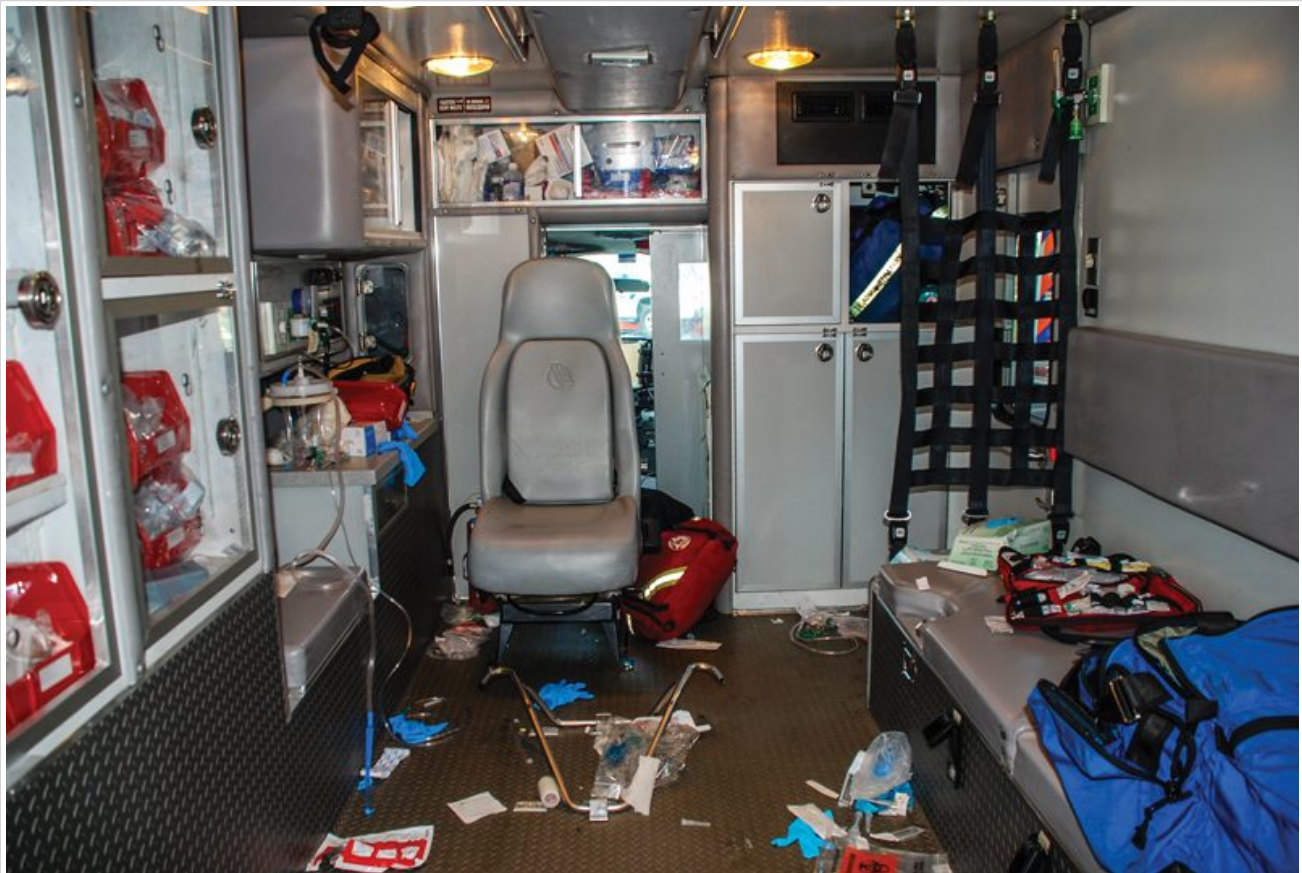




# Strategies for Keeping You and Your Patients Infection-Free

Tue, May 9, 2017 | By Katherine West, BSN, MEd, CIC



*Keeping your ambulance and equipment clean protects both you and your patients from acquiring a healthcare-associated infection. Photo A.J. Heightman*

There are many products in today's marketplace promoting that their use will kill virtually every organism known to man. Many companies claim that the use of their product eliminates the need for initial cleaning. Are these claims legitimate? And do they really remove the need for initial cleaning?

These are important questions, and additional questions must be addressed in order to answer them. First, are there replicated studies to support the claims? Second, is the cost of the product justified based on need and purpose-and in light of tight budgets and evidence-based practice in EMS? And third, will the use of new products for cleaning vehicles reduce the potential for patient infections?

Cleaning EMS vehicles and equipment has always played an important role in infection prevention for both patients and care providers. However, a review of published compliance monitoring data doesn't support that this is always accomplished.

In 2009, the U.S. Department of Health and Human services sent letters to medical facilities throughout the country stating that there would no longer be government reimbursement for healthcare-associated infections (HAIs), which means no Medicare or Medicaid reimbursement! The term HAI is new and replaced the term "hospital-acquired infections."

The terminology change represents a shift in focus from only hospital-acquired infections to a more broadened focus that includes EMS, ambulatory care and clinics. HAIs are defined as infections that people acquire while they are receiving treatment for another condition in a healthcare setting. Infections are considered healthcare associated if they first appear 48 hours or more after hospital admission and are not related to the admitting diagnosis or within 30 days after discharge.



**Although they may not look "dirty" or necessarily be the source of infection, a blue light reveals why high-touch objects and areas located in the vicinity of a patient should undergo regular cleaning and disinfecting. The bright yellow areas in the photos on the right highlights the soiled areas. Photos courtesy FoxFury Lighting**

## Current Issues

Ensuring that EMS complies with established infection control practices is very important. Not only does a patient infection equate to loss of revenue to the medical facility, but infection can result in severe adverse health effects for the patient. It should be noted that medical facilities are beginning to monitor EMS practices and the possible impact on patient infections. A review of the literature reveals that studies of compliance monitoring show poor compliance by EMS services involved in the studies.

In one study conducted by Bryan Bledsoe, DO, and his colleagues, compliance with practices for cleaning and disinfection of equipment was 31.6% for reusable equipment. The item that was most commonly cleaned was the stretcher.<sup>1</sup> This was an observational study involving 423 calls, which means the findings are particularly meaningful because such studies are considered the gold standard in monitoring compliance.

Let's take one example of a practice commonly seen during an EMS transport that can set a patient up for a urinary tract infection (UTI). A crew picks up a patient from a long-term care facility for transport to a medical facility. The patient has an indwelling urinary catheter and EMS places the catheter bag on the stretcher between the patient's legs. This practice creates backflow of urine to the bladder, which can result in the patient developing a healthcare-associated UTI that most likely will be diagnosed two days after admission. If determined to be a HAI, the average cost to treat a UTI is on average \$1,007.00, and that cost would be lost revenue to the facility if the patient is under Medicare or Medicaid.<sup>2</sup>

## What & How to Clean?

In 1989, the Centers for Disease Control and Prevention (CDC) published initial guidelines for cleaning EMS vehicles and equipment that in many respects are still appropriate.<sup>3</sup> For example, the guidelines state that low-level disinfection can be used for routine cleaning or removal of soiling when visible blood is not present; surfaces including floors, walls, ambulance seats and countertops that are contaminated with visible blood should be cleaned and then disinfected.

Cleaning is defined as the removal of visible soil and organic material from a surface or device using either physical action or chemical agents. Disinfection is defined as the process of microbial inactivation that eliminates virtually all vegetative pathogenic organisms but not spores. Items such as stethoscopes, blood-pressure cuffs and splints that are covered with blood can be cleaned with bleach and water (1:00) dilution (one-fourth cup bleach to one gallon of water). Items that are covered with visible blood or bloody fluids must be precleaned before disinfection. Cleaning must be performed for disinfection to be successful. This still holds true today.<sup>4</sup>

When selecting a cleaning agent, it's important to consider the following:

- >> suitability of the product for the area to be cleaned;
- >> ease of use;

- >> safety procedures, such as the PPE required for use;
- >> if it's labor saving;
- >> environmental impact;
- >> vehicle downtime.<sup>4</sup>

There's renewed focus on the role that environmental surfaces play in the spread of some types of hospital pathogens. This has brought the addition of many new products and marketing techniques into the marketplace. How does one choose what's best suited to their needs?

*Germicidal wipes:* The CDC has stated that premixed germicidal wipes are effective and only require a one-minute contact time. There are many such products in the marketplace to evaluate that eliminate potential errors in mixing and time-dating solutions. Wipes serve to ensure that solutions are in contact with surfaces to be cleaned and the focus of cleaning is to be "high-touch" areas. High-touch areas are defined as inanimate objects in the immediate vicinity of a patient (i.e., items used for patient care and the areas and equipment that come in contact with the patient). These areas figure prominently in the transmission of nosocomial pathogens.

New research conducted by the Society for Healthcare Epidemiology of America in September 2012, demonstrates that daily cleaning of high-touch surfaces in isolation rooms of patients with *Clostridium difficile* or methicillin-resistant *Staphylococcus aureus* significantly reduces the rate of the pathogens on the hands of healthcare personnel. The findings underscore the importance of environmental cleaning for reducing the spread of difficult to treat infections. As previously stated, multiple scientific papers have demonstrated significant microbial reduction with contact times of 30 to 60 seconds.<sup>5,6</sup>

*Ultraviolet germicidal irradiation:* The use of ultraviolet lighting (UVGI) isn't new. Its use began many years ago for cleaning air in medical facilities and laboratories. History shows that UVGI air disinfection had varying results on the air circulation of airborne particles.

Recently, there have been updates to the existing technology. However, there doesn't appear to be information on the actual performance for limiting the ability of organisms to grow and multiply when inhaled or when in contact with surfaces.

In an article published in the *American Journal of Infection Control*, researchers stated that more research is needed before relying on UVGI to prevent healthcare associated tuberculosis transmission.<sup>7</sup> Data shows that an efficient ventilation system helps reduce the spread of infectious particles and disease transmission. However, it's important to consider that ambulances have an air exchange rate of every two minutes when the exhaust fan is on, which is a U.S. General Services Administration KKK ambulance specification.

With regard to disinfection of surfaces, one study found that the use of UVGI on surfaces showed low-penetrating power and noted that this method could only be used when the use of liquid chemicals wasn't possible.<sup>8</sup> Some other studies showed that if mirrors were used to "bounce" UVGI around a room to reach all surfaces there was a reduction of vegetative bacteria in 15 minutes of exposure, and in spore-forming bacteria (e.g., *C. difficile*) there was a reduction with 50 minutes of exposure.<sup>8</sup>

Another factor to consider is that precautions for the use of UVGI are needed. The system must be turned off when working in the area, and protective clothing and eyewear should be worn to reduce overexposure. UVGI overexposure is associated with eye and skin irritations

Although there are studies that address the efficacy of UVGI, there appears to be a lack of epidemiological data to demonstrate that these systems prevent HAIs.

*Fumigation systems:* Chemical fumigation has been used effectively for building decontamination after a bioterrorism event and in agriculture. However, there have been times that fumigants have escaped and have caused illness and death in exposed workers and the public. Therefore, it's important to weigh and balance use of this technology.

Infectious agents are transmitted by organisms that survive on surfaces in the environment. Perhaps the most common route of transmission is contact with contaminated surfaces. This can result in infection transmission to a patient as well as to a care provider. As mentioned previously, high-contact areas are the focus of concern. Other areas like floors would be a low risk for infection. It's important to note that patients with preexisting medical conditions are at greater risk than a healthy care provider.

Research on fumigation shows that there's a challenge in killing microorganisms and preventing health effects from exposure to fumigants. The Environmental Protection Agency (EPA) published tests that provided scenarios for fumigation treatment as this method is more difficult to destroy surface contamination than to destroy spores-*C. difficile* and norovirus are both spore forming organisms.

EPA tests with fumigant on spores found a range of differences in effectiveness depending on the type of surface, the specific spore and type of fumigant. Performance was good on nonporous materials. Chlorine dioxide and formaldehyde showed a better killing action on spores than hydrogen peroxide (HPV). Other studies found that HPV was corrosive to surface materials. Studies conducted in France found that closing the door to the area to be cleaned with a cycle time of 4-5 hours resulted in spore inactivation.<sup>9</sup>

Some of the negatives associated with the use of fumigation are the long processing times, cost of equipment and inconvenient operation. The prevailing approach for reducing environmental surface pathogens remains manual cleaning focused on regularly touched surfaces.<sup>10</sup> The following is the most recent statement from the CDC on this issue, which it made in 2011: "More research is required to clarify the effectiveness

and reliability of fogging, UV irradiation and ozone mists to reduce norovirus environmental contamination. (No recommendation/unresolved issue)."<sup>11</sup>

The American Industrial Hygiene Association (AIHA) published a white paper on the use of fumigation systems that stated its significant concern about the use of chemical fumigation due to its potential for inadvertent occupational and public exposure. The AIHA recommended that, because of the potential for inadvertent exposure to people and damage to surfaces or equipment, chemical fumigants should only be used when the benefits clearly exceed the risks.<sup>12</sup> It added that there might be a place for using chemical fumigation following a bioterrorism attack.<sup>13</sup>

## Staying Clean

Review of the literature reveals that there's no quick fix to the cleaning issue and, in the end, there's no substitute for plain old cleaning. However, studies have noted that compliance with cleaning practices has been a problem. Enhanced cleaning procedures have resulted in reduction in organisms. May vehicle redesign assist in improving cleaning routines? A study was undertaken in London, England, to look at various aspects of ambulance redesign. This study also focused on high-touch surfaces. Vehicle design should ensure that high-touch areas are easy to clean.

Compliance monitoring is an important manner to document that personnel are cleaning vehicles and equipment properly. Compliance monitoring is a requirement under the Occupational Safety and Health Administration Bloodborne Pathogens standard and the general duty clause of the 1970 Occupational Safety and Health Act (OSH Act). Section 5(b) of the OSH Act states the following, which all emergency response employers need to consider: "Each employee shall comply with occupational safety and health standards and all rules, regulations and orders issued pursuant to this Act which are applicable to his own actions and conduct."<sup>14</sup> Any noncompliance issues should be addressed in education and training.

The bottom line: Nothing replaces initial cleaning.

## References

1. Bledsoe BE, Sweeney RJ, Berkeley RP, et al. EMS provider compliance with infection control recommendations is suboptimal. *Prehosp Emerg Care*. 2014;18(2):290-294.
2. Scott RD. (March 2009.) The direct medical costs of health-care associated infections in U.S. hospitals and the benefits of prevention. Centers for Disease Control and Prevention. Retrieved Feb. 27, 2017, from [www.cdc.gov/hai/pdfs/hai/scott\\_costpaper.pdf](http://www.cdc.gov/hai/pdfs/hai/scott_costpaper.pdf).
3. Centers for Disease Control (CDC). Guidelines for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health-care and public-safety workers. *MMWR Suppl*. 1989;38(6):1-37.
4. Gebel J, Exner M, French G, et al. The role of surface disinfection in infection control. *GMS Hyg Infect Control*. 2013;8(1):Doc10.
5. Sattar S. Promises and pitfalls of recent advances in chemical means of preventing the spread of nosocomial infections by environmental surfaces. *AJIC*. 2010;38(5):S34-S40.
6. Rutala W, Weber W, HICPAC. (Nov. 2008.) Guideline for disinfection and sterilization in healthcare facilities. Centers for Disease Control and Prevention. Retrieved Feb. 27, 2017, from [www.cdc.gov/hai/pdfs/disinfection\\_nov\\_2008.pdf](http://www.cdc.gov/hai/pdfs/disinfection_nov_2008.pdf).
7. Memarzadeh F, Olmsted RN, Bartley JM. Applications of ultraviolet germicidal irradiation disinfection in health care facilities: Effective adjunct, but not stand alone technology. *Am J Infect Control*. 2010;38(5 Suppl 1):S13-S24.
8. Escombe AR, Moore DA, Gillman RH, et al. Upper-room ultraviolet light and negative air ionization to prevent tuberculosis transmission. *PLoS Med*. 2009;6(3):e43.
9. Rutala WA, Gergen MF, Weber DJ. Room decontamination by UV radiation. *Infect Control Hosp Epidemiol*. 2010;31(10):1025-1029.
10. Byrns G, Fuller T. The risks and benefits of chemical fumigation in the health care environment. *J Occup Environ Hyg*. 2011;8(2):104-112.
11. Webb R. (Feb. 1, 2011.) A fast track to zero environmental pathogens using novel hydrogen peroxide technology. *Infection Control Today*. Retrieved Feb. 27, 2017, from [www.infectioncontroltoday.com/articles/2011/02/a-fast-track-to-zero-environmental-pathogens-using-novel-ionized-hydrogen-peroxide-technology.aspx](http://www.infectioncontroltoday.com/articles/2011/02/a-fast-track-to-zero-environmental-pathogens-using-novel-ionized-hydrogen-peroxide-technology.aspx).
12. American Industrial Hygiene Association. (Dec. 14, 2009.) American Industrial Hygiene Association position statement: Chemical fumigation in healthcare settings. Retrieved Feb. 27, 2017, from [www.aiha.org/government-affairs/PositionStatements/PStment-Fumigation-12-14-09.pdf](http://www.aiha.org/government-affairs/PositionStatements/PStment-Fumigation-12-14-09.pdf).
13. CDC. Update: Investigation of bioterrorism-related anthrax and interim guidelines for exposure management and antimicrobial therapy, October 2001. *MMWR Morb Mortal Wkly Rep*. 2001;50(42):909-919.

14. U.S. Department of Labor. (1970.) Occupational Safety and Health Act of 1970. Section 5 (b). Duties. Occupational Safety and Health Administration. Retrieved Feb. 27, 2017, from [www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=OSHACT&p\\_id=3359](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHACT&p_id=3359).

By

[Katherine West, BSN, MEd, CIC](#)

Katherine West, BSN, MEd, CIC, is an infection control consultant with Infection Control/Emerging Concepts Inc. and a JEMS Editorial Board member. Contact her at [info@ic-ec.com](mailto:info@ic-ec.com).

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