INFECTION PREVENTION AND CONTROL
CONSIDERATIONS DURING CONSTRUCTION
AND RENOVATION
LONG TERM CARE FACILITIES

ASHLEY JACKSON, BSMT, MPH, CIC
CLINICAL INFECTION PREVENTION CONSULTANT

https://spice.unc.edu/
https://spice.unc.edu/ask-spice/
INFECTION PREVENTION AND CONTROL CONSIDERATIONS DURING CONSTRUCTION AND RENOVATION OBJECTIVES

- Describe the chain of infection in regards to the infection risk of construction and renovation
- Identify most common pathogen associated with infections from construction and the severity these infections cause
- Overview of additional considerations with construction and renovation projects in healthcare facilities
- Identify infection control guidelines to assist prevention measures and how to implement them
- Explain Infection Control Risk Assessment (ICRA) requirements, process, and key staff involvement.
- Identify and be able to implement infection control measures during construction and renovation projects
CHAIN OF INFECTION IN CONSTRUCTION AND RENOVATION

- Infectious Agent
- Reservoir
- Portal of Entry
- Portal of Exit
- Means of Transmission

Chain of infection
CHAIN OF INFECTION IN CONSTRUCTION AND RENOVATION

Infectious Agent

Fungus

- Mold - Largest concern
  - Ubiquitous in environment - found in water, soil, and air
  - Aspergillus
  - Zygomycetes
  - Stachybotrys chartarum (black mold)

Bacteria

Images from CDC’s public health image library https://phil.cdc.gov/
CHAIN OF INFECTION IN CONSTRUCTION AND RENOVATION

Reservoir

Need a food source to grow. Mold and different fungi like cellulose materials such as:

- Drywall
- Ceiling Tiles
- Behind wall paper and wall coverings


Demo

Infectious agents may become airborne during construction activities

Mold counts in the air are higher than normal during a removal or cleaning project

Image from: https://www.placenorthwest.co.uk/news/work-underway-on-rochdale-indoor-market/
CHAIN OF INFECTION IN CONSTRUCTION AND RENOVATION

Means of Transmission

- Hands
- Air current
- Tools
- Cart
- Equipment
- Construction materials
CHAIN OF INFECTION IN CONSTRUCTION AND RENOVATION

- Inhalation
- Ingestion
- Open wounds
- Burns

Images from:
CHAIN OF INFECTION IN CONSTRUCTION AND RENOVATION

Susceptible Host

- Immunocompromised
  - Cancer
  - Immunosuppressive therapies

- Allergic

- Higher risk populations susceptible to mold:
  - Diabetes mellitus (unregulated)—Dialysis
  - Cavitary illness (dead lung tissue)—Tuberculosis
  - Late stage HIV/AIDS
  - Chronic granulomatous disease
  - Premature infants
  - Severe malnutrition & alcoholism
  - Recent surgical residents
COMMON PATHOGENS FROM CONSTRUCTION AND RENOVATION

Aspergillus spp.:
- Spores are ubiquitous in the environment
- May travel long distances as airborne particles and are inhaled by humans (several hundred spores each day)
- Healthy individuals are able to remove spores with our innate defense (macrophages)
- Severely immunocompromised individuals are great risk for serious complications.
- Can cause invasive (overall case fatality rate was 58% in reviewed reports), allergic, or chronic infections.
Fungal spores in the air increase dramatically with:
- Renovation, construction, excavation
- Ceiling access
- A contaminated or defective air supply

Nosocomial aspergillosis in outbreak settings systematic review
- 53 studies with 458 patients
- 356 patients (78%) were lower respiratory tract
- Underlying disease-hematologic malignancies 299 (65%)
  - Overall fatality rate in these 299 patients (57.6%)
- Construction or demolition probable/possible source-49%
- Virtually all outbreaks attributable to airborne source, usually construction
- Residents at risk should not be exposed to Aspergillus
ADDITIONAL CONSIDERATIONS CONSTRUCTION AND RENOVATION

- Exterior activities:
  - New and existing buildings
  - Ground breaking
  - Earth & tree work
  - Utilities installation
  - Demolition
  - Re-roofing & cladding
  - Paving/road work

- Interior activities:
  - New and existing buildings
  - Floor & carpet repair
  - Plumbing
  - Building connection
  - HVAC system & utilities upgrade
There are several authorities for healthcare construction and renovation:

- Center for Disease Control and Prevention’s Guidelines for Environmental Control in Health-Care Facilities (CDC)
- Facilities Guidelines Institute (FGI)
- North Carolina Division of Health Service Regulation (DHSR)
- North Carolina Administrative Code (NCAC)
- American Society for Healthcare Engineers (ASHE)
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
FGI 2018 GUIDELINES

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 is a multidisciplinary, organizational, documented process that considers the facility’s patient population and type of construction project (non-invasive to major demolition):

- Focuses on reduction of risk from infection
- Acts through phases of facility planning, design, construction, renovation, facility maintenance, clean up
- Coordinates and disseminates knowledge about infection, infectious agents, type of construction project and care environment permitting the organization to anticipate potential impact

What Are the Risks Associated with Construction and Renovation in Healthcare Settings? William A. Rutala, Ph.D., M.P.H., C.I.
INFECTION CONTROL RISK ASSESSMENT (ICRA) EDUCATION AND TRAINING

Five groups for whom training is important

1. Construction company supervisory personnel
2. Construction workers
3. Healthcare personnel impacted by construction projects
4. Healthcare facility maintenance and engineering personnel
5. Healthcare project manager

INFECTION CONTROL RISK ASSESSMENT (ICRA) EDUCATION

Construction Workers:
- Adverse effects of construction dust on residents
- The ICRA process
- Specific facility rules, such as entry and exit from buildings
- Worksite containment
- Dust control measures
- Containment and transport of construction materials and debris including use of elevator(s)

Facility staff impacted by project:
- A review of the ICRA plan
- Appropriate signage at the worksite
- What proper barriers look like
- Proper above-ceiling dust control measures
- The importance of negative pressure
- Proper debris removal procedure
- Whom to notify about possible deficiencies.

APIC Infection Prevention Manual for Construction and Renovation
INFECTION CONTROL 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

INFECTION CONTROL RISK ASSESSMENT (ICRA)

Design Elements

- Number and location of hand washing stations and hand sanitation dispensers
- Impact on water system
- Surfaces and finishes

INFECTION CONTROL RISK ASSESSMENT (ICRA)

Construction Elements

- Location of residents and resident care equipment/materials
- Interruptions in water, electric and HVAC must be planned (potential risks for airborne and waterborne contaminants)
- Impact of moving debris, traffic flow, and spill clean-up
- Assessment of construction activities

Identify and plan for internal and external areas affected

Identify potential risk of transmission of airborne and waterborne contaminants


INFECTION CONTROL RISK ASSESSMENT (ICRA)

- Resident 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

INFECTION CONTROL RISK ASSESSMENT (ICRA) 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

INFECTION CONTROL RISK ASSESSMENT (ICRA)
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

### 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>1. Clean work area upon completion</td>
</tr>
<tr>
<td>2. Replace displaced ceiling tiles</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>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

## During Construction

- 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

## Upon Completion

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

---

INFECTION CONTROL MEASURES- 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
- Visible display of negative pressure

INFECTION CONTROL MEASURES- CONTROLLING DUST

- Mats changed weekly
- HEPA vacuum only—documentation from construction company
- Particle counter
  - Baseline
  - Daily
  - HEPA units/filter
    - # of particles going in
    - # of particles coming out
INFECTION CONTROL MEASURES
WALK OFF MAT
INFECTION CONTROL MEASURES
BARRIERS
INFECTION CONTROL MEASURES
CEILING WORK
INFECTION CONTROL MEASURES
SEALING VENTS
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.
QUESTIONS?
RESOURCES

- CDC Aspergillosis: [https://www.cdc.gov/fungal/diseases/aspergillosis](https://www.cdc.gov/fungal/diseases/aspergillosis)