Antibiotic Resistance in the Healthcare Environment

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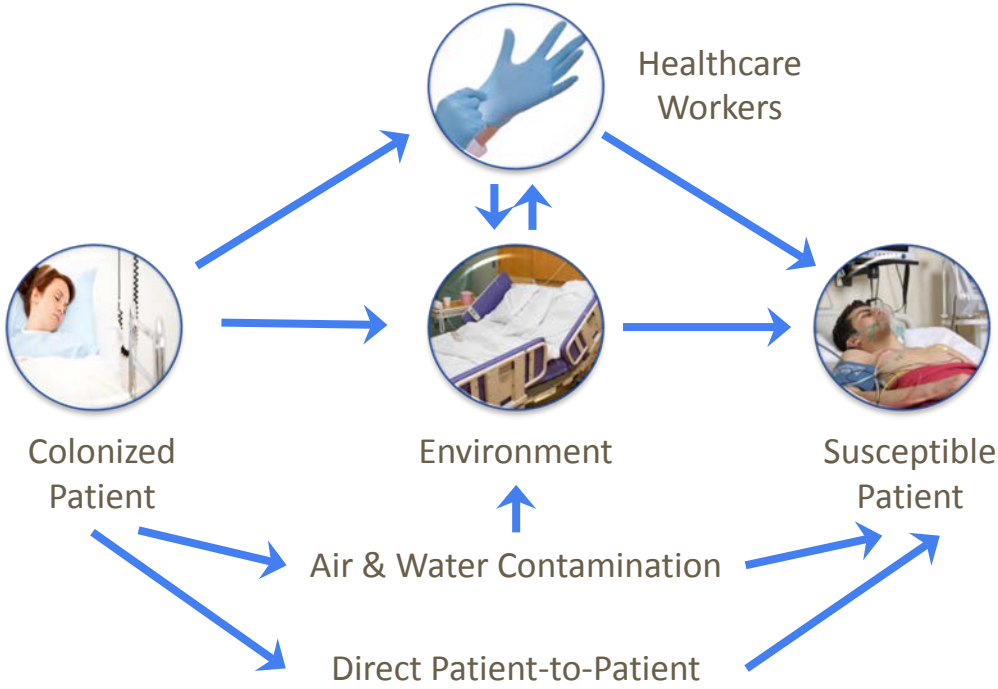
What is the Healthcare Environment?

- Dry environment
  - Example: Non-critical surfaces (e.g., bedrails and bedside tables)
  - Transiently contaminated by patients and healthcare workers
  - Contributes to transmitting pathogens in healthcare settings

- Wet environment
  - Example: Sink drains
  - Contaminated fluids from colonized patients pass through plumbing
  - Biofilm formation in drainage system may serve as a reservoir for antibiotic resistant organisms and genetic elements, e.g., plasmids

Transmission of Pathogens in Healthcare Settings



Adapted from: Otter JA, Yezli S, French GL. The role played by contaminated surfaces in the transmission of nosocomial pathogens. Infect Control Hosp Epidemiol. 2011 Jul;32(7):687-99.

Dry Environment: Role of Non-Critical Surfaces in Transmitting Pathogens

- In 1970s-1980s, transmission of healthcare-associated infections (HAIs) was most strongly correlated with medical procedures and device utilization, especially in high-acuity ICU care
  - Environmental surface contribution was less prominent in that era before aggressive improvements in procedure and device-related care

- Currently, non-critical surfaces are part of the remaining burden of infection transmission that needs to be addressed in addition to the improvements in care to date, including:
  - Optimizing terminal cleaning of patient rooms
  - Understanding environmental surfaces as sources for pathogens
  - Identifying opportunities for design improvements to reduce infection transmission from the environment

Specific Aims of CDC's Research Framework for Environmental Infection Control of Dry Environment

1. **Modeling transmission**

   Understand the role of non-critical surfaces in the transmission of pathogens in different types of healthcare facilities

2. **Measuring cleanliness**

   Evaluate methods for measuring the contamination of non-critical surfaces and determine cleanliness thresholds associated with improved patient safety outcomes

3. **Improving cleanliness**

   Understand the current state of cleaning and disinfecting non-critical surfaces and evaluate methods for reducing contamination (preventing or decreasing) on non-critical surfaces in order to improve patient safety outcomes

CDC's Evidence-based Guidelines

- *Guidelines for Disinfection and Sterilization in Healthcare Facilities, and Environmental Infection Control*
- Undergoing segmental update by CDC with input from the federal advisory committee, Healthcare Infection Control Practices Advisory Committee (HICPAC)
  - Transparent process that evaluatespeer-reviewed evidence, solicits public review and feedback, and follows rigorous conflicts of interest assessments
  - Reviewing emerging technologies, including disinfectant vapor generators, UV devices, and surface treatments
  - Assessing evidence of benefit/harm to patients, personnel, or healthcare environment to support any new recommendations to use or avoid these technologies
  - Target date for final update: early 2018

Changing Landscape in Environmental Infection Control

- Infections transmitted through soiled surfaces, e.g., Ebola virus, *C. difficile*, AR threats
- Emerging technologies for reducing and preventing contamination
  - No-touch cleaning and disinfection modalities
  - Enhanced wipes, mops, and cloths
  - Enhanced surfaces, coatings, treatments
- Emerging technologies for monitoring cleaning and disinfection
- Opportunities for improvements in facility design and layout

Wet Environment: Emerging Role in the Healthcare Infections

- Several outbreak investigations have detected the organism (or plasmid) of interest from sink drains of patient rooms
  - Biofilms in plumbing could serve as a reservoir for resistant Gram negative infections, e.g., carbapenemase-producing Enterobacteriaceae
  - However, causality is difficult to prove

- Many unanswered questions regarding these wet environments:
  - Persistence of pathogens and potential for genetic exchange
  - Role in dissemination of pathogens to patients
    - Potential mechanisms that splash zone could lead to patient contamination
    - Options for minimizing this potential risk

For more information, contact CDC
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