

INFECTION PREVENTION AND CONTROL CONSIDERATIONS DURING CONSTRUCTION AND RENOVATION

LONG TERM CARE FACILITIES

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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







Infectious Agent

► Fungus

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

▶ Bacteria



Images from CDC's public health image library https://phil.cdc.gov/



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



Ordog, Gary. (2002). TOXIC MOLD. NORTH CAROLINA; THE CHARLOTTE OBSERVER. Featuring: Gary Joseph Ordog, MD. DOI: 10.13140/RG.2.2.22138.72641..





► Demo

- Infectious agents may become airborne during construction activities
- Mold counts in the air are higher than normal during a removal or cleaning project













Images from:

Keller, Nancy. (2017). Heterogeneity Confounds Establishment of "a" Model Microbial Strain. mBio. 8. e00135-17. 10.1128/mBio.00135-17. and https://phil.cdc.gov/



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.



Image from: https://mycology.adelaide.edu.au/descriptions/hyphomycetes/aspergillus/

COMMON PATHOGENS FROM CONSTRUCTION AND RENOVATION

- 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-hemotologic 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

What Are the Risks Associated with Construction and Renovation in Healthcare Settings? William A. Rutala, Ph.D., M.P.H., C.I.C

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







CONSTRUCTION / RENOVATION GUIDELINES

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 GUIDELINES









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









INFECTION CONTROL RISK ASSESSMENT (ICRA)

- ICRA is an 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



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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 Cook, Evelyn (2018). Infection Control Issues Construction and Renovation Water and Mold Remediation.

INFECTION CONTROL RISK ASSESSMENT (ICRA) DOCUMENTED PROCESS TO PROACTIVELY:





INFECTION CONTROL RISK ASSESSMENT (ICRA)

Design Elements

Identify and plan safe 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)

Identify and plan for internal and external areas affected

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



Locations of monitored hospital units, Edouard Herriot Hospital, Lyon, 2015

INFECTION CONTROL RISK ASSESSMENT (ICRA)

Develop infection control risk mitigation recommendations

- 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



INFECTION CONTROL RISK ASSESSMENT (ICRA) DETERMINING CONTROL MEASURES



- 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



- 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

| Risk Group | Туре А | Туре В | Туре С | Туре D |
|---------------|--------|--------|--------|--------|
| Low | 1 | П | | III/IV |
| Medium | 1 | П | Ш | IV |
| High | 1 | П | III/IV | IV |
| Highest | 1-111 | III/IV | III/IV | IV |

| During Construction | Upon Completion |
|---|---|
| Minimize raising dust Replace displaced ceiling | Clean work area upon |
| tiles | completion |



| | During Construction | Upon Completion |
|----------------------------------|--|---|
| 1. 2. 3. 4. 5. 6. | Provide active means to prevent airborne dust dispersal Water mist surfaces Seal unused doors Sticky mat at entrance Seal air vents Isolate HVAC system | Wipe work surfaces with disinfectant Contain waste before transport in covered containers Wet mop or Vacuum (HEPA filtered) before leaving Restore HVAC system |



| Ouring Construction | Upon Completion |
|--|---|
| LL CLASS I, II plus | 1. Do not remove barriers |
| Isolate HVAC | until project completed, inspected and cleaned |
| . Construct critical barriers | 2. Remove barriers carefully |
| Maintain negative pressure, HEPA equipped air filtration units | to minimize dust dispersal 3. Vacuum (HEPA filtered) work area 4. Wet mop area w/ |
| Contain construction waste in tightly covered containers | disinfectant 5. Restore HVAC |





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

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



QUESTIONS?



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