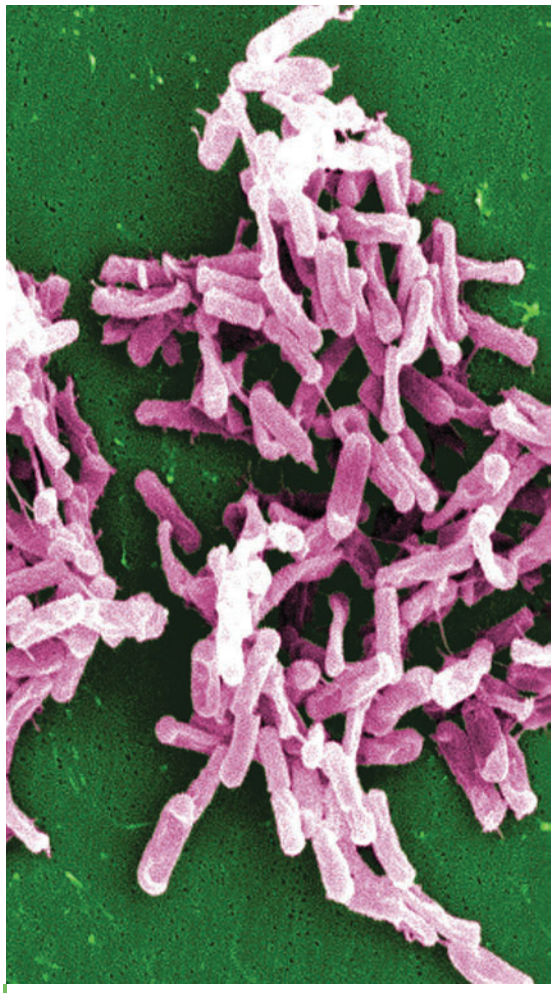
FEATURE

THE CRUCIAL ROLE OF THE ENVIRONMENT

Evidence-based strategies for improved environmental hygiene

By Linda R. Greene, RN, MPS, CIC



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This micrograph depicts Gram-positive C. difficile *bacteria from a stool sample culture obtained using a .1µm filter. People can become infected if they touch items or surfaces that are contaminated with feces and then touch their mouth or mucous membranes. Healthcare workers can spread the bacteria to other patients or contaminate surfaces through hand contact.*

It is widely accepted that environmental contamination plays an important role in the transmission of certain pathogens in the healthcare environment. As such, there has been a revival of interest in the role of environmental surfaces as potential vehicles for the transmission of several healthcare pathogens. This interest underscores the importance of environmental services in infection prevention programs and the crucial need for understanding and implementing evidence-based practices.

First and foremost, cleaning forms the foundation for environmental hygiene. The monitoring and evaluation of cleaning practices is an essential part of the infection prevention program. However, until recently, this evaluation consisted primarily of visual inspections. Clean looking rooms and "shiny floors" were perceived as a reflection of good cleaning practices. Unfortunately, visual examination does not address the issue of high-touch surfaces and places undue importance on non-critical areas such as floors and walls.

Enhanced monitoring

To properly address environmental hygiene, there are several key components that must be combined to deliver improved cleaning outcomes. These include such processes as consistent delivery of the correct disinfectant concentration, infection control practices to prevent cross contamination, standardized processes to consistently disinfect high-touch surfaces, training on best practices, and objective measures for enhanced monitoring.

These objective measures are referred to as enhanced monitoring or EC. EC monitoring consists of repetitive monitoring of actual findings based upon standardization and uniform definitions, and facilitates program development based upon both individual and system issues. In addition to direct observation, the following measures are more objective measures for EC monitoring:

- **Swab cultures:** Swab cultures identify microorganisms and are very useful in outbreak situations. This technique may provide periodic information but is limited in its ability to provide real-time feedback on a consistent basis due to the delay in analyzing results and its limited feasibility for monitoring multiple surfaces in multiple rooms.
- **Fluorescent markers:** Fluorescent gel, powder, and lotion have all been developed for the purpose of marking high-touch objects prior to room cleaning. Fluorescent gel has an advantage in that it dries transparent on surfaces and resists abrasion. There are several studies demonstrating the accuracy of the system in objectively evaluating cleaning practice. Fluorescent gel is applied to high-touch surfaces prior to cleaning and is then evaluated with a UV light to see if the mark was removed. Because these fluorescent markers are all designed to indicate physical removal of an applied substance, surfaces that are effectively disinfected but less effectively cleaned may be more likely flagged as failing to meet a quality standard using one of these markers than with culture techniques.
- **ATP bioluminescence (ATP):** This technique has been used in the food industry for many years. Before cleaning, a swab is used to sample high-touch surfaces and then is placed in a luminometer, which analyzes the amount of ATP present. Because ATP measures organic debris as well as bacterial counts, the accuracy of the readings has been challenged. Despite limitations, however, the ATP

system has been reported to result in significant improvement in daily cleaning as well as providing an objective measurement of the level of cleanliness of high-touch surfaces.

Advanced measures for environmental cleaning

Although environmental cleaning is a basic key practice, newer technologies for disinfection are often seen as an important adjunct to these key practices. Despite vigorous attempts to improve routine cleaning practices, many hearty organisms such as *Clostridium difficile* have been cultured from the healthcare environment and implicated in disease transmission. Technologies such as ultraviolet (UV) light, hydrogen peroxide (HP), both vaporized and aerosolized, and self-disinfecting surfaces such as copper and silver hold promise in our attempts to achieve optimal environmental hygiene. A brief review of these technologies is described below.

- **Ultraviolet light:** UV light has been used in industry for many years. In the healthcare environment it is effective against a wide range of pathogens. The light is placed in an empty patient room and the UV acts by breaking down the organism's DNA and destroying the organism. It has several advantages including ease of use and lack of residual effects or health and safety concerns. It does not require the need to disable heating or air conditioning systems.
- **Hydrogen peroxide:** HP is available as a vapor, aerosolized dry mist, and vaporized HP. It has good activity against a variety of pathogens including bacteria, fungi, viruses, and spores. HP is especially useful for disinfecting complex furniture and equipment and has proven effective against *Clostridium difficile*. HP is residual free and does not pose any health concerns. One disadvantage is that aerosolized HP does require that air vents be sealed.
- **Copper and silver surfaces:** Surfaces such as silver and copper have shown to have an effect on inactivating some bacteria and other pathogenic organisms. However, there is limited data available on their effectiveness in healthcare. One disadvantage is cost. Although self-disinfecting surfaces such as copper and silver show promise, further studies are needed to evaluate and assess their impact in reducing healthcare associated infections.

Putting it all together

Clear evidence exists that the environment can be a source of transmission of microorganisms. Contamination of patient surfaces and equipment requires that organizations develop programs to optimize the thoroughness of cleaning and disinfection of high-touch surfaces, both as part of routine cleaning and at the time of discharge or transfer of patients. Enhanced environmental monitoring techniques and adjunctive terminal disinfection strategies hold promise in our efforts to enhance environmental hygiene and provide a safe environment for patients. ●

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