INFECTION CONTROL ISSUES
CONSTRUCTION AND RENOVATION
WATER MANAGEMENT AND MOLD REMEDIATION

Evelyn Cook
I want to begin with the premise that patients can leave the hospital sicker than they arrived if construction crews don’t use established precautions to control infection during new construction or major renovations. In fact, it is estimated that there are at least 5000 construction-related infections that occur every year in healthcare facilities.
## INCIDENCE OF INVASIVE ASPERGILLOSIS IN AT-RISK GROUPS

<table>
<thead>
<tr>
<th>Host Group</th>
<th>Incidence of invasive aspergillosis</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allogenic bone marrow transplantation</td>
<td>5-10%</td>
<td>57.6%</td>
</tr>
<tr>
<td>Autologous bone marrow transplantation</td>
<td>0-5%</td>
<td></td>
</tr>
<tr>
<td>Peripheral blood stem-cell transplantation</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Cytotoxic therapy-induced granulocytopenia</td>
<td>Up to 70%</td>
<td>52.3%</td>
</tr>
<tr>
<td>Kidney transplantation</td>
<td>0-3%</td>
<td>55.9%</td>
</tr>
<tr>
<td>Liver transplantation</td>
<td>1-15%</td>
<td></td>
</tr>
<tr>
<td>Heart/lung transplantation</td>
<td>0-20%</td>
<td></td>
</tr>
<tr>
<td>Heart transplantation</td>
<td>0-25%</td>
<td></td>
</tr>
</tbody>
</table>
DOCUMENTED SOURCE OF SPORES IN CONSTRUCTION SETTINGS

- General construction and renovation work
- Disturbance of soil resulting from earth works associated with building construction and site development
- Removal of suspended ceiling tiles
- Removal of fibrous insulation material or fire-stopping
- Opening up of service distribution shafts
- Improper maintenance and operation of ventilation systems
8 cases of invasive fungal sinusitis and 5 deaths
4 cases surgical and burn wound aspergillosis

Outside of packaging contaminated with dust
REVIEW OF FUNGAL OUTBREAKS AND INFECTION PREVENTION IN HEALTHCARE SETTINGS DURING CONSTRUCTION AND RENOVATION

<table>
<thead>
<tr>
<th>Time Period</th>
<th># of Outbreaks</th>
<th># of Infected</th>
<th># of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>76-80</td>
<td>2</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>81-85</td>
<td>3</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>86-90</td>
<td>2</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>91-95</td>
<td>6</td>
<td>35</td>
<td>21</td>
</tr>
<tr>
<td>96-2000</td>
<td>3</td>
<td>63</td>
<td>23</td>
</tr>
<tr>
<td>2001-05</td>
<td>6</td>
<td>160</td>
<td>14</td>
</tr>
<tr>
<td>2006-10</td>
<td>5</td>
<td>67</td>
<td>25</td>
</tr>
<tr>
<td>2010-14</td>
<td>1</td>
<td>50</td>
<td>10</td>
</tr>
</tbody>
</table>

Review of Fungal Outbreaks and Infection Prevention in Healthcare Settings During Construction and Renovation; Hajime Kanamori, William A. Rutala, Emily E. Sickbert-Bennett, and David J. Weber
Healthcare Epidemiology; April 2015
JOINT COMMISSION

EC.02.06.05 – The hospital manages its environment during demolition, construction or renovation (d/c/r) to reduce risk to those in the organization

➤ EP 1 – When planning for new, altered or renovated space, use one of the following design criteria

➤ State rule and regulations


➤ When above rules, regulations and guidelines do not meet specific design needs, use other reputable standards that provide equivalent criteria
STATE RULES

10A NCAC 13B .6200 – Construction Requirements (.6201 -
EC.02.06.05 – The hospital manages its environment during demolition, construction or renovation (d/c/r) to reduce risk to those in the organization

- EP 2 – When planning for d/c/r, hospital conducts a preconstruction risk assessment for air quality, infection control... and other hazards that affect care, treatment and services
1.2-4 Safety Risk Assessment Components

- Infection control risk assessment
- Patient handling and movement assessment
- Fall prevention assessment
- Medication safety assessment
- Behavioral and mental health risk assessment
- Patient immobility assessment
- Security risk assessment
ICRA

DOCUMENTED PROCESS TO PROACTIVELY:

1. Identify and plan safe design elements
2. Identify and plan for internal and external areas affected
3. Identify potential risk of transmission of airborne and waterborne contaminants
4. Develop infection control risk mitigation recommendations
ICRA CONSIDERATIONS

Design Elements

► Number and location of All and PE rooms

► HVAC needs

► Number and location of Hand washing stations and hand sanitation dispensers

► Impact on water system

► Surfaces and finishes
OTHER ICRA CONSIDERATIONS

Identify and plan for internal and external areas affected

Identify potential risk of transmission of airborne and waterborne contaminants

Construction Elements

- Disrupting essential services
- Specific hazards and protection levels
- Location of patients
- Impact of moving debris, traffic flow, and spill clean-up
- Assessment of construction activities
- Location of known hazards
RISK MITIGATION

- Patient placement/location
- Barriers and other protective measures
- Temporary phasing of HVAC/water
- Protection from demolition
- Training

- Impact of utility outages
- Movement of debris, traffic flow, cleanup and elevator control
- Provision of bathroom and food for construction workers
- Protection of building material

Develop infection control risk mitigation recommendations
RISK MITIGATION

Monitoring plan and procedures

- Determined by the governing body
- Conducted by IP, epidemiologist, construction coordinators, safety staff or an outside consultant
- Have written procedures for emergency suspension of work
- Protective indicating the responsibilities of each party (governing body, contractor, designer, and monitor)
DETERMINING CONTROL MEASURES

Identify type of Construction

- Type A – Inspection and non-invasive activities
- Type B – Small scale, short duration, limited dust
- Type C – Requires demolition and removal of fixtures, moderate to high dust
- Type D – Major demolition and construction
DETERMINING CONTROL MEASURES

Patient Risk Groups

- Low risk – Office areas, public areas
- Medium risk – Outpatient clinics, cafeterias, public corridors
- High risk – All inpatient nursing units (except ICU/Stepdown), ER, L&D, etc.
- Highest risk - All ICUs and Stepdowns, Oncology, Surgical suites (OR, PACU), Transplant clinics
DETERMINING CONTROL MEASURES

Complete Risk Matrix

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>I</td>
<td>II</td>
<td>II</td>
<td>III/IV</td>
</tr>
<tr>
<td>Medium</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>High</td>
<td>I</td>
<td>II</td>
<td>III/IV</td>
<td>IV</td>
</tr>
<tr>
<td>Highest</td>
<td>I-III</td>
<td>III/IV</td>
<td>III/IV</td>
<td>IV</td>
</tr>
</tbody>
</table>
## INFECTION CONTROL PRECAUTIONS BY CLASS

<table>
<thead>
<tr>
<th>During Construction</th>
<th>Upon Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minimize raising dust</td>
<td></td>
</tr>
<tr>
<td>2. Replace displaced ceiling tiles</td>
<td>1. Clean work area upon completion</td>
</tr>
</tbody>
</table>
## INFECTION CONTROL PRECAUTIONS BY CLASS

<table>
<thead>
<tr>
<th>During Construction</th>
<th>Upon Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Provide active means to prevent airborne dust dispersal</td>
<td>1. Wipe work surfaces with disinfectant</td>
</tr>
<tr>
<td>2. Water mist surfaces</td>
<td>2. Contain waste before transport in covered containers</td>
</tr>
<tr>
<td>3. Seal unused doors</td>
<td>3. Wet mop or Vacuum (HEPA filtered) before leaving</td>
</tr>
<tr>
<td>4. Sticky mat at entrance</td>
<td>4. Restore HVAC system</td>
</tr>
<tr>
<td>5. Seal air vents</td>
<td></td>
</tr>
<tr>
<td>6. Isolate HVAC system</td>
<td></td>
</tr>
</tbody>
</table>
## INFECTION CONTROL PRECAUTIONS BY CLASS

<table>
<thead>
<tr>
<th>During Construction</th>
<th>Upon Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL CLASS I, II plus</td>
<td>1. Do not remove barriers until project completed, inspected and cleaned</td>
</tr>
<tr>
<td>1. Isolate HVAC</td>
<td>2. Remove barriers carefully to minimize dust dispersal</td>
</tr>
<tr>
<td>2. Construct critical barriers</td>
<td>3. Vacuum (HEPA filtered) work area</td>
</tr>
<tr>
<td>3. Maintain negative pressure, HEPA equipped air filtration units</td>
<td>4. Wet mop area w/ disinfectant</td>
</tr>
<tr>
<td>4. Contain construction waste in tightly covered containers</td>
<td>5. Restore HVAC</td>
</tr>
</tbody>
</table>
## Infection Control Precautions by Class

<table>
<thead>
<tr>
<th>During Construction</th>
<th>Upon Completion</th>
</tr>
</thead>
</table>
| ALL CLASS I, II, III plus  
1. Seal all holes, pipes, and conduits  
2. Construct Anteroom at entrance, must vacuum off prior to exiting or wear coveralls  
3. All personnel wear shoe covers. Covers removed at exit | 1. Do not remove barriers until project completed, inspected and cleaned  
2. Remove barriers carefully to minimize dust dispersal  
3. Vacuum (HEPA filtered) work area  
4. Wet mop area w/disinfectant  
5. Restore HVAC |
CONTROLLING AIR FLOW

Ventilation of the Construction Space
Airflow into the construction zone from occupied spaces by dedicated ventilation/exhaust system for the construction area

- Location of exhaust discharges, fresh air intakes, sealing of existing air ducts
- Use of existing building systems
- Pressure differential of at least 0.03 inch water gauge (7.0 pascals)
- Visible display of negative pressure
Sealed Air Vents
MOBILE CONTAINMENT
EDUCATION AND TRAINING

Five groups for whom training is important
1. Construction company supervisory personnel
2. Construction workers
3. Hospital staff impacted by construction projects
4. Healthcare facility maintenance and engineering personnel
5. Healthcare project manager
DATE: June 02, 2017

TO: State Survey Agency Directors

FROM: Director
Survey and Certification Group

SUBJECT: Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires’ Disease (LD)

Memorandum Summary

- **Legionella Infections:** The bacterium *Legionella* can cause a serious type of pneumonia called LD in persons at risk. Those at risk include persons who are at least 50 years old, smokers, or those with underlying medical conditions such as chronic lung disease or immunosuppression. Outbreaks have been linked to poorly maintained water systems in buildings with large or complex water systems including hospitals and long-term care facilities. Transmission can occur via aerosols from devices such as showerheads, cooling towers, hot tubs, and decorative fountains.

- **Facility Requirements to Prevent Legionella Infections:** Facilities must develop and adhere to policies and procedures that inhibit microbial growth in building water systems that reduce the risk of growth and spread of *legionella* and other opportunistic pathogens in water.
CDC Water Management Toolkit

Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings

A PRACTICAL GUIDE TO IMPLEMENTING INDUSTRY STANDARDS
Sources of Water in HC

- Roof leaks
- Steam leaks
- Burst pipes
- Sewage back-ups
- Leaking fire sprinkler
- HVAC condensate pans
- Groundwater Infiltration
MOLD REMEDIATION

► When a hospital experiences water intrusion such as flooding or water leaks, resulting mold growth can seriously compromise the health of patients and others such as nursing staff and physicians.

NORTH CAROLINA GUIDELINES FOR MOISTURE MANAGEMENT AND MOLD REMEDIATION IN HEALTHCARE FACILITIES

These guidelines are a consensus document approved by the Association for Professionals in Infection Control (APIC-NC), the Statewide Program for Infection Control and Epidemiology (SPICE), the Public Health Institutional Task Force for Best Practices (PHIT Force), North Carolina State Division of Public Health, and the North Carolina Infectious Disease Society (NCIDS).

DETERMINING WHETHER A MOLD PROBLEM CURRENTLY EXISTS

- Are building materials or furnishings visibly moisture damaged?
- Have building materials been wet more than 48 hours?
- Are there existing moisture problems in the building?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health problems that they think are related to mold in the indoor environment?
- Has the building been recently remodeled or has the building use changed?
- Has routine maintenance been delayed or the maintenance schedule been altered?
THE REMEDIATION PLAN SHOULD INCLUDE

- Steps to permanently correct the water or moisture problem
- The use of appropriate personal protective equipment (PPE)
- Steps to carefully contain and remove moldy building materials in a manner that will prevent further contamination.
- Depending on the size and complexity of the job, allow for revision of the plan if circumstances change or new facts are discovered. The types of affected materials and pathways for exposure are important considerations in any remediation plan. Porous materials may need removal and semi-porous and non-porous materials may only need cleaning and drying.
- Evaluating patient or healthcare case workers’ exposure to contaminated air and construction materials. Patients may need to be relocated if traffic flow of construction activity cannot be found through non-patient areas.
8 TIPS TO CLEAN UP MOLD

1. Protect Yourself
   - Put on personal protective equipment (gloves, mask, goggles) to protect your eyes, nose, mouth, and skin.

2. Toss it out
   - Anything that was wet with flood water and can’t be cleaned and dried completely within 24 to 48 hours should be taken outside. Take photos of damaged items for filing insurance claims.

3. Air it out
   - Open all doors and windows when you are working, and leave as many open as you safely can when you leave.

4. Circulate
   - When electricity is safe to use, use fans and dehumidifiers to remove moisture.

5. Beat into cleaners
   - If you use cleaning products, do not mix cleaning products together. DO NOT mix bleach and ammonia because it can create toxic vapors.

6. Scrub surfaces
   - Clean with water and a detergent. Remove all mold you can see. Dry right away.

7. Paint it or remove it
   - Painting or caulking over mold will not prevent mold from growing. Fix the water problem completely and clean up all the mold before you paint or caulk.

8. Dry it out
   - Dry your home and everything in it as quickly as possible – within 24 to 48 hours if you can.

http://www.cdc.gov/mold/cleanup.htm
SUMMARY

The IP should be involved in all construction projects from planning to completion

Common challenge – Lack of engagement or support from administration and getting support for IP involvement in construction activities

▸ Need to comply with regulatory agencies (State, FGI and TJC)
▸ Demonstrate value of the program
▸ Demonstrate how IP input results in an enhanced outcome and/or where the lack of input resulted in adverse outcomes
It is important for infectious disease physicians and infection preventionists in collaboration with building contractors and other associated departments to appropriately implement risk assessment and mitigation measures and prevent healthcare-associated fungal outbreaks and infections.