Breath of FRESH AIR

Indoor air quality critical to effective infection control

By Laura Rygielski Preston

January and February are historically the peak months of seasonal flu activity in the United States, according to the Centers for Disease Control. So it is no surprise that healthcare facilities across the country are reinforcing infection control processes and procedures and enlisting medical professionals, hospital staff, patients and visitors in their efforts.

The annual cost to healthcare consumers and taxpayers is $24-$45 billion, according to the CDC, which estimates that 70 percent of hospital-acquired infections cases are preventable.

The hospital design, construction and facilities-management communities play a crucial role in preventing HAIs and creating a physical environment that supports quality care and positive patient outcomes. The Center for Health Design analyzed more than 120 independent studies before concluding that clinical outcomes improve when patients receive quality-centered care in a healthcare facility where the temperature, humidity and indoor air quality are effectively managed.

HVAC TECHNOLOGIES HELP REDUCE AIRBORNE INFECTION THREATS

Modern HVAC systems help hospitals control the spread of the airborne pathogens that cause more than 30 percent of HAIs, according to the CHD.

For example, maintaining operating room temperatures between 55 and 65 F and using desiccant dehumidifier technology to control moisture can help hospitals prevent the spread of pathogens, which grow best in warm, damp conditions.

HVAC Systems HELP COMBAT Infections

HVAC systems are critical in creating a comfortable indoor environment and reducing the incidence of hospital-acquired infections.

> Ventilation needs to meet the specific requirements of hospital units, patient rooms and common areas. Proper ventilation is critical since one-third of all infection threats are airborne.

> Temperature affects patient, staff and visitor comfort. Maintaining the right temperature can also help create an indoor environment that promotes healing and makes it harder for pathogens to grow and spread.

> Moisture can also encourage the growth spread of pathogens, which thrive in a warm, humid environment. Desiccant dehumidifier technology can help hospitals maintain the proper humidity levels to impede the growth of bacteria and other pathogens.

> Pressure levels need to be appropriate for each unit to restrict the spread of airborne pathogens — keeping infectious agents out of surgical suites, for example.

> Monitoring for bacteria, viruses, particulates, pressure and moisture enables hospitals to stay in compliance and act quickly if problems occur.

To be effective in a healthcare setting, ventilation systems need to be quiet, efficient and capable of meeting differing requirements of intensive care, isolation and surgical units, as well as patient rooms, offices and common areas. They must be able to handle frequent air changes with low airflow velocity to restrict the movement of molds, bacteria, viruses and other potential contaminants.

New-generation air handling systems play a key role in managing the risk of HAIs. They make use of a wide range of technology advancements, including quieter, more efficient direct-drive plenum fans and redundant fan-array configurations that improve performance, reliability and maintainability. Modern air handlers also feature low-leakage designs to maintain the high-filtration and static pressure standards needed to control the movement of pathogens within and between hospital units.

Using modern HVAC control technologies, facilities managers can maintain precise pressure levels to impede the movement of airborne contaminants. For example, negative pressure in isolation rooms helps ensure potentially dangerous infectious agents stay in the room. Conversely, positive pressure in surgical units keeps pathogens and other contaminants out of operating rooms.

Integrated HVAC control systems use sophisticated sensors to detect the presence of contaminants and keep tabs on temperature, humidity and pressure levels. The system automatically addresses problems, enabling the hospital to respond quickly and effectively to indoor air quality concerns.

AIR CLEANING SYSTEMS INSTRUMENTAL IN AIR-QUALITY IMPROVEMENTS

Advances over the last decade have made air-cleaning systems one of the most important technologies healthcare facilities managers can use to improve indoor air quality and support infection-control efforts. The most effective are catalytic air cleaning systems that have set new standards by removing virtually all contaminants and odors from hospital air.

Catalytic air cleaning systems integrate three distinct technologies:

> Air passes first through a highly efficient air filter, rated minimum efficiency reporting value 13 or higher

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DEFERRING MAINTENANCE MAY ADD TO RISK OF HAI

HVAC systems that are not performing at peak efficiency can seriously affect a hospital's environment of care by allowing indoor air quality to deteriorate. For example, a faulty dehumidification system could create a humid environment where problems and pathogens can grow.

Cases cited in a Center for Health Design study traced an outbreak of MRSA, or methicillin resistant staphylococcus aureus, to a hospital ventilation system and the source of another infection to faulty ventilation ducting.

Conducting an HVAC critical system audit, or CSA, can help hospital facilities managers identify potential reliability and performance problems, reduce the chance of unplanned system failure and identify energy saving opportunities.

A CSA almost always pays for itself in energy savings, improved reliability, reduced maintenance and better use of facilities department personnel. Hospital facilities managers often engage an independent engineer or energy service company to help perform the CSA.

Information on conducting a CSA can be found at www.ashrae.org and in other locations online. The National Association of Energy Services Companies www.naesco.org and other sources are available to help facilities managers select an ESCO to help with an audit.

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by ASHRAE. The filter captures more than 95 percent of particulates 1 micron or larger in size. That includes molds, spores, pollens and bacteria as well as some viruses; a MERV 13 filter captures about 46 percent of the seasonal influenza virus, for example.

> After passing through the filter, air enters the ultraviolet germicidal irradiation area of the catalytic air cleaning system. In this section of the system, any remaining biological contaminants are exposed to high-intensity ultraviolet light. The light penetrates the remaining microbes and damages their DNA bonds. As a result, any remaining viruses, fungi or bacteria are sterilized.

> At the same time, the air undergoes a photo-catalytic oxidation process as it passes through a mesh panel coated with titanium dioxide. When the panel is exposed to ultraviolet light, a powerful oxidizing agent is created that converts any organic compounds to harmless trace amounts of water and carbon dioxide.

With pathogens, particulates, odors and other contaminants removed, the cleaned air can be safely reintroduced to the facility's air supply. Catalytic air cleaning systems are available on most new air handling systems installed today in healthcare facilities. The systems can be easily added as an upgrade to existing systems.

Healthcare design, construction and facilities-management professionals are playing an increasingly important role as hospitals deal with the human and financial costs of HAIs. These key players have a unique opportunity to apply proven HVAC technologies to improve indoor air quality and make an important contribution to creating the best possible physical environment of care and improve patient outcomes. ■

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