Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
The Importance of the Clinical Environment in the Transmission of Health Care-Associated Infections

by J. Hudson Garrett Jr, PhD, MSN, MPH, FNP-BC, CSRN, PLNC, CDONA, FACDONA, VA-BC

Introduction

Collaboration is a critical component in the prevention of health care-associated infections (HAIs) in today’s health care environment. Now more than ever, a clean and sanitary patient environment is being measured as a component of the infection prevention and control process. In addition, outcome measures such as patient satisfaction and the cleanliness of the environment are common metrics in this era of continual health care reform. Payers such as the Centers for Medicare and Medicaid Services correlate hospital reimbursement with many of these measures and metrics, resulting in financial effects low-performing facilities. The cleanliness of medical equipment such as a portable ultrasound machines, patient care surfaces, and environment surfaces are all included; thus, an impeccably clean environment is a shared goal between environmental services workers and vascular access professionals.

Patients, visitors, and health care providers routinely contaminate health care environments through daily activities, and this can increase the risk for infection transmission. Transmission can result from contact with either contaminated hands or environment surfaces, and also a patient’s own skin flora. One of the most critical interventions that can be routinely performed to decrease the risk for cross-transmission and development of HAIs is routine cleaning and disinfection of the environment. This includes both medical equipment and environment surfaces. High-touch items, such as those used between patients regularly, should be disinfected between each single use to minimize the risk for contamination.

Recent expert opinions have posited that it is actually environmental surfaces professionals who spend the most time with patients in hospital rooms. This creates an interesting opportunity to utilize environmental services professionals as a part of infection prevention advocacy plans. Facilities should include environmental services team members in infection prevention unit-based education, and also engage them in an active and personal role in preventing infections among the patients that they serve. This concept was demonstrated by researchers at John Hopkins through the Comprehensive Unit-Based Safety Program initiative.

Environmental services and vascular access professionals can also serve as educators by informing patients of the steps being taken to mitigate the risk for infection, such as daily and terminal cleaning and use of alcohol-based handrubs, and encouraging family members to follow isolation precautions as appropriate. There is typically a positive correlation between enhanced patient satisfaction and increased interaction with members of health care delivery teams, which most certainly includes environmental services professionals. Environmental services professionals are not only experts in maintaining the environment, but also in serving as patient safety advocates who reduce the incidence of HAIs.

Surface disinfection is an important factor in the prevention of HAIs. Many surfaces in health care settings are considered noncritical and therefore require cleaning with a low-level disinfectant. However cross-contamination can and does occur in a variety of ways, most often when a surface becomes contaminated and then serves as a reservoir for microbial growth. Consider a situation wherein the hands of either a health care provider or patient come in contact with a contaminated surface, then hand contact is made with another device or surface, contaminating it as well. Thus the chain of infection transmission begins. Unfortunately, all too often high-touch surfaces are not properly cleaned and disinfected routinely due to a variety of reasons.
The ability of microorganisms to survive and reproduce on environment surfaces has never been greater. Organisms such as methicillin-resistant *Staphylococcus aureus*, *Escherichia coli*, *Clostridium difficile*, and *Mycobacterium tuberculosis* can survive on surfaces for several months. Because of the resilience of these microorganisms, it is important to routinely disinfect all potentially contaminated surfaces to reduce the risk of transmission. Emergent threats such as Middle East respiratory syndrome coronavirus and carbapenem-resistant Enterobacteriaceae continue to plague the health care delivery system. Although environmental services professionals are certainly experts in the maintenance of a clean environment, clinical nursing teams have accountability for items such as ventilators, intravenous pumps, and other medical devices. Family members visiting patients can serve as an extension of the teams by either cleaning certain soiled surfaces themselves, or promptly notifying staff members when surfaces become soiled.

Before effective disinfection can occur, it is important to thoroughly clean visibly soiled surfaces to allow for the full efficacy of the chosen disinfectant product. The latest Centers for Disease Control and Prevention Guideline for Disinfection and Sterilization in Healthcare Facilities (released in 2008) describes cleaning as:

> The removal of foreign material (eg, soil and organic matter) from objects, and is normally accomplished using water with detergents or enzymatic products. Thorough cleaning is essential before high-level disinfection and sterilization because inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of these processes.

Cleaning removes bioburden from an affected surface by reducing the number of microorganisms that must be inactivated. Removing bioburden from a surface before application of a disinfectant solution will result in increased disinfectant efficacy. It is also important to also apply friction to the area being cleaned and disinfected to remove more resistant forms of microorganisms such as spores (eg, *C difficile* spores) from surfaces that may not be readily inactivated by the disinfectant. This will decrease the risk for development of multidrug-resistant organisms.

The selection of the appropriate disinfectant product is crucial. Always choose a disinfectant that is approved by the Environmental Protection Agency and that has established efficacy claims. In addition, infection prevention specialists should refer to their facility’s risk assessment document and ensure that the disinfectant selected has efficacy claims for microorganisms that are routinely found within the facility. Efficacy claims are readily available through product manufacturers and should be carefully reviewed before introduction of a product into the facility. The environmental services team should work carefully with colleagues in infection prevention and vascular access to ensure that the disinfectant selected meets the efficacy needs for infection prevention but also is safe for the staff to use and also for use around patients.

High-touch surfaces such as blood pressure cuffs, stethoscopes, and glucometers require frequent disinfection to prevent cross-transmission between patients. The physical number of microorganisms present on any given surface is influenced by a number of factors, including the amount of moisture present on the surface, the amount of activity taking place in the immediate environment, the number of people who have contact with the environment, and the type of surfaces present and their ability to support the growth of microorganisms. High-touch surfaces are contaminated continually throughout the day; therefore, it is critical to have an understanding between nursing personnel and environmental services professionals regarding the frequency of cleaning necessary and also the ownership for each item. This methodical approach to environmental hygiene will produce meaningful and sustainable results.

The primary focus of a thorough environment disinfection program should be on those items that are used with multiple patients and/or procedures. Spaulding created a standardized approach to disinfection in the health care environment that consists of 3 categories: critical, semicritical, and noncritical. Noncritical items such as wheelchairs and bedside tables are those that have contact with intact skin, but not sterile body tissues or mucous membranes. These items require the use of a low-level disinfectant. With the recent move of most acute care facilities to use of electronic medical records, disinfection of noncritical items such as computer keyboards is of high importance to reduce transmission of microorganisms throughout the entire environment. Hand hygiene is still the most critical intervention to break the chain of infection, but routine disinfection of these potential reservoirs for microbial growth is a key component as well.

It is critical to have a complete set of policies and procedures identifying each individual’s and department’s responsibility in the cleaning and disinfection process. Careful collaboration with the environmental services team is necessary to ensure that all surfaces are routinely disinfected by the appropriate personnel. Education programs are available through organizations such as the Association for the Healthcare Environment. Also, a collaborative partnership with the facility’s health care engineering team is critically important in executing infection prevention/vascular access and environmental services projects. The Association for the Healthcare Environment publishes the only evidence-based practice guidance resource (www.ahe.org) specifically for environment cleaning. It is a tool that can be referenced for managing the disinfection needs specific to vascular access professionals and the equipment used in their daily roles.

Education of health care staff members is key to minimizing risks associated with using any disinfectant product. Staff members should be educated on the appropriate indications for use for each product, the instructions for use, including total overall contact time required to effectively inactivate the microorganisms according to the product’s efficacy label, the product’s material safety data sheet, and also the appropriate use of personal protective equipment as required by the Occupational Safety and Health Administration Bloodborne Pathogens Standard. In addition, steps must be taken to ensure that infection prevention in vascular access is addressed.
across the entire continuum of care, including inpatient and outpatient settings. By educating the appropriate staff members on the appropriate use of the chosen product, the manufacturer’s documented product efficacy will be achieved and end users of the product will be protected from adverse reactions.

A thorough cleaning and disinfection program combined with careful selection of the most appropriate hospital-grade disinfectants will dramatically improve health care professionals’ daily fight against HAIs. Appropriate product use combined with education of the users will give health care facilities the greatest opportunity to reduce contamination within the facility. With the continual development of new surface disinfection technologies, it is also crucial for health care providers to evaluate these new technologies carefully and review the supporting efficacy data thoroughly before changing processes already in place. Hand hygiene combined with disinfection of the patient environment will significantly reduce the risk for cross-transmission. It is only through a comprehensive and collaborative effort between vascular access and environmental services teams that facilities can target zero HAIs. It is time for perfect care every time, for every patient.

Dr. Garrett is the Vice President of Clinical Affairs for PDI, Inc., Atlanta, GA and also the Industry Liaison for the Board of Directors for the Association for the Healthcare Environment (AHE).

Correspondence concerning this article should be addressed to hudsongarrettjr@gmail.com.

References
1. Garrett JH Jr. Break the infection chain. Provider. 2010;36(3). 37, 39-40, 43.
2. Garrett JH Jr. HAI transmission in the health care environment. Health Facil Manage. 2014;27(4):40.
3. Sehulster L, Chinn RY, Centers for Disease Control and Prevention, Healthcare Infection Control Practices Advisory Committee. Guidelines for environmental infection control in health-care facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). MMWR Recomm Rep. 2003;52(RR-10):1-42.
4. Garrett JH Jr. A review of the CDC recommendations for prevention of HAIs in outpatient settings. AORN J. 2015;101(5):519-525. quiz 526-518.

http://dx.doi.org/10.1016/j.java.2015.10.002
Copyright © 2015, ASSOCIATION FOR VASCULAR ACCESS. Published by Elsevier Inc. All rights reserved.