SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The purpose of this article is to present a review of the evidence pertaining to the contamination of hospital surfaces, its significance to the transmission of HAIs, and interventions that reduce contamination and infections.

The role of the surface environment in healthcare-associated infections

Weber, D. J., Anderson, D., & Rutala, W. A. 2013 | *Current Opinion in Infectious Diseases*. Volume 26, Issue 4, Pages 338-344

Key Concepts/Context

Healthcare-associated infections (HAIs) are associated with morbidity and mortality in hospitals in the USA. Sources and transmission of contamination can be several. Contamination of hospital surfaces is a common occurrence. This paper reviews the evidence that points to the role of surface contamination in the transmission of HAIs and interventions that have proven effective.

Methods

This article reviews recent literature. The review focused on the following:

- Contamination of surfaces in the hospital environment
- Role of the contaminated environment in transient hand/glove contamination of healthcare personnel
- Surface contamination following disinfection
- Risks of pathogen acquisition due to inadequate terminal disinfection
- Preventing transmission of nosocomial pathogens due to contaminated surfaces

Findings

Contamination of surfaces in the hospital environment:

- Pathogens like methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus spp. (VRE), Pseudomonas spp., Acinetobacter spp., and norovirus can survive for days to weeks on dry inanimate surfaces. Spores of Clostridium difficile (C. difficile) can survive for months on such surfaces.

- A varying proportion of surfaces and furniture in rooms and wards that house infected patients have shown positive for contamination. The level of contamination, however, is very low. Also the difference in level of contamination in high-, medium-, and low-touch surfaces was not statistically significant.
- Role of the contaminated environment in transient hand/glove contamination of healthcare personnel:
- Contamination of hands with MRSA occurs irrespective of whether the healthcare worker was in direct contact with an infected patient or touched contaminated surfaces in the patient's room.
- The frequency of finding cultures of C. difficile on the hands or gloves of healthcare workers was found to be correlated with environmental contamination by C. difficile.

Surface contamination following disinfection:

- Surfaces in hospital rooms are not cleaned thoroughly. Studies have indicated that fewer than 50% of the rooms examined were not clean.
- Portable medical equipment between patients was not always cleaned and disinfected effectively.
- Common disinfectants used for hospital surfaces like phenols and quaternary ammonium compounds are not effective against C. difficile and norovirus.
- The use of non-sporicidal wipes or incorrect use of sporicidal wipes on surfaces contaminated with C. difficile actually transfers the spores of the pathogen to clean surfaces.

Risks of pathogen acquisition due to inadequate terminal disinfection:

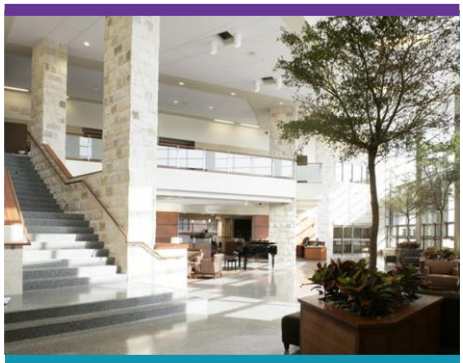
- A patient admitted to a room that previously housed a patient infected with MRSA, VRE, C. difficile, multidrug-resistant Acinetobacter spp., or multidrug-resistant Pseudomonas, faces a risk of getting infected or colonized with the same pathogen.

Preventing transmission of nosocomial pathogens due to contaminated surfaces:

- Improving surface cleaning and disinfection:
    - Education of:
        - Environmental service workers (who clean surfaces)
        - Nursing staff (who clean instruments and equipment)

  - Assessment of cleaning:
    - Fluorescent dye: When applied to a disinfected surface, a fluorescent dot will appear if the surface is not clean.
    - ATP bioluminescence: This measures the presence of ATP which is a marker for microbial contamination. This is not as effective as fluorescent dye.
  - Daily disinfection:
    - Multiple cleaning strategies that included daily disinfection, use of ultraviolet light devices, and use of fluorescent dye were effective in a substantial decrease in C. difficile.
    - Daily disinfection of high-touch surfaces in patient rooms with MRSA and C. difficile reduced contamination of hands and gloves.

- 'No-touch' methods of surface disinfection: Room disinfection units have been created that decontaminate environmental surfaces and contents in a room. These are used only as supplementary to regular cleaning and disinfection processes.
  - Ultraviolet (UV) light devices: Although these devices are being used to decontaminate rooms, surfaces, and equipment, there are no studies in connection with reduction of HAI. A drawback of this device is that it cannot disinfect spaces that are not in its line of sight.
  - Devices using hydrogen peroxide: The use of hydrogen peroxide devices has been effective in almost eliminating pathogens like MRSA, VRE, Mycobacterium tuberculosis, spores, viruses, and multidrug-resistant Gram-negative bacilli, and reduction of C. difficile. A disadvantage of this system is that it needs a lot of time to effectively decontaminate.
- 'Self-disinfecting' surfaces:
  - The use of copper on surfaces: Copper alloys have been used for controlling Legionella species in water supplies and Aspergillus on building materials. One study conducted in a hospital environment found that copper reduces HAIs by over 50%.
  - The authors indicate that the use of germicides such as triclosan, altered topography (e.g., Sharklet AF pattern), and light-activated antimicrobicides are potential methods of disinfection as well.



The Center for Health Design: Moving Healthcare Forward

The Center for Health Design advances best practices and empowers healthcare leaders with quality research that demonstrates the value of design to improve health outcomes, patient experience of care, and provider/staff satisfaction and performance.

Learn more at www.healthdesign.org

Limitations

The authors do not indicate any limitations that their review may have. One limitation this study had was a lack of a systematic method for the literature reviewed.

Design Implications

The authors indicate that the literature alludes to the use of 'no touch' devices (devices that use UV light and hydrogen peroxide) to supplement the regular cleaning and disinfecting processes in hospitals. Since these devices are bulky, designers may incorporate adequate storage and charging provisions for these devices if the decision is made to use them.

The Knowledge Repository is provided with the funding support of:

AIA Academy of Architecture for Health of the American Institute of Architects

ASHE American Society for Healthcare Engineering, A personal membership group of the American Hospital Association

AAHF Academy of Architecture for Health Foundation

FGI

Additional key point summaries provided by:

NIHD Nursing Institute for Healthcare Design — Leadership · Education · Advocacy

Research Design Connections