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Information and insight for the healthcare facility team

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

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]

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.

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.

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."

Linda Lee, DrPH, MS, MBA, is the Chief Science Officer at American Green Technology, South Bend, IN, and lead researcher for environmental testing of VidaShield. She can be reached at ldlee@agtus.org

1**King 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

3 **Shiomori T, et al**. Evaluation of bedmaking-related airborne and surface methicillin-resistant Staphylococcus aureus contamination. *J Hosp Infect. 2002;50:*30 –35. [PubMed]

BECKER'S
Infection Control & Clinical Quality

Driscoll Children's reduces airborne bacteria by 73% in active air UV-C system study

Written by Nancy Fallwell, RN, MSN, MHA, Director of Infection Prevention, Driscoll Children's Hospital | May 16, 2016

It started with an odor. Something smelled... musty. It wasn't horrible, but it wasn't right. We launched an investigation to start looking for the source.

Driscoll Children's Hospital in Corpus Christi, Texas is a tertiary care, regional referral center offering complex and comprehensive medical and surgical care for children. Our location near the Gulf of Mexico makes high humidity a frequent issue. Was someone's nose just working overtime or was there really a problem? What if the smell was indicative of a greater issue with mold, bacteria or fungus, any of which can trigger hospital-associated infections (HAI)?

The CDC considers hospital-associated infections to be a threat to public safety, reporting nearly three-quarters of a million HAIs in hospital patients. More than 75,000 people with HAIs died during their hospitalizations. The problem is real, growing, and urgent. We didn't have an outbreak of infectious disease, but weren't willing to wait until an outbreak occurred.

We launched a comprehensive internal investigation of sourcing and air sampling, then designed and conducted an evidence-based pilot to confirm and resolve air quality issues. The study reflected the impact of an active environmental air treatment system with an ultraviolet germicidal irradiation chamber on neutralizing airborne pathogens. The pilot resulted in a 73 percent decrease in the total airborne bacteria count and a 44 percent decrease in airborne fungal counts.

First steps

Before we initiated the study, we tried to source and solve the musty odor problem. Over the course of 10 weeks, our teams looked top to bottom, from fan coils in patient rooms to sink drains, but no leaks were found. Our engineers reinforced the walls over drainage lines to see if that would correct the problem. It did not.

They looked at the air conditioning lines in the ceiling, and found condensation due to the temperature differences between the warmer air and the cold lines. They installed fans in the ceiling, but that solution caused its own set of problems, so the fans were removed. And the smell lingered.

Because we couldn't locate a physical source for the odor, we turned to the air. Air sampling revealed new issues: we learned what pathogens were in the air, and how many. But were the number and type of organisms unacceptable? That was undetermined, because we discovered there are no universally accepted standards for air quality in medical

facilities. The industrial hygienists we consulted had differing opinions, so we created our own standards for the air quality in patient rooms.

We're a children's hospital and see patients from birth to age 21. Some are especially sick: some are immunocompromised, some have had transplants, some have cancer, and some have had cardiac surgery. This patient population is already at increased risk, and they're under our care. We wanted to offer them greater protection.

Cleaning the air

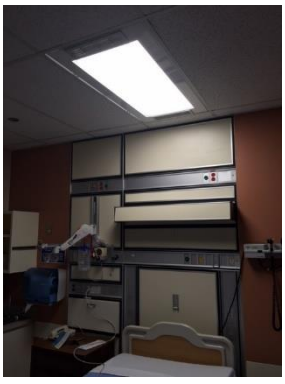
Cleaning a patient room in a hospital starts with surfaces. All people shed bacteria constantly, and these bacteria collect on bed rails, light switches, sinks, even bed linens. Fungus settles out of the air and lands on surfaces as well. These surfaces are all cleaned according to a strict protocol. We even employ an ultraviolet light to spot check surfaces for cleanliness. But what about the air? How do you clean something you can't even see?

Again, the answer is ultraviolet light. Although hospitals have understood the benefits of ultraviolet germicidal irradiation (UVGI) and used it for decades, there have been challenges to implementing this technology. A surface had to be in the direct line of the light in order to be cleaned. It couldn't be used in an occupied space, and as soon as cleaning was complete, pathogens could begin to accrue again through settling. And the devices were expensive. We wanted to use this technology to clean the air itself.

Enter the Health Risk Management System, where the HRMS UV-C/UVGI mechanism is housed atop a standard footprint (2 x 4) ceiling light fixture. Because the ultraviolet light itself is completely shielded, the room does not need to be vacant, and, in fact, can operate 24/7 in an occupied room. Each unit houses four small fans (like those in a laptop computer) that pull room air into the system at 50 cubic feet per minute. The air passes through the irradiation chamber, and then the cleaned air is pushed back into the room. The intake and exhaust vents are set at a 30 degree angle, which moves the air in a pattern that avoids repeatedly recirculating the same air.

The pilot

When we determined that cleaning the air was a reasonable next step, we set about designing a pilot study with Dr. Linda Lee, DrPH, MBA of American Green Technology. A room at Driscoll would be selected, and the air sampled for an independent testing agency to culture and report its findings. Then the HRMS lighting/air treatment units would be installed, and later further sampling and testing conducted and the results compared. It was a way to objectively measure which and how many contaminants were in the air, and whether and how well the active UV-C air treatment units worked to reduce the levels of contaminants in the air.



For the study, we selected patient room 425 on the fourth floor oncology unit. The room of approximately 220 square feet was vacant and had been terminally cleaned and was under positive pressure. Pre-installation sampling was done by running the SAS 180 sampler to pull 1000L of air through it onto agar plates specific to collect bacteria and separate agar for fungus.

When 30 samples for bacteria and fungus had been collected over two days, the plates and chain of custody documents were packaged under refrigerated conditions and shipped overnight to the independent lab for incubation. All plates were incubated for 5-7 days, after which they were evaluated. An error correction, standard in the industry, was performed for all air sampling samples, using the SAS 219-Hole Impactor Correction Factor.

After two active UV-C air treatment units were installed in patient room 425, post-installation sampling following a similar protocol for bacteria and fungus was conducted. The only difference in the room conditions was that a patient had been in the room (on isolation) and the room had not been terminally cleaned.

The findings

"The air in the patient room is quietly pulled into the UV-C chamber and continually treated, 24 hours per day," said Dr. Lee. "It was very satisfying to improve the conditions in the room, and to improve the environment for everyone; patients, staff, and visitors." The results reported from the lab were impressive. In patient room 425, total bacterial count in the air was reduced an average of 73 percent and fungal counts were reduced by 44 percent. "These values are especially notable because the room had been occupied until two hours before the post-test sampling began by an isolation patient," Dr. Lee said. "The room had not yet been terminally cleaned when post-installation commenced, so it is reasonable to assume that bacterial counts would be quite high at the time of post-installation sampling."

Just to be sure, we ran another post-installation test, to see if our results matched the reporting. The results were good. The data from the research pilot supports our incorporating an active UV-C air treatment system in our HAI prevention protocol as a great adjunct to our infection control efforts. The continual cleaning of the air is a terrific investment for our patients and their welfare.

And that musty odor? Along with the bacteria and fungi, it's gone, too.

About the author

Nancy Fallwell, RN, MSN, MHA is director of Infection Prevention & Control at Driscoll Children's Hospital in Corpus Christi, Texas. Fallwell was formerly the interim director of Infection Prevention & Control and, prior to that, was a nursing house supervisor at Driscoll. She has served in various nursing roles at Corpus Christi-area hospitals, the first as a nurse technician at Driscoll in 1989. Fallwell holds a master's degree in nursing and healthcare administration from the University of Phoenix and a bachelor's degree in nursing from the University of Texas at Tyler.

Add'l Photo:

Installed HRMS unit.

BECKER'S
Infection Control
& Clinical Quality

Lowell General looks to the air for IC innovation; Reduces airborne bacteria by 69%, surface bacteria by 51%

Written by Dudley Abbe, BA, VP Hospitality and Support Services, Sodexo | September 30, 2016 |

Your Infection Control plan needs airing out. Literally. And new technology can help.

You may know Sodexo as a food services and facilities management provider, but in fact we have a track record of enabling healthcare clients to be first in their markets with important new technology.

For example, we're a strategic partner with Lowell General Hospital in Lowell, Mass., a 400-bed acute care hospital with a daily census between 250 and 330 patients. Sodexo provides a myriad of management services including food and hospitality services, laundry, transportation, maintenance services and environmental engineering.

With that partnership comes a commitment to identify and review cutting-edge technology.

Lowell General celebrated its 125th anniversary in 2016. You don't hit a milestone like that by being slow moving or complacent. This is a place where we try things, always looking at ways to enhance the patient experience and to make continuous operational and process improvements.

Don't wait to innovate

The hospital's commitment to providing quality healthcare includes investment in state-of-the-art technology and a pervasive culture of safety. It was precisely that foundational vision that prompted a team from Sodexo and Lowell General to mount a challenge test in this environment – a live hospital setting, surrounded by patients and staff – to prove the efficacy of a new technology.

The innovation at hand is called VidaShield™. VidaShield is an in-room air purification system that uses short wavelength ultraviolet light (UV-C) to reduce the amount of airborne pathogens.

Together with Geoff Slowman, Director of Facilities at Circle Health, Lowell General Hospital's parent organization, and John Larochelle, Sodexo's Vice President of Brand Management, we framed a proof of concept test to determine if the VidaShield system made an impact on bioburden control over airborne microorganisms.

Lowell General Hospital's Michelle Antonellis, RN, CIC, Infection Preventionist, and Angela Catalanotti,

RN, BSN, led the clinical team along with Linda Lee, DrPH, Chief Science Officer, VidaShield. We agreed to install the active air UV-C system and all parties committed to pre- and post-installation studies.

"When Dudley brought up the idea of innovative technology in the form of active UV-C air purification, we saw it as a system that could do no harm and bring only benefit," said Antonellis. "Dr. Lee provided a good deal of research and served as a tremendous partner during and after the testing."

Truly disruptive technology
The system installs in the ceiling, above a standard lighting fixture. Room air is drawn via small fans through a MERV 6 filter into a fully-shielded UV irradiation chamber, disrupting the DNA of airborne bacteria and fungus, rendering them incapable of colonization.

After the air is purified, it is dispersed back into the room. The device does not interfere with existing HVAC systems, the technology is hidden from view, and it operates continuously in occupied spaces.

We considered many areas for the study: OR, ICU, a decontamination area. Lowell General has a Xenex surface cleaning robot in the OR, and we worried we might generate a false negative by testing there.

The team decided on areas where we expected greatest benefit, with a minimum of interruption for the installation: ICU patient rooms and hallways, and a staff break room and corridors inside a busy operating suite. Site selection came down to choosing areas with controlled access and heavy traffic (ICU) and in a busy area of heavy contamination, with a closed door but near a sterile area (OR break room).

For the study, we conducted business as usual and didn't change any process or procedure. We worked with our facilities people and unit staff, installing the UV-C systems during off hours or when a patient room was vacant.

The testing and results
Ten active air UV-C purification systems were installed in ICU patient rooms and 11 in ICU hallways. Six more systems were installed in the OR break room. Pre-and post-installation samples measuring total bacteria counts for air and surfaces were taken using an SAS 180 sampler with blood agar and Rodac plates. An independent laboratory analyzed the samples. The results were eye opening:

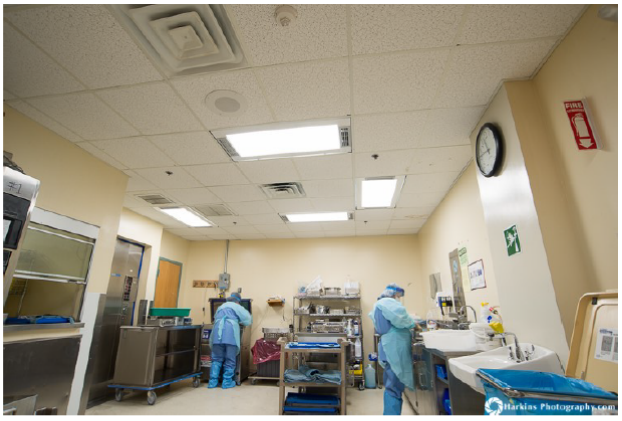
Airborne bacteria levels in the ICU were reduced 69% and surface bacteria levels in the ICU were reduced 51%.

Airborne bacteria levels in the OR break room were reduced 70% and surface bacteria levels were reduced 48%.

The staff was ecstatic over the bacteria reduction.

"It was a relief the active air UV-C system was so effective at neutralizing pathogens," said Antonellis. "The air is better and cleaner. It's a direct, positive impact on patient health and our health as well."

The impact



Reducing healthcare-associated infections (HAIs) is one of the most important issues facing healthcare organizations. First is the issue of safety for patients and staff. Then there is a financial impact – as a component of value-based purchasing put forth by Medicare, hospitals with higher HAI rates will see less reimbursement. Also, infection rates and outbreaks are publically reported, potentially affecting reputation and loyalty.

Hospitals with positive outcomes and scores can use their position in marketing, particularly in a competitive situation. No one is saying they are the cleanest or that there are zero infections. But it's increasingly a Board-level initiative and there is positive movement to put safeguards and protocols in place to stave off infection. It's what industry leaders do, and demonstrates commitment to a community and to employees.

At Lowell General, we'll use Xenex for cleaning surfaces and VidaShield to clean the air, though we found VidaShield also positively impacted surface cleaning. "Settling" may occur any time, including after a terminal clean. The room is clean but a person comes in and coughs and it's back to square one. Here is smart, practical, innovative technology, some of the best technology out there to create a cleaner, better environment for patients and staff.

Every hospital wants to reduce HAIs. Our earlier study of pulsed xenon UV disinfection in the OR – the Xenex robot – showed a 44% reduction in surgical site infection (SSI) rates. We know that UV technology helps reduce our infections rate. So with VidaShield technology focused on cleaning the air, we felt pretty confident going in that we'd have positive results.

Also in choosing the ICU as a challenge site, where we only run the Xenex unit if there's a multi-drug resistant organism issue, we further demonstrated the efficacy of this active air UV-C technology. VidaShield will be part of our approach in continuing to reduce in HAIs overall or in areas of specific concern.

Hospitals are so used to focusing on surfaces, they're overlooking the air. This needs to change.

That the pilot was a success was not unexpected. We believe in UV and know the impact it makes. People were thrilled with the results. Hospital leadership said, "This is why we have Sodexho here. You bring us innovation."

As we began the pilot, we thought, 'If this is successful, we'll consider using the VidaShield system in renovations and build outs, or in new construction.' But the outcomes in reduction of airborne and surface bacteria were so compelling, we are moving now to put VidaShield in place in other areas of the hospital for immediate, continuous benefit.

# # #

About the author

Dudley Abbe has worked in the hospitality industry for 40 years, most of his career in healthcare, with Sodexo. He was responsible for developing partnerships with organizations that complemented Sodexo's service offering and deliver added value to clients. Currently Dudley is Vice President of Hospitality at Lowell General Hospital, overseeing support services which includes the operation of VidaShield.

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http://www.beckershospitalreview.com/quality/lowell-general-looks-to-the-air-for-ic-innovation-reduces-airborne-bacteria-by-69-surface-bacteria-by-51.html