Fighting Superbugs

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A look at the role of the environment in the spread of infection-causing superbugs, and how best practices and new technology to enhance cleaning can help prevent their transmission.

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The 3M™ Clean-Trace™ Hygiene Management System monitors surface cleanliness.

‘Superbug’ – it’s a term often used when discussing infection risks in hospitals today. While the worded definition may vary slightly from institution to institution, the term ‘superbug’ refers to drug-resistant bacteria, meaning it can cause a serious infection and cannot be treated with common antibiotics. According to Michelle Hulse Stevens, MD, medical director for the Infection Prevention Division of 3M Health Care, these forms of bacteria have been dubbed ‘superbugs’ because when they cause infection, they’re harder to treat.

“They usually behave the way the drug sensitive organisms behave,” Dr. Hulse Stevens says, “but they’re more difficult to treat because of their drug resistance.”

Devices that are used to support patients while in the hospital, such as catheters and breathing tubes, are currently commonly associated with hospital-acquired infection, Dr. Hulse Stevens explains. It is well-known among healthcare professionals that central venous catheters place the patient at great risk of acquiring blood stream infections, urinary catheters can increase the risk of bladder infections, and breathing tubes can lead to ventilator-associated pneumonia.

Controlling these superbugs within the hospital environment, including on surfaces,

has become a growing concern. According to Grace Thornhill, PhD, Technical Service Specialist for 3M Health Care's Infection Prevention division, the strains of bacteria that make patients ill are the same strains found on surfaces in the hospital or colonize the devices used to support patients. Specifically, Methicillin-resistant Staphylococcus aureus (MRSA), Acinetobacter baumanii (multi-drug resistant gram negative rods), Vancomycin resistant enterococci (VRE), and Clostridium difficile (C. diff) are the main superbugs posing a concern in terms of the environment for hospitals today.

Elimination of all infections from superbugs is not a realistic goal, says Joanne Levin, MD, medical director of infection prevention at Cooley Dickinson Hospital.

"It's not about elimination per se because patients come to us from the community with these diseases – with MRSA, with VRE, with C. diff," she says.

In a hospital, Dr. Hulse Stevens says these organisms become part of the environment's flora. "The hospital environment is not sterile," she says.

Therefore, Dr. Levin says, the issue of superbugs is not about elimination, but rather, transmission. Superbugs can be transmitted through the environment indirectly by a patient or staff member touching a colonized surface or device. Or, they can be transmitted directly via human contact such as from a healthcare worker to a patient. This makes compliance with basic infection prevention protocols such as hand hygiene and barrier protection important as the starting point to reducing superbug transmission.

Furthermore, research shows enhanced cleaning is one intervention that can reduce the risk that these organisms will be transmitted to a patient.

"Several studies have demonstrated that if you enhance environmental cleaning, you do see a reduced infection rates in patients," Thornhill says.

Traditionally, hospital environmental services staff have utilized checklists and visual inspections to gauge whether they are achieving sufficient cleaning. Some hospitals may require cleaning staff to be observed to ensure they are in compliance with protocol. Other facilities have used visual fluorescent dyes or markers to mark surfaces in a room before being cleaned, then go back in after it's cleaned with a UV light detector to see if any marks are left – indicating it hasn't been adequately cleaned.

Still, these solutions aren't always sufficient, as indicated by the rates of infection caused by superbugs.

Take, for example, C. diff. While specific numbers are not available, the Centers for Disease Control and Prevention (CDC) tracked a nearly twofold increase in C. diff infections from 1996 to 2003. Two statewide studies in Oregon and Massachusetts found C. diff infections increasing at an even faster pace.

According to Dr. Levin, C. diff is an example of an especially-virulent superbug. The

organism can make spores, which are like seeds with a hard shell, that even strong hospital cleaning products can't penetrate. Subsequently, C. diff can live in an environment for months. In one study, C. diff spores were found on 49 percent of surfaces in hospital rooms housing a patient with the infection and on 29 percent of surfaces in rooms with a patient who carries the germ but had no symptoms, according to a March 2011 report in *Infection Control and Hospital Epidemiology*.

Therefore, technology has been developed to help hospitals enhance environmental cleaning beyond traditional methods. Whole-room disinfection products have emerged that use either UV light or fogging/misting technology to disinfect entire rooms in a hospital. In fact, a March 2011 study at the University of Texas MD Anderson Cancer Center found that the use of a UV light disinfection device reduced contamination found on 75 surfaces, such as hospital floors, walls, tray tables and handrails, in 12 patient rooms, and eliminated VRE bacteria.

According to Thornhill, the 3M™ Clean-Trace™ Hygiene Management System, an ATP bioluminescence technology to monitor surface hygiene, is another tool to assess cleaning compliance and efficacy.

As Dr. Hulse Stevens explains, ATP bioluminescence products detect adenosine triphosphate (ATP), a substance found in all living cells and present on contaminated surfaces. Samples from surfaces in a hospital are collected using a swab that is then put into a luminometer. If ATP is detected, light is emitted in direct proportion to the ATP present, which can be read and quantified. Data collected can be uploaded to software for advanced data analysis with tracking and full trending capabilities.

This technology is currently being used on environmental surfaces in patient rooms, ORs, even cafeterias in a hospital – anywhere cross contamination is a risk, Thornhill says. It's also used to assess cleanliness of surgical instruments before going into sterilization or high-level disinfection.

"There has been interest in having objective measure available for training and monitoring in environmental services," Dr. Hulse Stevens says. "When infection control has identified a problem with an organism known to the present in the environment, the environmental services management can demonstrate performance objectively as the infection control team performs root cause analysis in order to prioritize areas of focus to identify the cause of the problem."

Going forward, Dr. Hulse Stevens points to antimicrobial stewardship as a key effort in reducing drug-resistant organisms overall.

"It's important to understand that the evolution of drug-resistant bacteria is most directly linked to overuse of antibiotics – called antibiotic pressure," Dr. Hulse Stevens says. "Therefore, being judicious with antibiotic use is critically important to minimizing the emergence of resistance."

In fact, Dr. Hulse Stevens says antimicrobial stewardship programs have been evolving to provide education and process flow to guide individuals to the most

appropriate antibiotics for treating infections.

“I think the principle is to use antibiotics for indicated purposes such as a bacterial infection or for surgical prophylaxis for indicated procedures,” she says, “While these programs are evolving, it is important to use multifactoral interventions to address the environment because the solution is not singular.”

From a technology standpoint, Thornhill sees a need for a real-time identification method that could be integrated into surface hygiene monitoring technology. The availability of real-time objective data, says Karim Mansour, Global Business Director for 3M Health Care’s Infection Prevention division, can aid facilities in making the quick decisions necessary to prevent outbreaks, and help ensure that hospital infection prevention methods are adequate.

“The adoption of new technology is all about putting a quality process in place, which is what most hospitals are being asked to do today,” Mansour says, “to make sure you have the right measurements to prevent infection.”

Still, even with new technology, Thornhill says, it’s important for all hospital professionals to keep a broader perspective when fighting superbugs.

“Go back to first principles,” she says. “Wash your hands. Keep the room clean. That does a lot to fight these infections. Look at it from a multi-modal perspective. Antibiotic stewardship, environmental cleaning – all of this needs to be looked at from a holistic point of view.”

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