Nosocomial Infection Prevention on Construction Sites

By Constance Nestor, FACHE

Nosocomial infections, also known as hospital-acquired infections, rank among the top causes of avoidable patient deaths. The 21st century has brought with it new and evolving drug-resistant strains that can be deadly to frail, immunodeficient and otherwise compromised patients. Preventing contact, airborne and waterborne microorganisms from infecting patients has become a formidable challenge for healthcare providers.

On today's construction and maintenance sites, additional training is key to understanding a host of infection-prevention measures, steps and protocols. Yet training in and of itself hasn't proved to be enough. If our contractor and subcontractor teams are to realize the importance of their infection-prevention roles, several tangible changes are in order.

The Challenge

If we look at the most common sources of nosocomial Aspergillus outbreaks, we find that between 43 and 49 percent of instances are caused by facility construction projects.

Ever since awareness was raised through the Institute of Medicine's To Err Is Human report in 1999, healthcare providers everywhere have labored to improve patient safety and infection control in U.S. hospitals. St. Joseph's Community Hospital in West Bend, Wis., designed by Gresham, Smith and Partners (GSS&P), received world acclaim as early as 2002 for being the nation's first hospital to be designed around a goal of being the nation's safest hospital.

Preventing infections has always been a challenge, but nowadays healthcare providers are faced with an even greater challenge: multi-drug-resistant organisms (MDROs). MDROs are able to resist available antibiotics and other medications, plus they are capable of surviving for long periods in an array of environments. Examples of the most notable MDROs include MRSA, VRE, Burkholderia cepacia, ESBLs, VISA, VRSA, Klebsiella pneumoniae, Pseudomonas and others.

The United States, like the U.K. and southern Europe, is experiencing exceptional challenges related to MRSA. Of the patient blood cultures testing positive for staphylococci, 50 percent also tested positive for MRSA. These antibiotic-resistant superbugs are evolving much faster than new effective antibiotics are being developed.

Aspergillus, one of the powerful MDROs, is often fatal. It attacks the frail, the old, the young, the acutely ill, immunodeficient people, children and adults – anyone with a vulnerable respiratory system. The patient populations are at the highest risk for being infected by Aspergillus include cancer, critically ill, transplant and surgery. Much too often, tragic sentinel events have been reported where otherwise recovering infants, children and adults have lost their lives after exposure to Aspergillus in the nation's hospitals.

Aspergillus exists as fungal spores that typically affix themselves to common dust. This is why hospitals all over the country have declared war on dust. Efforts are being made to eradicate ledges, reveals, cracks, crevices and any other feature that may harbor dust in the built environment. This endeavor cannot be taken too seriously.

Aspergillus spores float through the air or on dust and often travel long distances. In hospital inpatient rooms, there are at least 100 high-touch areas where Aspergillus may live and be transmitted.

Aspergillus lives and grows on, in and behind plumbing fixtures and ceiling tiles and in demolition debris. It is transported on shoes and boots. It collects in HVAC ductwork. It may, along with mold, be lurking behind vinyl wall coverings, especially in areas where moisture has penetrated.

If we look at the most common sources of nosocomial Aspergillus outbreaks, we find that between 43 and 49 percent of instances are caused by facility construction projects. An additional 17 percent are attributed to air supply issues (e.g., HVAC systems, room pressurization). Construction and maintenance activities such as drilling; hammering; flooring removal; and installation of piping, cable and ductwork – virtually any demolition or construction that stirs the air or stirs up dust – releases airborne Aspergillus spores.

Stakeholders

The stakeholders connected to infection control on construction sites include both clinical and nonclinical personnel and professionals. Certainly, the clinical team is integral to patient safety and infection control activities. Infection preventionists, industrial hygienists, epidemiologists, infection disease physicians, the environmental services team and a host of others are all actively involved in curtailing infections. Yet no one plays a more important role than the facilities/contractor team. Facilities staff, engineers, safety and security personnel, and others play an active role in preventing infections. Whether it is the internal construction leader, the external general contractor or the environmental quality contractor, all have a leadership role to play.

Construction and maintenance personnel are required to follow infection control policies and guidelines during all phases of maintenance, renovations and construction. The Joint Commission standards specify that "functions within the hospital must collaborate to implement the infection control program ... in order to reduce the potential for organizational-acquired illness" (IC.8.10 and EC.1.7). We must ensure that infection control plans are implemented in order to provide environments that are safe from potential pathogens.
Assembling a Multidisciplinary Team

When assembling the infection control project team, savvy healthcare provider organizations are assembling multidisciplinary teams that include a) in-house experts such as infection control clinicians, facilities management/engineering personnel, information systems, environmental services, security and other staff; b) external professionals including quality contractors, architects, MEP engineers, contractors, subcontractors and others; and c) industrial hygienists.

The primary benefits of employing a multidisciplinary team include distribution of workload, provider control and spreading the liability. Internal personnel are likely to have a multitude of responsibilities that may distract them from important project infection control accountability. External partners may serve to leverage an organization’s talent and at the same time manage the quality assurance aspects. For instance, an external firm may be retained to clean the construction site. When retained to provide a specific role or set of services, without the distractions of other responsibilities, a quality outcome is highly likely.

Also when a provider organization has made a concerted effort to undertake due diligence by employing a multidisciplinary team, should an untoward event occur, the organization may take comfort in knowing that every effort had been made to prevent the compromise of its patients.

Finally, the utilization of a combination internal/external infection control team is likely to be the most cost-effective approach, saving providers up to 66 percent of the costs of a fully outsourced program. Regardless of the model employed, it will be important to include the costs of infection control measures in the project budget template prior to project capital funding requests.

The Infection Prevention Assessment

Where does one begin? The first step in preventing infections in any project is the completion of an infection control risk assessment (ICRA). An ICRA is a legal, binding document. It functions as a signed contract agreeing to the infection control measures required for a particular project. It enables the specification of the steps and procedures needed for each individual project. The measures required for any project are based on three key determinants: 1) the extent and duration of the project, 2) the patient population impacted and 3) the construction area.

The next task is identifying the human risk groups. Construction activity types must also be defined by the amounts of dust generated, the

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duration of the construction activity and the amount of shared HVAC systems impacted.
Construction projects have been classified into four major risk types. Type A Construction is the
lowest risk for causing infections. Type A projects are limited to building upkeep and routine
maintenance, building inspections, and other noninvasive activities. Type B construction includes small-scale, short-duration activities
that create minimal dust. Type C construction encompasses work that generates a moderate to
high level of dust or requires demolition or the removal of any fixed building components or
assemblies. Type D construction includes all major construction or demolition projects.

The next task is to develop a matrix blending the four patient risk groups with the four con-
struction project types. The appropriate activity classes required for construction projects may
then be derived. All maintenance, renovation or new construction projects will fall into one of
four classes requiring specific infection control procedures during and after completion of
the projects. Class I projects are at lowest risk for causing infections, while Class IV construction
projects are where patients are most susceptible to infections. Strict infection prevention pro-
cedures must be followed during construction and after construction.

Developing an Action Plan

After completing the project infection control assessment, the next step is to prepare a
project infection control plan. Prior to the completion of architectural design, the multidisci-
plinary team should be assembled to develop a detailed action plan. At this time, construction
phasing should be detailed; an activity that often results in additional design and construction
for temporary or phased conditions. Accessibility routing, temporary barrier needs and
locations, negative air pressure requirements, hospital security's role, housekeeping
considerations, and other infection control details must all be defined. The plan should
include mechanisms for monitoring the success of the program on a daily basis, as well.
Once fully documented, the plan should be reviewed by all interested stakeholders prior to
finalization.

The healthcare practitioners will be working hand in hand with the construction and mainte-
nance teams. Clinical plans, designed to break the chain of infection, outline the necessary pre-
cautions and procedures, emphasizing the participation of all health professionals. Such plans
address infectious agents, susceptible hosts, portals of entry, portals of exit, reservoirs and means
of transmission. Reservoirs include people, equipment and water, including environmental
sanitation, disinfectants and sterilization. Means of transmission include airborne contaminants
and air quality and airflow controls.

Best Practices

Infection control action plans differ some-
what depending on their authors. However, a
few best practices should be adopted to safe-
guard construction sites.
1. Avoid routing construction personnel
through the hospital. One or more elevators
should be dedicated to renovation projects
located on upper floors. Hospital elevators
should never accommodate both hospital
and construction project traffic. Temporary
external stairs, elevators, scaffolding and
ramps should be constructed in order to
route workers directly to and from the con-
struction site without accessing other areas
within the hospital buildings.

Hospital crews should not eat in hospital
cafeterias. Savvy contractors will provide
accommodations or tents in the construc-
tion staging areas to accommodate meals,
meetings and breaks for project workers.

2. When negative air pressures are required
within construction sites, they must be
strictly maintained at all times. Air filter
or purification systems utilizing HEPA filters
are typically incorporated. Airflows must
occur from the clean area to the dirty area
and, ideally, be vented out of the building.
Industrial hygienists typically monitor partici-
cle counts for patient safety. Equipment and
filters must be inspected continuously for
proper function and integrity.

3. Construction sites must be contained
through the employment of temporary bar-
riars or enclosures in order to prevent the
circulation of dust. These tight barriers must
be repaired immediately if damaged, to pre-
vent air pressures from becoming positive.

4. Dust containment carts should be used
when mandated by the relevant activity
class and patient group. All personnel using
containment carts must be trained and cer-
tified by hospital engineering and infection
control personnel.

5. HVAC ductwork and systems terminating
within the construction site must be pro-
tected so as not to hinder negative air pres-
surization.

6. The construction of anterooms where work-
ers may change into protective apparel/shoe
covers and store clean equipment are rec-
ommended and may be required.

7. An ample number of clean and properly
sized walk-off (sticky) mats must be
employed at site access points.

8. Daily checklists and score cards should be
maintained for all projects.

9. New construction building components are
typically not clean. Was the Sheetrock stored
in areas where it was allowed to sit in
rainwater prior to use? Was paper-faced
insulation subject to windblown rain prior
to installation? If so, visible or not, mold is
likely to be growing already. Was the duct-
work protected when fireproofing and
spraying were performed? Dust levels in
new ductwork must be checked and reme-
diated prior to building occupancy. Project
budgets must include allocations for such
activities.

10. Every construction, maintenance and clin-
ical worker must be given the authority to
interfere and stop the work when a breach in
infection control measures is suspected.

Current statistics are staggering, but
many nosocomial infections are preventa-
ble. In healthcare environments the train-
ing, implementation and monitoring of
infection-prevention protocols are serious
matters. Infection-prevention measures on
hospital construction and maintenance sites
are among the most important. Where
human lives are at stake, there is no room
for error.

Additional Sources of Information

- Centers for Disease Control and Prevention and the Healthcare Infection Control
  Practices Advisory Committee, Guideline for Environmental Infection Control in
  Health-care Facilities. 2003, CDC and HIC-
  PAC: Atlanta, GA. CDC - Guideline for Isolation Precautions
- Preventing Transmission of Infectious Agents in Healthcare Settings 2007
- CDC - Campaign to Prevent Antimicrobial Resistance in Healthcare Settings
- The APIC State-of-the-Art Report on Construction and Renovation (SOAR), The
  role of infection control during construction in health-care facili-
- "New Challenge, New Opportunity – Professionalizing the ES Discipline" by
  Constance Nestor, FACHE, Health Facilities Management journal, June 2010 Issue, Pages
  39-41.

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