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LONG-TERM CARE NEWS

Study shows reduced HAIs, airborne pathogens with in-room active UV-C system

By Douglas Kane, M.D., November 18, 2016

It sounds like a bad joke: The problem with infections is that they're spreading. But it's true, particularly in extended care settings. The Centers for Medicare & Medicaid Services noted between an estimated 1 and 3 million serious infections occur in nursing homes each year. As many as [300,000 people die](#) annually from these infections.

CMS penalizes healthcare facilities for events it feels shouldn't happen during hospitalization, including healthcare-associated infections. Some of these events include pressure sores, hospital-acquired pneumonia, catheter-associated urinary tract infections and falls that cause injury.



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Beginning in fiscal year 2017, long-term care facilities will be penalized by Medicare for 30-day readmissions. That is, Medicare payment for a discharged patient who returns to the facility in the 30 days post-discharge would be reduced. It's even more incentive for the facility to exert increased vigilance against these distressing occurrences.

The Agency for Healthcare Research and Quality [reported](#) in 2012 that the average cost, in 2012 dollars, of a single case of central line-associated bloodstream infection for adults was \$70,696. The low end of the range was \$40,412 and the top end was \$100,980. Multiply those numbers by multiple infections, in multiple patients, and the economic impact to a healthcare system can become staggering.

Could HAIs be costing you in multiple ways? Could your patients and facility be at risk? Here's what one LTC in Tennessee did to keep their patients safe and their costs down.

Standifer Place

Cynthia Finley, BS, RRT, is Respiratory Director at Standifer Place, an LTC facility in Chattanooga, TN. She explained that patients are admitted to Standifer from an acute care hospital or from a long-term acute care hospital. Of Standifer's 450 total beds, 60 are dedicated respiratory beds. Of those, 40 are designated for ventilator-dependent patients.

Such at risk patients are especially susceptible to contracting an HAI

Most of the patients in the Standifer Place respiratory unit suffer from acute or chronic respiratory failure. Morbid obesity is also increasingly evident in the patient population. There are many patients who have suffered strokes. Finally, the mix includes people who have been in car accidents or suffered other closed head trauma. As a group, Finley said, "Our patients are pretty sick."

Such at-risk patients are especially susceptible to contracting an HAI. The National Institutes of Health notes that just being ventilator-dependent increases the likelihood of infection for that patient. Any indwelling medical device, such as a urinary catheter, an IV or a PICC line will also elevate the risk. And not many LTC patients have only one of these devices in place. The chances for a patient contracting an HAI are elevated, simply by their existing illnesses and location.

In addition, most patients have been admitted from an acute care facility and have often been on multiple antibiotics for resistant infections, and bring with them infections including MRSA, *C. diff*, Acintobacter, VRE and others, which can then be passed to nearby patients, visitors, and staff.

The Infection Prevention teams in LTCs have expended tremendous effort to educate the staff about the many steps to take to reduce the risk of infection to their patients. Hard surfaces are cleaned with germicidal disinfectants. Bio-hazardous waste is red bagged appropriately. Best practices, including proper use of PPE and handwashing, are followed. Ventilator bundles are used. But still, some of these very sick patients contract infections, and become even sicker. Outcomes can be extremely serious, even fatal for the patient. It's bad for the facility as well.

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Cleaning the air

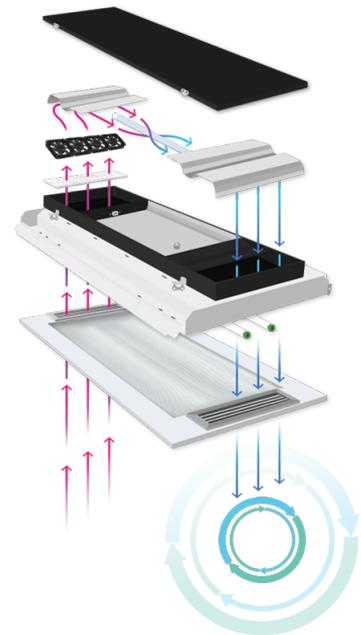
Although Standifer Place didn't have a particular problem with HAIs, they decided to be proactive, looking at something they couldn't actually see: the air itself. What they learned was simultaneously surprising and unsurprising. "We knew about aerosol transmission of disease through coughing or sneezing," Finley said, "and we knew that just walking into a room could throw settled bacteria into the air, or that making the bed could do the same. And we also knew about some uses of UV-C in a healthcare environment. What we didn't know was how easy it would be to implement this technology at the room level."

Standifer decided to be proactive and look at something they couldn't see; the air itself.

She is referring to the use of ultraviolet light, a standard in hospital disinfection. But in the past, its uses have often been for cleaning surfaces, not the air itself, and those uses can come with a fair amount of baggage: the space to be cleaned can't be occupied, the surface needs to be in a direct line with the UV source, products using this technology are expensive and require training. That won't always work in an LTC, where rooms may seldom be vacant, and where the need for cleaning is high. At Standifer Place, the rooms in the ventilator unit are semi-private, so having a room be conveniently vacant for this type of cleaning is not always achievable.

Standifer learned about a new approach to UV cleaning: the VidaShield™ system of continuous air purification at the room level. Generally installed in the ceiling to replace an existing 2 x 4 lighting fixture, the system uses fully-shielded short-wavelength ultraviolet (UV-C) light in a chamber mounted atop a room light. This shielding permits ongoing use of the UV-C lamp for germicidal irradiation, regardless of room occupancy. The product has four small fans, like those in a desktop computer that draw air from the room. The air passes through a MERV6 filter that traps dust and larger particulates, and then is pushed into the irradiation chamber.

Within the chamber the UV-C lamp disrupts the DNA of bacteria and fungus, essentially rendering it inert and incapable of reproduction. The cleaned air is then returned to the room via angled baffles to ensure distribution of the purified air within the room. The system requires only minor routine maintenance, easily managed by existing environmental services staff, and it works 24/7 to purify the air, regardless of whether the room light is on or off.



Challenge testing

As Chief Medical Advisor at Encore Healthcare and Director of Clinical Trials, I was introduced to the UV-C system by Eventa LLC. When I learned of the plan to field test the [VidaShield](#) system, I was intrigued. I wondered what data there was, and I looked for it, but what I found was mostly environmental data. Those studies proved the active air, room-based UV-C systems were able to lower the number of airborne microorganisms. But I couldn't find much about whether this technology had a positive impact on rates of infection, and VidaShield itself makes no claims about reducing HAIs.

We designed a study to evaluate the possible effect of the UV-C system on infection rates and partnered with Standifer Place to perform the study in its ventilator unit. The study was developed as a six month prospective observational study to collect data concerning the possible effect of 24/7 shielded UV-C in patient rooms on the rate of HAIs. I served as the principal investigator, with assistance from Cynthia Finley and Dianne Brown, RRT.

Can UV-C air purification have a positive effect on HAIs?

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The physical layout at Standifer Place made the study design straightforward. The ventilator unit at Standifer can be described as three spokes of a wheel, radiating out from a central nursing station. One spoke (wing) had UV-C units placed in all patient rooms, hallway, bathrooms, and workroom, and the other wings served as the control. The study was not truly randomized because patients were admitted either to the control wings or experimental wing based on room availability, but overall patient days for both wings were similar. In review there were no significant differences in patient comorbidities. All admitted patients were ventilator dependent.

Data on infections was collected for six months, ending in February 2016, and the results between rooms with UV-C and rooms without were compared. We tallied an infection when an antibiotic was ordered by a clinician, with a few exclusions. Infections that occurred within 48 hours of admission were not included, and when an antibiotic was changed based on culture results or lack of response, that incident was not counted a second time. We did not ask clinicians to change their behavior in any way, we simply tracked which rooms had patients who developed new infections.

Fewer HAIs reported with active air UV-C

The team didn't expect the results. Over the six months of the study we found:

- In rooms without the system, infections per 1,000 patient days averaged 17.5.
- In rooms with the VidaShield system, infections per 1,000 patient days averaged just 12.5, a statistically significant outcome.
- Additionally, those rooms exhibited a 51% reduction in airborne bacteria.

*Fewer HAIs
reported in area
installed with
VidaShield system*

I was skeptical that the environmental data would be supported by clinical results. Once the study was completed I was pleasantly surprised to find our data did indeed reveal a reduction in HAIs.

Part of my skepticism stemmed from the fact the UV-C lamps are covered, therefore surface bound organisms wouldn't be exposed to direct UV-C. However, bacteria are dislodged from surfaces by movement of the patient, sheets, furniture, and changes in airflow. When these bacteria became airborne, the system was able to draw them in and neutralize them.

I knew automated mobile UV-C units were effective, but they work on a direct line of sight. It's not always feasible to use them, because the rooms must be vacant, be thoroughly cleaned by Environmental Services, the mobile device must be available, and somebody has to go get it and set it up. All these steps must occur before the room can be used for the next patient. The shielded ceiling UV-C units completely eliminate the requirement for human intervention. This preliminary data provides evidence suggesting that HAIs could be reduced with this simple system. It's especially gratifying that this technology requires no active intervention by a clinician. We don't have to change anything we've been doing to get improved results in the form of lower rates of infection.

This study provides enough evidence to suggest that a larger multicenter randomized clinical trial be performed to look at viral infections as well as bacterial ones. In addition it would be interesting to know if there is any impact on employee sick time. This rather elegant approach to reducing HAIs may be of particular benefit in hospital units caring for immunocompromised hosts, in particular, bone marrow transplant where Aspergillus is a constant threat.

I've gone from being a skeptic to a believer, based on real data.

Although the reduction in HAIs was an excellent outcome, there were other benefits that Standifer realized as a result of the VidaShield installation. "The odors went away," Finley said. "We're a clean facility, but as in any LTC we still have hospital smells. When the systems were installed we noticed the dense hospital smells were diminished. We weren't expecting that."

The Standifer team reported that improved lighting was another unexpected benefit. The systems are available with or without room lights, and the Standifer installation included units with lights, replacing existing ceiling fixtures.

"Honestly, I'm trying to get more," Finley said. "The working environment is enhanced, it's an efficient, effective way to reduce the bioburden at the room level, and we think these systems help keep down hospital readmission. We've been amazed at the amount of change."