

Role of hospital surfaces in the transmission of emerging healthcare-associated pathogens: Norovirus, *Clostridium difficile*, and *Acinetobacter* species

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ABSTRACT

Health care-associated infections (HAI) remain a major cause of patient morbidity and mortality. An estimated 20%-40% of HAI's are attributed to cross contamination by touching contaminated environmental surfaces, which play a role in the transmission of MRSA, VRE, norovirus, *Clostridium difficile*, and *Acinetobacter* spp. Transmission of these pathogens can be interrupted by appropriate hand hygiene and improving the cleaning and disinfection of environmental surfaces. This article focused on the role of surface contamination in the transmission of 3 emerging nosocomial pathogens: norovirus, *C difficile*, and *Acinetobacter* spp.

Norovirus

Caliciviruses, within the family Caliciviridae, are single-stranded RNA, non-enveloped viruses that are now recognized as common pathogens of humans and animals. Because human noroviruses cannot be cultured, most of the data on environmental survival is based on studies using surrogate caliciviruses such as feline calicivirus or murine norovirus.

They are responsible for an estimated 23 million infections annually in the United States. Modes of transmission include human-to-human transmission (fecal-oral route), contact with a contaminated surface or by consumption of fecally contaminated food or water. Environmental survival of noroviruses is enhanced by their ability to withstand a wide range of

temperatures (from freezing to 60C) and persist on environmental surfaces, recreational and drinking water, and in a variety of food items.

Using a human challenge study, Barker et al demonstrated that human noroviruses could be consistently transferred via contaminated fingers to surfaces such as toilet tops, door handles, and telephone receivers. They demonstrated that contaminated fingers could sequentially transfer virus to up to 7 clean surfaces. Therefore, hand hygiene should be performed with soap and water (for at least 1 minute) which is more effective than hand hygiene with a waterless alcohol-based hand sanitizer. For environmental high-touch surfaces, experts have recommended frequent cleaning and disinfection of rooms every 24 hours. Ethanol and quaternary ammonium products have not proved effective. Hypochlorite at concentrations over 1000 ppm has been demonstrated to be very effective along with acid-based disinfectants in eliminating the virus.

C difficile

C difficile is an anaerobic, gram-positive, spore-forming, toxin-producing bacillus. *C difficile* exists in the colon as a vegetative cell, whereas, outside the colon, it survives in spore form and is acquired by fecal-oral transmission. In the health care setting, 3 mechanisms of transmission are possible: direct transfer from an infected patient to the environment (rectal thermometer, commode) and further contact by another patient into the mouth or directly into the colon; second, direct transfer via hands

to a non-infected patient; and finally, indirect transfer from contact with the contaminated environment to a non-infected patient. Bacterial spores are highly resistant to drying, heat, and chemical and physical agents. In 1981, Kim et al reported that *C difficile* inoculated onto a hospital floor persisted for 5 months. It is widely accepted that environmental contamination plays an important role in the transmission of *C difficile* in the hospital setting. In addition to surface contamination, several medical devices have been linked to transmission of *C difficile* in the hospital, including electronic rectal thermometers.

Interventions to control surface contamination include hand hygiene with soap and water, shown to be superior to an alcohol rub. For environmental surfaces, the CDC guidelines recommend the use of 1:10 diluted hypochlorite solutions for surface disinfection which has a demonstrated benefit when used as part of an intervention program to control outbreaks. Surface disinfectants such as 70% isopropanol, phenols, and quaternary ammonium compounds should not be used because they are not sporicidal. Recently, the routine use of hydrogen peroxide vapor room decontamination was shown to reduce the epidemic rate of CDI.

Acinetobacter Species

Acinetobacter spp are strictly aerobic, gram negative, non-fermentative, coccobacillary rods. Higher relative humidity promotes survival. Both sporadic and outbreak strains of *A baumannii* exhibit prolonged survival on dry surfaces (21 to 31 days) which is thought to play an important role in hospital outbreaks. In a human challenge study, *Acinetobacter* survived on fingertips for 60 minutes.

Contamination of high touch surfaces, respiratory tract equipment, devices and hands of health care workers have been responsible for numerous outbreaks.

Common measures to control *Acinetobacter* outbreaks

have included emphasizing hand hygiene, use of Contact Precautions, cohorting infected patients and staff, and unit closures. The hand antiseptic found to be most effective for heavily contaminated fingertips were 70% ethanol and 10% povidone-iodine. Regarding environmental cleaning/disinfection, *Acinetobacter* has been shown to be susceptible to phenols, quaternary ammonium compounds, a 0.5% accelerated hydrogen peroxide product, and ultraviolet light.

CONCLUSION

In accordance with the CDC guidelines for environmental infection control in health care facilities and recent scientific evidence strongly suggests that contamination of surfaces in hospital rooms plays an important role in the transmission of MRSA and VRE including health care-associated pathogens such as norovirus, *C difficile*, and MDR-*Acinetobacter*. For all 3 emerging pathogens, as well as all MDR, enhanced cleaning and disinfection of all room surfaces are highly recommended when managing outbreaks. Alternatively, the use of no touch disinfection methods such as ultraviolet light and vaporized hydrogen peroxide may be used. For norovirus and *C difficile*, the use of hypochlorite solutions (usually 1:10 diluted household bleach) has often been recommended for surface disinfection in hospital rooms.

IMPLICATIONS FOR AHP

AHP Disinfectants are One-Step Disinfectant-Cleaners

- AHP has proven cleaning efficiency resulting in lower costs and faster results as well as added confidence that disinfection can occur
- AHP has been proven effective in lifting *C diff* spores off of contaminated surfaces due to the superior surfactant package and detergency capabilities
- AHP Disinfectants are effective against *Acinetobacter* species

REFERENCE

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