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Surface Sanitation in Healthcare:

Why Your Disinfection System May Be Letting You Down

By Valerie Williamson

According to the World Health Organization (WHO), one out of every 136 hospital patients in the United States becomes seriously ill as a result of acquiring an infection in a hospital. This is equivalent to 2 million cases and about 80,000 deaths a year. In a recent study of the financial impact of healthcare-acquired infections (HAIs), it was found that the average additional incremental direct cost for patients with an HAI was $8,832 and that each HAI-infected patient reduced overall net inpatient margins by $5,018.

Cleaning and disinfecting surfaces in healthcare facilities is critical to reducing HAIs. However, infection control practitioners and other healthcare professionals may be surprised to learn that not all surface sanitation efforts are equal. In fact, some common systems – such as using a cotton rag or cellulose-based wiper to apply bleach or quaternary amines to surfaces – deliver less-than-ideal concentrations of disinfectants/sanitizers to the surface, according to two recent studies.

These studies showed that using a wiping material specifically designed to be compatible with disinfecting/sanitizing chemicals such as quaternary amines and bleach results in much better delivery of target concentrations of chemicals to the surface.

Cleaning and Disinfecting Environmental Surfaces

The number and types of microorganisms present on environmental surfaces are influenced by several factors:

- The number of people in the environment
- Amount of activity
- Amount of moisture (microorganisms are present in greater numbers in moist, organic environments, but some can also persist under dry conditions)
- Presence of material capable of supporting microbial growth
- Rate at which organisms suspended in air are removed
- Type of surface and orientation (i.e., horizontal or vertical)

Common germs, such as *Staphylococcus aureus*, can live up to three weeks on a dry surface and may cause skin and surgical infections, food poisoning and pneumonia, according to the Association for Professionals in Infection Control and Epidemiology (APIC). Vancomycin resistant enterococci (VRE) can live on dry surfaces from seven days to four months. *Clostridium difficile* is another hardy pathogen that can survive in the environment as a spore. APIC also notes that contaminated environmental surfaces in healthcare facilities are a mode of transmission for multiple drug-resistant organisms (MDROs).

APIC points to studies which show that 70 percent of environmental surfaces in rooms of patients who were colonized or infected were contaminated with potentially harmful microorganisms.

APIC defines cleaning as the removal of all foreign material (i.e., dirt, body fluids, lubricants) from objects by using water with detergents or soaps and by washing or scrubbing the object. Cleaning is the necessary first step of any sterilization or disinfection process. It is needed to render the environmental surface safe to handle or use by removing organic matter, salts, and visible soils – all of which interfere with microbial inactivation. In fact, the physical action of scrubbing with detergents and surfactants and rinsing with water removes large numbers of microorganisms from surfaces.

Most, if not all, housekeeping surfaces require regular cleaning with soap and water or a detergent/disinfectant for removal of soil and dust, according to the Guidelines for Environmental Infection Control in Health Care Facilities (2003) from the Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC). High-touch housekeeping

surfaces in patient-care areas – such as doorknobs, bedrails, light switches, wall areas around the toilet, and the edges of privacy curtains – should be cleaned and/or disinfected more frequently than surfaces with minimal hand contact. Horizontal surfaces with infrequent hand contact, such as window sills and hard-surface flooring in routine patient-care areas, require cleaning on a regular basis, when soiling or spills occur and when a patient is discharged from the facility.

Methods of Disinfection

APIC defines disinfection as a process that eliminates many or all microorganisms except spores, which is done with liquid chemicals or by pasteurizing objects. For the process to work, proper contact time and dilution of the disinfectant must be followed. There are three levels of disinfection, according to APIC:

- High-level disinfection – can be expected to destroy all microorganisms, with the exception of high numbers of bacterial spores.
- Intermediate disinfection – inactivates M. tuberculosis, vegetative bacteria, most viruses and most fungi, but does not necessarily kill bacterial spores.
- Low-level disinfection – can kill most bacteria, some viruses, and some fungi, but it cannot be relied on to kill resistant microorganisms (e.g., M. tuberculosis or bacterial spores).

There are two primary methods for applying surface disinfectants in healthcare environments, which were tested in the study discussed below:

1. Open-bucket system: This system employs an open bucket in which cotton rags or disposable cellulose-based wipers are submerged into the disinfecting solution and then taken out to wipe down various surfaces. To ensure that the chemical concentration of the disinfectant solution is adequate, a simple paper indicator strip is typically used to check the parts per million of active disinfectant present in the open bucket. However, this practice does not monitor the amount of active disinfectant present in the liquid deposited from the wiper to the surface.

2. Closed-bucket system with disposable nonwoven wipers: These disposable cleaning wipers have a fiber preparation that is compatible with bleach. They are typically purchased as a system with bucket dispensers included. A dry roll of these wipers can be placed into the bucket. Then, the cleaning or disinfecting chemical is added to saturate the wipers. The bucket is closed and the saturated wipers are dispensed via a port on the top of the bucket.

APIC calls for the use of disposable cloths during environmental cleaning as a way to prevent and/or control multiple drug-resistant bacteria and notes that, for all environmental surface cleaning, cloths should be thoroughly moistened with disinfectant. APIC further cautions against returning a cloth to the bucket of disinfectant once it has been used to wipe surfaces as this may "promote increased environmental contamination and microbial spread."

Optimizing Disinfection

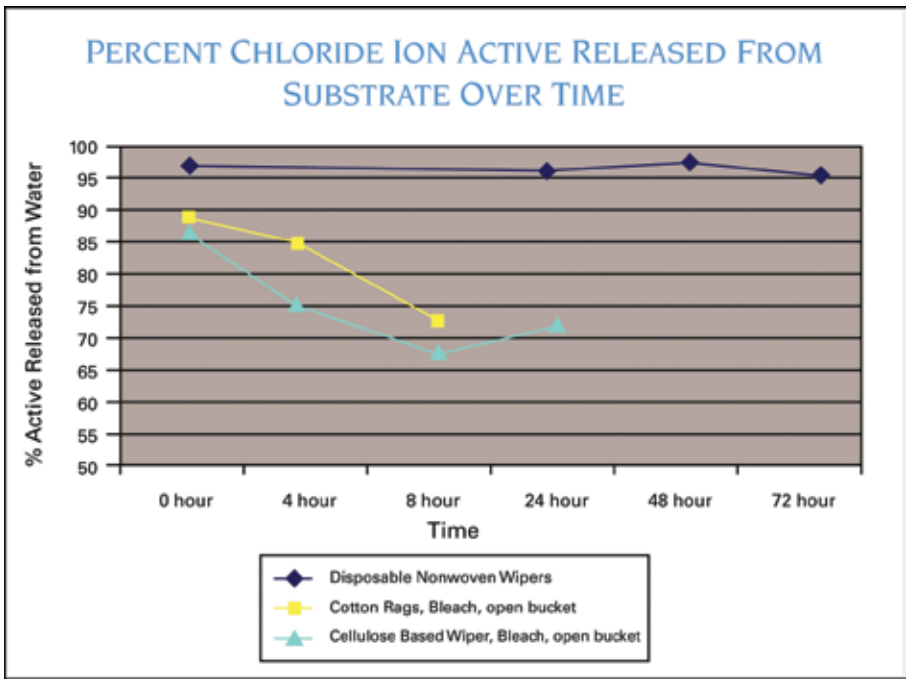
The selection and use of chemical germicides is an important step in the disinfection process. A number of disinfectants are currently in use in healthcare facilities, including alcohols, hypochlorites, chlorohexidine, iodophors, hydrogen peroxide, phenolics and quaternary amine compounds.

Typically, the main criteria for selecting a registered cleaning agent are cost, safety, product-surface compatibility and acceptability by housekeepers. Consider forming a cleaning products selection committee made up of representatives from environmental services, chemical and radiation safety, infection control, purchasing and campus safety. Talk with chemical suppliers to obtain product data sheets or labels for evaluation criteria such as dilution ratios, minimum exposure time to kill and stability of dilution.

According to the CDC guidelines, environmental surface germicides (intermediate- and low-level disinfectants) should specify (via labels, technical data and/or product literature) indications for product use. They should also provide claims for the range of antimicrobial activity, per EPA regulations. Make sure the cleaning product chosen has been registered with the Environmental Protection Agency (EPA) and has a registration number on the label.

Always refer to manufacturers' instructions for appropriate use sites, dilution and application methods. Also note that the CDC recommends against using high-level disinfectants/liquid chemical sterilants for disinfection of any environmental surface, as such use is counter to label instructions for these toxic chemicals. In addition, alcohol should not be used to disinfect large environmental surfaces.

Another important step in the disinfection process is the application of the disinfectant itself, which should be applied to the surface uniformly, and according to the manufacturer's directions. The surface should remain wet for the length of time recommended by the chemical manufacturer.



Study Results and Discussion

A study was conducted to evaluate the effects of commonly used wiping substrates (using common industry systems of saturation and disinfection practices) on the amount of bleach being released to surfaces for the purpose of disinfection. The wiping materials studied were common cotton rags and disposable cellulose-based wipers used with an open-bucket system and disposable non-woven wipers designed to be compatible with bleach used in a closed-bucket system.

The cotton rags and cellulose-based wipers were tested following a common hospital protocol in which the wipers are dipped into the open bucket to absorb disinfectant solution to be applied to a surface. The disposable non-woven wipers were used in a closed-bucket system with 90 pre-saturated wipers extracted as needed for the purpose of surface sanitation. This system keeps the wipers clean in the container and pre-saturated with the preferred disinfectant for an extended period of use.

The variables tested in the study – including the type of delivery system, the length of time the wipers were exposed to the chemical and the number of wipers placed in the chemical at one time – mirror practices commonly used in healthcare disinfection applications. The bleach solution tested was diluted to the chemical manufacturers' recommended level for disinfection. Because bleach tends to be less stable over time, the testing period was limited to 72 hours.

The study results showed that cotton rags and cellulose wipers in an open-bucket system rapidly depleted the active chloride ion present in bleach. However, the disposable non-woven wiper used in the closed-bucket system kept it stable for a full 72-hour period.

In the study, the chloride ion release from the first cotton rag from the open bucket was 11 percent lower than the original bleach concentration. The chloride ion release from the first cellulose-based wiper was 13 percent lower than the original bleach disinfectant solution and dropped to 28 percent lower after 24 hours of use.

In contrast, the initial chloride ion release for the disposable non-woven wipers was only three to five percent lower than the original bleach concentration even after 72 hours of use.

The significant decline in the release of bleach disinfectant when cotton rags and cellulose-based wipers were used in an open-bucket system implies that active disinfecting agents are not always applied to the surface in the ideal concentration to support optimum environmental disinfection. Selecting the appropriate wiper and system is critical to optimum disinfectant application.

The enclosed system helps to avoid contamination of the wipers and the cleaning solution because it eliminates any opportunity to re-dip the wipers into an open bucket. In addition, the use of the closed-bucket system reduces the need for mixing new solution batches because the system is stable for an extended period of time. Factors such as changes in pH and exposure to air and light, which can affect the stability of bleach, are not a problem because the closed-bucket system allows for minimal bleach and wiper exposure to air and light.

These closed-bucket systems are also portable, allowing cleaning crews to spot-clean germ "hot zones" throughout the day without the inconvenience associated with bringing a full cleaning cart into an occupied space. These benefits should save time and labor for the cleaning professional.

Cleanliness Important to Facilities, Patients

Infection rates in healthcare facilities are a major patient safety concern. In fact, cleanliness topped the list of factors considered by consumers in a 2005 national telephone survey about decision factors when choosing a hospital. An overwhelming majority (94 percent) of those polled rated "clean" as very important when deciding on a hospital, while 85 percent considered low infection rates very important in hospital selection. Moreover, nearly nine in ten survey respondents said that a higher-than-average infection rate is a very important reason to avoid a hospital, while four out of five respondents said that lack of cleanliness is a very important reason to avoid a hospital.

Commonly used materials, such as cotton or cellulose-based wipers, are far from optimal in their ability to deliver disinfectant actives to surfaces in the intended concentrations. The use of treated non-woven wipers with a fiber preparation designed to be compatible with disinfectant chemicals improves the delivery of the disinfectant chemical to the surface. Wiping systems that sustain disinfectant concentrations over prolonged periods can improve disinfection protocol consistency. Ultimately, the use of these tools helps create an optimized disinfection practice. ICT

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