COMMENTARY

Acinetobacter in the Air: Did Maryland Get It Wrong?

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(See the article by Rock et al, on pages 830-832.)

In this issue of *Infection Control & Hospital Epidemiology*, Rock and colleagues[1] present their experience culturing the air of patients colonized or infected with *Acinetobacter baumannii*. The authors used an air impactor in order to culture the ambient air of 12 patient rooms. They found only 1 patient with *A. baumannii* present in ambient air. This is in contrast to what has been previously identified elsewhere.[2–4]

Let's go over some potential explanations of these findings. Obviously, the first thoughts that came to mind had to do with the study design itself. On the basis of Shiomori's article in regard to *Staphylococcus aureus*,[5] air contamination would seem to be associated with activities occurring in the patient's room. Thus, air contamination might fail to follow a constant function over time, and random 1-hour samples per unique patient might not provide the full picture of what is occurring with the ambient air throughout the day. Our group recently detected sporadic air contamination using an air culturing machine throughout continuous 6-hour observations per unique patient (Munoz-Price, unpublished data). Additionally, using 24–48 hour settle plates (a rather insensitive method), we previously found up to 40% of ambient air contamination.[2]

Setting the design aside, what other factors might be contributing to the results of Rock and colleagues[1]? Most certainly the heating, ventilating, and air conditioning (HVAC) system of their hospital. According to the American Society of Heating, Refrigerating, and Air-Conditioning Engineers,[6] the American Society for Healthcare Engineering,[6] and the Centers for Disease Control and Prevention,[7] the standard for air changes per hour in any patient room (including intensive care units) should be 6. Additionally, the air should be filtered at 2 points before reaching the patient's room: (1) before the heating and cooling coils, and (2) downstream from the wet-air cooling coils and supply fan. The minimum efficiency reporting value of the first and second filter should be 7 and 14, respectively. A minimum efficiency reporting value of 7 will filter out particles larger than 3 μm and a value of 14 will filter out particles larger than 0.3 μm. These filters need regular maintenance to prevent clogging or leaks and should have a manometer installed to ensure an adequate pressure differential.

We should also be aware of the costs to maintain the average American hospital electrical system. According to the US Energy Information Administration,[8] an American hospital's square foot electrical cost is approximately $2.84 per year, of which ventilation and cooling correspond to 30% (approximately $1 per year per square foot). Even though these costs do not seem to be increasing in the nation as a whole, certain regions of the country have observed rising electrical costs, such as Alaska, Florida, California, the Southwest, and the Gulf Coast.[9] From this list, it would seem intuitive that warmer climates might be playing a role on the differential rise in electrical costs. Lastly, in my discussion of HVAC systems with a trade expert, frequent anecdotal observations at American healthcare facilities include (1) the failure by healthcare facility directors to perceive a connection between poor HVAC operations and the potential patient safety implications; (2) the constant pressure of facility directors to decrease costs, resulting in shortcuts; (3) the poor coil cleaning methods (or even complete absence of coil cleaning), which results in restriction of airflow and inability of the system to cool the air—consequently, these situations result in increased ambient temperature and higher humidity, which are frequently remedied by the removal of filters (increasing airflow but removing filtration) rather than by cleaning the cooling coils or replacing the filters; (4) the tendency of hospitals to recondition circulating air rather than 100% exhaust it (in order to decrease electricity costs); and (5) the lack of regular monitoring of filters, existence of by-pass leaks, or filter life cycle status.

As professionals within the field of infection control, we all know that hospitals frequently have to make hard decisions based on budget. Some administrative decisions obvious (and common) to infection control departments include cutting nursing staffing and environmental personnel. In infection control, we know that these decisions have an impact in patient safety outcomes. Considering that HVAC systems are expensive to run and are not seen by most healthcare workers, wouldn't it be reasonable that similar budgetary decisions are occurring on matters that we cannot readily see? How do variables such as temperature and humidity outside the facility, age of the infrastructure, and economic viability of the hospital affect decisions regarding cutting HVAC system costs? It is reasonable to wonder whether the number of air changes per hour, comfort cooling, and humidity settings in a new,

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relatively wealthy hospital in Maryland would be different than in a poor hospital in a subtropical area. Would higher humidity and temperature in patient rooms affect the degree of ambient air contamination? The reader should keep in mind that our first report with over 40% of ambient air contamination with *A. baumannii* occurred during the malfunctioning of our HVAC system for a couple of days, which required the use of portable fans in the unit.[2]

To answer the intentionally provocative title of this piece, I do not think Maryland got it wrong. Just to get the issue settled, it would still be worthwhile to repeat the measurements at the same hospital over several consecutive hours rather than only 1 hour. Just as environmental cleaning impacts environmental contamination, the functionality of HVAC systems might be affecting the degree of air contamination in patient rooms, particularly on organisms that use the hospital environment as a reservoir (eg, *A. baumannii*). Further research should be done to confirm this hypothesis, especially in hospitals located in subtropical and tropical regions with higher than expected rates of *A. baumannii* infections.

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