Electrostatic Technology for Surface Disinfection in Healthcare Facilities

By: Joshua T. Robertson  
Edited by: Andrew Duong  
Date: October 14, 2016

Abstract:

Studies have shown that less than 50% of environmental surfaces in patient care rooms are properly cleaned and disinfected. Evidence strongly suggests that cross contamination of microorganisms from environmental surfaces is directly related to patient infections. High-touch surfaces such as bed rails, bed surfaces, tables, fluid poles, doorknobs, and supply carts have all been identified as having the greatest potential for transmission of pathogens. Current cleaning/disinfecting methods and procedures are critical to prevent the transmission of infectious diseases, yet, nearly 100,000 people will die this year directly attributable to HAIs. Electrostatically applied disinfectant may assist in the battle against preventable infections, improve patient experience, while increasing hospital revenues.

Main Article:

One out of every 25 patients who are admitted to a hospital will contract a preventable healthcare-acquired infection (HAI). According to a 2002 study, approximately 1.7 million HAIs occur in U.S. acute care hospitals each year, resulting in 99,000 deaths at a total direct, indirect and nonmedical social cost estimate of $96-147 billion per year.\(^1\text{,}^2\) Study estimates did not include the more than 26,000 U.S. facilities such as ambulatory surgical centers, skilled nursing, long-term acute care, hospice, or dialysis centers. Obviously these HAI statistics are dated and may be vastly underestimated. In April 2016, the CDC approximated that the actual number of deaths from sepsis were as much as 140% higher than those recorded on death certificates, or as many as 381,000 deaths a year. Sepsis is just one subgroup of the infections.\(^3\) Healthcare-acquired infections continue to occur at alarming rates in U.S. hospitals and represent a significant cause of morbidity and mortality. HAIs have a devastating impact on people’s lives, the national economy, hospital reputations and financial sustainability.\(^4\)

Studies Have Indicated That Inadequate Cleaning And Disinfecting Of Surfaces Is Widespread

The physical environment is an important link in the chain of infection prevention and control. Contaminated environmental surfaces provide an important potential source for transmission of healthcare-associated pathogens.\(^5\)
Cleaning and disinfecting of environmental surfaces in healthcare facilities is fundamental in healthcare facilities. The Centers for Disease Control and Prevention (CDC) Guidelines recommend that hospitals clean and disinfect all “high-touch surfaces.” High-touch surfaces include: bed rails, bed surfaces, supply carts, over-bed tables and intravenous pumps. Experts agree that monitoring terminal room cleaning and disinfecting practices in healthcare facilities is an important element of infection control programs. Still, studies have indicated that inadequate cleaning and disinfecting of surfaces is widespread with housekeeping wiping only 50% of surfaces targeted for cleaning.

One way to break the chain of infection includes the use of innovative technology such as the application of EPA-registered disinfectants using electrostatic systems. As compared to traditional spray-and-wipe, fogging, and UV lighting, electrostatic disinfection application systems present a complementary and cost effective approach to healthcare facility environmental surface disinfection methods. Electrostatic spraying has been used in the agricultural and automobile industry for decades. In effect, a spray gun modified with an electrode charges the liquid particles, which are then guided to an oppositely charged target. Based on Coulomb’s law, an electrostatic disinfectant application system applies disinfectant more evenly to all surfaces. Coulomb’s law states that the magnitude of the electrostatic force of interaction between two point charges is directly proportional to the scalar multiplication of the square of the distance between them. The force is along the straight line joining them.

Electrostatics is a proven technology in the agricultural and automotive industries. This technology is now being integrated into healthcare settings as a tool to break the chain of pathogen mobility. As an example, Creative Solutions in Healthcare owns and operates 46 skilled nursing and 13 assisted living facilities throughout the state of Texas. This top-50 ranked long-term care facility company uses electrostatic application technology in their efforts to prevent the transmission of dangerous pathogens. According to Gary Blake, President of Creative Solutions, this technology “has proven to be far more cost-effective than we ever dreamed possible. There’s a huge chemical cost savings, our employees are healthier – they’re staying at work, so our overtime is down in many markets during flu season. Our residents are returning home sooner from their rehab stays with us instead of going back into the hospital, and that’s gotten the attention of our managed-care insurance companies and even from Medicare.”

Most surface areas are neutral (uncharged) or negative. Electrostatic application for healthcare surface disinfection is a method of applying an EPA-registered disinfectant to a target surface area using electrostatic force of attraction. Using Coulomb’s law, these systems place a positive or negative charge on the chemical disinfectant as it leaves the spray nozzle. Because most surface areas are neutral or negative, a positively charged electrostatic spray application system optimizes adhesion and attraction (electromagnetic theory). The dispersed droplets spread out more evenly and seek out the negative (-) or neutrally charged surface (neutral surfaces have the same number of protons as electrons – a neutral object can be polarized by a charged object and create attraction). The disinfectant is more targeted, provides more consistent coverage with less waste, and like two magnets, attracted to the oppositely charged surface with remarkable force.

Pathogens Can Survive On Surfaces For Months

Most common nosocomial pathogens can survive on surfaces for months. These deadly bugs can become a continuous source of transmission. As such, regular, preventative surface disinfection is recommended. Wiping hard surfaces with contaminated cloths can contaminate hands, equipment, and other surfaces. Those involved in the prevention and control of infections require a balanced approach of cost and quality to improve outcomes. Existing healthcare disinfection methods including wipes, spray and wipe, fogging, and UV lighting all have their place in a multimodal IPC program, but may be ineffective or cost prohibitive for routine or comprehensive use. As environmental surface contamination and healthcare-acquired infections have become more defined, electrostatic disinfection application systems present a viable and cost effective tool in the environmental surface disinfection arsenal.
The battle against nosocomial pathogens is costly. This has become even more pronounced in light of the Hospital Value-Based Purchasing (VBP) Program. VBP rewards or penalizes hospitals based on degrees of care quality. Centers for Medicare & Medicaid Services (CMS) bases hospital performance on an approved set of measures and dimensions grouped into specific quality domains. For 2017, The CMS has created a new safety domain that primarily measures infection rates. Yet, most infection prevention and environmental surface teams continue to use antiquated or cost prohibitive disinfection methods including labor-intensive hand-wiping or UV lighting.

As presented, research studies have shown that environmental cleaning and disinfection play important roles in the prevention and control of healthcare-acquired infections. Though prevalent and widely used in other industries, electrostatic technology is now being adopted in the application of disinfectants. This new, innovative technology may assist in the battle against preventable infections, improve patient experience, while also increasing hospital revenues.

References: