HEALTHCARE FACILITIES TODAY®

# Does your air measure up?

By Linda D. Lee, DrPH / Special to Healthcare Facilities Today
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Infection prevention (IP) professionals agree their highest priority is keeping patients safe. For decades, these experts have discovered, evaluated and implemented new and innovative approaches to IP, while maintaining proven prevention measures such as hand hygiene and environmental cleanliness.

One of the biggest challenges is that the bugs are getting stronger and smarter. Superbugs are more resistant to the antibiotics used against them, infecting more than two million people in the U.S. each year, according to the Centers for Disease Control and Prevention (CDC). *Clostridium difficile* (*C. diff*) and methicillin resistant *staphylococcus aureus* (*MRSA*) can persist on surfaces for months after an infected patient has left the room. Airborne dispersion may play a role in healthcare-associated infections (HAIs), such as MRSA and *C. diff*, with surface contamination and subsequent cross transmission.[1]

***"Airborne dispersion may play a role in healthcare-associated Infections, such as MRSA and C. diff"***

In addition, the Centers for Medicare & Medicaid Services (CMS) has begun to penalize facilities when their patients contract HAIs. Other new legislation, including the Readmissions Reduction Program and the Hospital Acquired Conditions Reduction Plan also impact healthcare system economics. Where is the light in this tunnel?

The answer is, it's in the light itself.

As the Corporate Director of Infection Prevention at Universal Health Services, Inc. (UHS), Maureen Spencer, RN, M.Ed, CIC, is a resource for Infection Preventionists and analyzes HAI data and trends that influence program decisions and products. She's engaged in the here and now of the UHS system, but constantly looking toward the future, to get ahead of the curve in terms of enhancing the wellbeing of patients, staff and visitors.

Last year, she was intrigued to learn of a new delivery system for ultraviolet germicidal irradiation (UVGI), because the concept is so well established. Hospitals have long used UVGI to clean the air, and in fact, Spencer notes, many UHS hospitals have a robot for UVGI-delivered surface cleaning. There are limitations to implementing this approach, however. The initial investment is high, but more importantly, the space has to be unoccupied for the robot to operate. That can be hard to realize in a busy ICU or ED. It also requires resources from environmental services to decontaminate isolation rooms after terminal cleaning.

So when she heard of an unobtrusive technology that brings active Ultraviolet C (UV-C) air treatment to the room level, Spencer wanted to know more. And she wanted proof.

**Protecting patients**

The most contaminated areas in a patient room are the surfaces closest to the patient, according to a study published in *Infection Control and Hospital Epidemiology*. Surfaces associated with patients' beds were the most heavily contaminated with hospital pathogens.2 These areas can be difficult to clean completely, especially in an ICU or ED, where the beds are seldom empty and patients can be very ill. Patients in the ICU are often surrounded by a great deal of equipment, with cords dragging across the floor and attracting dust and dirt. The environmental team can only do so much when the room is occupied by a critically ill patient. These patients are among the most vulnerable, and require vigilance to protect them in every way possible.

**And what about the air?**

The IP community has had HAI bundles for many years, but infections still happen. Focus was so concentrated on the patient that attention to the environment declined. The idea of an "air scrubber" appealed to Spencer. Just making the bed can release bacteria into the air – an evaluation of bed making-related airborne and surface *MRSA* contamination confirmed air current transmission. [3]

> ***"Just making the bed can release bacteria into the air"***

Says Spencer: "If we could find a way to treat those contaminants in the air, we would improve the environment for everyone.

This prompted her research into the VidaShield™ air treatment system. The VidaShield UV-C mechanism is housed atop a standard footprint (2 x 4) ceiling light fixture. Because the UV light itself is completely shielded, the room doesn't need to be vacant before it can be used, and, in fact, the system can operate in the background, 24/7, whether the room light is on or off, making it ideal for areas that are seldom unoccupied.

Unlike other, passive systems, the system houses four small fans (like the ones in a desktop computer) that pull room air into the system at 50 cubic feet per minute. The air passes through a MERV-6 filter, then on through the mirrored irradiation chamber where the DNA of the bacteria and fungi is disrupted so it can't reproduce or mutate.

The treated air is then pushed back into the room. The intake and exhaust vent baffles are angled to prevent constant recirculation of the same air.

And because most hospital rooms already have a light source directly over the patient bed, the unit is well-suited for purifying the air closest to the patient, without requiring costly renovations.

This made good sense to Spencer, but she wanted to experience the system with her colleagues in a real world setting, so together they could judge proof of concept and determine the efficacy of the solution.

In December 2015 through January 2016, they designed and executed an environmental study and pilot test at Desert Springs Hospital Medical Center in Las Vegas, Nevada. The implementation team included Maureen Spencer, RN, M.Ed, CIC, Corporate Director of Infection Prevention, UHS; Dr. Deborah Ellis, PhD, MSPH, MLS (ASCP), CIC, Senior Director of Infection Prevention for the Valley Health System, of which Desert Springs is a member; Kristine King, RN, BSN, CIC, Infection Prevention Manager, Desert Springs Hospital Medical Center; Jouleen Cotton, RN, BSN, Infection Prevention Consultant, Desert Springs Hospital Medical Center; and Linda Lee, DrPH, MBA, Chief Science Officer, VidaShield.

Desert Springs is a 293-bed acute care facility with 24-hour emergency services. It was founded in 1971, and although the hospital is well-maintained and in excellent shape, it still has 45 years of history within its walls. Aging systems can increase the burden of microorganisms in the air.

> ***"Aging systems can increase the burden of microorganisms in the air. Its not uncommon for unpleasant odors to be present."***

Within Desert Springs' ED is a psychiatric observation department (POD), a six-bed psychiatric holding area where people with mental health conditions are triaged, diagnosed, and treated. The POD also houses a Nurse's Station, a bathroom and a TV area.

Access to the unit is controlled, though the area can be bustling. It's a high traffic, high turnover location, and it's rarely empty. Because of all the activity, it can be challenging to clean completely. It's not uncommon for unpleasant odors to be present.

**Pilot study**

We designed an environmental study and pilot test as a before-and-after scenario. The air and selected surfaces within the POD were sampled for bacteria, after which 13 active air in-room UV-C systems were installed. After the units were operational, the sampling was repeated to determine differences in the quantity of microorganisms found.

Pre-installation sampling was achieved by running a Surface Air System (SAS) 180 sampler to pull 1000L of air through it per sample plate. Samples were collected onto agar plates/petri dishes, specifically designed to culture bacteria. When dozens of samples had been collected over two days, the plates and chain of custody documents were packaged with gel packs into a cooler and shipped

overnight to an independent lab for incubation. All plates were incubated for 5-7 days, after which the growth colonies were inspected and evaluated. An error correction, standard in the industry, was performed for all air sampling samples, using the SAS 219-Hole Impactor Correction Factor. Total raw colony forming units (CFUs) were reported and averaged.

Several weeks later, the sample collection was repeated. The same protocol was followed and the same independent lab was used. Because this was a live field study and not a laboratory experiment, some conditions were different. The patient population had changed, and the number of non-patient personnel present in the POD was significantly higher in the post-test than in the pre-test.

**Outcomes, feedback**

Although there were peaks and valleys for some individual values, which is to be expected in a busy unit, it's clear that the overall burden of microorganisms in the air and on surfaces was greatly reduced. Air samples (minus a few outliers) showed a 64 percent reduction in microorganisms. The surface samples did even better, with a 66 percent overall reduction. The greatest reductions were in the bathroom, with a 72 percent reduction, and at the Nurse's Station, where the air samples less outliers yielded a 70 percent reduction in microorganisms.

***Air samples were reduced by 64% Surface were Reduced by 66%***

The staff had positive comments. Hospital windows generally don't open; staff are inside all day. All three shifts of nurses and staff remarked on the improvement in air quality and odor, saying with the VidaShield system the air feels clean. Other anecdotal comments include an employee reporting her allergies no longer bothered her and the absence of odors common to the area.

It has been well established that contaminants can be abundant in the air, and those pathogens can settle out of the air and land on surfaces, where they may linger. With this study, the UHS team underscored the relationship between air and surface contamination and demonstrated the efficacy of the technology. It makes a significant impact on infection control efforts, reduces airborne microorganisms, and removes odors and allergens from the air, improving indoor air quality, enabling UHS and Desert Springs to provide a healthier environment for patients, visitors, and staff.

"I see this technology as part of an environmental bundle approach," says Spencer. "It's not only the patients who reap the benefits of cleaner air. With less settling on surfaces and fewer microorganisms circulating in the air everyone breathes better, staff exposure to harmful pathogens is also reduced. It's a demonstration that the health system cares about their comfort and safety as well as that of the patients," Spencer adds. "We're adding VidaShield systems to our bundled environmental approaches to prevent HAIs."

***"It's not only the patients who reap the benefits of cleaner air… everyone Breathes better."***

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**The data for this environmental study was published prior to being evaluated for correctional hole factor which impacts air sampling results. Therefore, adjustments are not reflected in the article above. Results of the testing showed that airborne bacteria levels were reduced by 80% instead of 66%.*

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http://www.healthcarefacilitiestoday.com/posts/Does-your-air-measure-up--13470

**1King MF; Noakes CJ; Sleigh PA; Camargo-Valero MA**. Bioaerosol Deposition in Single and Two-Bed Hospital Rooms: A Numerical and Experimental Study' *Building and Environment* (*2012*). Available to download (DOI 10.1016/j.buildenv.2012.09.011)
**2 Moore G, Muzslay M, Wilson APR**. The Type, Level, and Distribution of Microorganisms within the Ward Environment: A Zonal Analysis of an Intensive Care Unit and a Gastrointestinal Surgical Ward. *Infect Control Hosp Epidemiol*. Vol. 34, No. 5, Special Topic Issue: The Role of the Environment in Infection Prevention (May 2013), pp. 500-506
**3Shiomori T, et al**. Evaluation of bedmaking-related airborne and surface methicillin-resistant Staphylococcus aurous contamination. *J Hosp Infect*. *2002;50*:30–35. [PubMed]