- Relationships between the environment, the providers of care and the patient
- Understanding the spatial relationships and pathogen transmission
- Patient movement
- Enhanced attention to areas previously under-scrutinized (e.g., Emergency Departments)

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Time for Action

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