Environment of Care

Basics of Infection Prevention
2-Day Mini Course
May 2017
Objectives

• Describe the relationship between the healthcare environment and infection prevention
• Identify key systems and practices that contribute to infection prevention
• Identify practices to reduce the risk of environmentally-related healthcare-associated infections
Background of Environmental Infection Control

- 20-40% of HAIs are due to infection via hands of HCW\(^1\)
- Surface contamination plays a large role in transmission
  - Pathogens survive for long periods on surfaces
  - Only 32% of objects in HCF are thoroughly cleaned\(^2\)
- Extent of patient-to-patient transmission found to be proportional to level of environmental contamination\(^1\)

Breaking the Chain of Infection

- Infectious Agent
- Reservoir
- Portal of Entry
- Susceptible Host
- Portal of Exit
- Mode of Transmission
Sterile Processing (SP)

- Goal: provide safe, functional, sterile instruments and medical devices to reduce risk of transmission\(^1\)
- SP is a dedicated department that oversees:
  - Handling
  - Collecting
  - Transporting
  - Sorting
  - Disassembling
  - Cleaning
  - Disinfecting
  - Inspecting
  - Packaging
  - Sterilizing
  - Storing
  - Distributing

- More information in Cleaning and Disinfection presentation

- IP’s role: assist with process monitoring/quality control, competency testing, education, and certification of reprocessing staff

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1. Association for the Advancement of Medical Instrumentation (AAMI) Standards ST79 & ST58
Environmental Services (EVS)

- Two major categories of cleaning:
  - High-touch surfaces (ie. bedrails/doorknobs)
  - Minimal hand contact (ie. floors/walls)
- More information in Cleaning and Disinfection presentation

- IP’s role is to work with EVS to:
  - Select cleaning/disinfection products and PPE based on ease of use, safety, and efficiency
  - Write cleaning, disinfection, PPE, waste and pest control procedures and policies
  - Evaluate effectiveness of cleaning and disinfection
Laboratory Services

• Laboratory’s role in IP program is fundamental
• Lab workers at increased risk for contamination/infection (laboratory-associated infections (LAIs))

• IP’s role: work with lab supervisor to maintain safe environment and ensure appropriate training of staff
  – Include laboratory representative on IP committee
Food and Nutrition Services (FNS)

• Use Food Code 2009 and 2013 to guide policy and procedures
  – How to purchase, store, prepare and serve food
    • Including vending and ice machines
  – Ensure personnel hygiene

• IP’s role:
  – Include FNS representatives on IP Committee
  – Assist with environmental (water), waste, and pest control
  – Investigate foodborne outbreaks
Laundry Services

• Key elements: water temperature, type of detergents and disinfectants, rinsing, finishing
  – Hot-water washing: at least 160°F (71°C) for 25 minutes
    • Low-temperature washing: 71°F-77°F (22°C-25°C) +125ppm chlorine bleach rinse
  – Routine microbiological sampling not recommended
• Use Healthcare Laundry Accreditation Council (HLAC) standards (2012) as guidance

• IP’s Role: ensure consistent monitoring and implementation of best practices
Waste Management (WM)

• Work with WM to define infectious waste categories and management plans
  – Not all hospital waste is infectious waste
  – Identify waste that represent(s) substantial infection risk
    • i.e. Contaminated sharps injuries

• IP’s Role:
  – Stay abreast of new technologies for waste management
  – Work with WM to develop management plans
  – Performance improvement measures
Maintenance and Engineering (MAE)

- Maintain, repair, and monitor patient care equipment, existing structures and equipment (including supply systems)
- Minimize potential colonization/infection for patients, visitors, and workers
- Emergency preparedness integration

IP’s Role:
- Round with MAE to do risk assessments
- Apply appropriate interventions/ performance improvement initiatives, based on risks identified
- Provide appropriate education/training to MAE staff regarding infection risks/transmission methods
Heating, Ventilation, & Air Conditioning Systems (HVAC)

- Poor design, installation, system performance, and/or maintenance can lead to transmission of airborne agents
  - Many guidelines/standards available
    - Facility Guidelines Institute (FGI) Guidelines for Design and Construction of Healthcare Facilities = most comprehensive

- IP’s Role:
  - Understand key terms, concepts, and health effects
  - Round as part of infection control risk assessment (ICRA)
  - Detail requirements for specialty care areas
HVAC Terms in Infection Prevention

Filtration
• Describes removal of particles from air
• MERV (minimum efficiency reporting value)- higher is better

Pressure Relationships (Positive or Negative)
• Describes the movement of air between the room and the corridors

Air Changes
• Describes movement of air to dilute air contaminants
• Air can either be moved and filtered in the room or exhausted to the outside
• Requirements for air changes per hour (ACH) differ by room type and use
Care Areas Requiring **Negative** Air Pressure

- Air moves *into* room
- Includes airborne infectious isolation rooms (AIIR) and areas where coughing may be induced
  - Bronchoscopy suite, endoscopy suite, sputum induction rooms
- Proper effect achieved when the equivalent of 12 ACH filtered/exhausted to outside and overall pressure is negative
  - Monitor for negative pressure **daily**
Care Areas Requiring **Positive** Air Pressure

- Air moves out of the room
- Includes:
  - Operating rooms
  - C-Section suites
  - Protective environments
    - e.g. Bone marrow transplant unit

1. CDC/HICPAC Guidelines for Environmental Infection Control in Healthcare Facilities; 2003 (pg 36)
## ACH and Pressure Requirements

<table>
<thead>
<tr>
<th>Room Type</th>
<th>ACH/hr</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating and delivery rooms</td>
<td>25</td>
<td>Positive</td>
</tr>
<tr>
<td>Airborne infection isolation room (AIIR)</td>
<td>12</td>
<td>Negative</td>
</tr>
<tr>
<td>Patient room</td>
<td>6</td>
<td>Continuous directional control not required (positive or neutral)</td>
</tr>
<tr>
<td>Patient bathroom</td>
<td>10</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Water Systems

• Waterborne bacterial/fungal contamination of water
  – Stagnant water allows formation of biofilms
    • Infrequently used fixtures are more prone

• IP’s Role:
  – Understand how agents cause waterborne disease
  – Conduct facility risk assessments and implement remediation measures
    • I.e. Policies to identify/respond to water damage
  – Monitor dialysis fluid and dialysate monthly
    • Pathogen limits: < 200 bacteria/ml for fluid, < 2000 bacteria/ml dialysate
Construction and Renovation

• Provisions must be made for protection of patients during any renovations or new construction

• Determine mitigation strategies by
  1) Patient risk (as determined by patient care area)
  2) Construction activity type

• IP’s Role:
  – Ensure facility-wide awareness of construction process
  – Educate patient care staff on risks, mitigation strategies
  – Daily monitoring/documenting of airflow in construction/renovation zones
Long-term Construction Projects

- Daily rounds by construction supervisor
- Containment barriers should be made of fire-rated wallboard supported with stud frame
- All edges of construction area sealed
- Door installed so it opens into the work area
## Risk Categories by Patient Care Areas

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
<th>Highest Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Office Areas</td>
<td>-Cardiology</td>
<td>-CCU</td>
<td>-Burn</td>
</tr>
<tr>
<td>-Dining Hall</td>
<td>-Echocardiography</td>
<td>-Emergency Dept.</td>
<td>-Cardiac Cath Lab</td>
</tr>
<tr>
<td></td>
<td>-Endoscopy</td>
<td>-Labor &amp; Delivery</td>
<td>-Sterile Central Supply</td>
</tr>
<tr>
<td></td>
<td>-Nuclear Medicine</td>
<td>-Specimen Labs</td>
<td>-ICU</td>
</tr>
<tr>
<td></td>
<td>-Physical Therapy</td>
<td>-Nursery</td>
<td>-Medical Units</td>
</tr>
<tr>
<td></td>
<td>-Radiology</td>
<td>-Outpatient Surg</td>
<td>-NPIR</td>
</tr>
<tr>
<td></td>
<td>-Respiratory. - Therapy</td>
<td>-Pediatrics</td>
<td>-Oncology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Pharmacy</td>
<td>-Operating Room</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-PACU</td>
<td>-Any area caring for immunocompromised patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Surgical Units</td>
<td></td>
</tr>
</tbody>
</table>
## Risk Categories by Construction Activity Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type A</strong></td>
<td><strong>Non-Invasive Activities and Inspection</strong></td>
</tr>
<tr>
<td></td>
<td>• Removal of ceiling tiles for visual inspection (limit 1 tile per 50 square feet)</td>
</tr>
<tr>
<td></td>
<td>• Painting (but not sanding)</td>
</tr>
<tr>
<td></td>
<td>• Wall covering, electrical trim work, minor plumbing, other activities that do not generate dust, require cutting of walls, nor accessing ceilings</td>
</tr>
<tr>
<td><strong>Type B</strong></td>
<td><strong>Small scale, short duration activities that create minimal dust</strong></td>
</tr>
<tr>
<td></td>
<td>• Installation of telephone and computer cabling</td>
</tr>
<tr>
<td></td>
<td>• Access to chase spaces</td>
</tr>
<tr>
<td></td>
<td>• Cutting walls or ceiling where dust migration can be controlled</td>
</tr>
<tr>
<td><strong>Type C</strong></td>
<td><strong>Work that generates moderate to high levels of dust, requires demolition, or removes fixed building components or assemblies</strong></td>
</tr>
<tr>
<td></td>
<td>• Sanding walls for painting or wall covering</td>
</tr>
<tr>
<td></td>
<td>• Removal of floor coverings, ceiling tiles, and casework</td>
</tr>
<tr>
<td></td>
<td>• New wall construction</td>
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<tr>
<td></td>
<td>• Minor duct work, electrical work above ceilings, major cabling activities</td>
</tr>
<tr>
<td></td>
<td>• Any activity that cannot be completed within a single work shift</td>
</tr>
<tr>
<td><strong>Type D</strong></td>
<td><strong>Major demolition and construction projects</strong></td>
</tr>
<tr>
<td></td>
<td>• Activities that require consecutive work shifts</td>
</tr>
<tr>
<td></td>
<td>• Require heavy demolition or removal of a complete cabling system</td>
</tr>
<tr>
<td></td>
<td>• New construction</td>
</tr>
</tbody>
</table>
Class of Mitigation Activities Determined by Construction Type and Patient Risk Level

<table>
<thead>
<tr>
<th>Patient Risk Level</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>II</td>
<td>III/IV</td>
<td>III/IV</td>
<td>IV</td>
</tr>
</tbody>
</table>
Mitigation Activities Required for Construction

<table>
<thead>
<tr>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Execute work to minimize raising dust from construction operations</td>
<td>1. Actively work to prevent airborne dust from dispersing into atmosphere</td>
<td>1. Remove or Isolate HVAC system in area where work is being performed to prevent contamination of duct system</td>
</tr>
<tr>
<td>2. Immediately replace ceiling tile displaced for visual inspection</td>
<td>2. Seal unused doors with duct tape</td>
<td>2. Before construction begins, complete all critical barriers, i.e. sheetrock, plywood, plastic, to seal area from non work areas –OR- implement control cube method, i.e. cart with plastic covering and sealed connection to work site, vacuuming with HEPA prior to exit</td>
</tr>
</tbody>
</table>

3. Block off and seal air vents | 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units | 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units |
<p>| 4. Place dust mat at entrance and exit of work area | 4. Before transport, contain construction waste in tightly covered containers | 4. Before transport, contain construction waste in tightly covered containers |
| 5. Remove or isolate HVAC system in areas where work is being performed. | 5. Cover transport receptacles or carts. Tape covering unless solid lid. | 5. Cover transport receptacles or carts. Tape covering unless solid lid. |</p>
<table>
<thead>
<tr>
<th>Class IV</th>
<th>1. Isolate HVAC where work is being done to prevent contamination of duct system.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins.</td>
</tr>
<tr>
<td></td>
<td>3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</td>
</tr>
<tr>
<td></td>
<td>4. Seal holes, pipes, conduits, and punctures appropriately.</td>
</tr>
<tr>
<td></td>
<td>5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site.</td>
</tr>
<tr>
<td></td>
<td>6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.</td>
</tr>
<tr>
<td></td>
<td>7. Contain construction waste before transport in tightly covered containers.</td>
</tr>
<tr>
<td></td>
<td>8. Cover transport receptacles or carts. Tape covering unless solid lid.</td>
</tr>
<tr>
<td></td>
<td>9. Do not remove barriers from work area until completed project is inspected by the owner’s Safety Department and Infection Control Department and thoroughly cleaned by the owner’s Environmental Services Department</td>
</tr>
</tbody>
</table>
Infection Control Risk Assessment (ICRA)

- Develop risk assessment process to monitor and evaluate projects and hospital systems
  - In policy, define responsibilities for assessment, monitoring, enforcement and evaluation of projects
- Determine who keeps copies and where ICRA will be filed
  - (e.g., in Safety Department)
- Report status to Infection Control Committee
Emergency Planning and Response

• Policies and procedures should
  – Define what constitutes an emergency
  – Define roles of multidisciplinary response team
  – Identify:
    • First responders
    • Escalation determinants
    • Who reports to local public health
    • Who determines when it’s safe to go back into affected space
Environmental Assessments

• Conduct EOC rounds on all areas at least annually
  – Clinical areas twice a year
  – Required for accreditation by TJC
• Opportunity for multidisciplinary, multipurpose inspection
## Example of EOC Rounds Checklist

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.</strong></td>
<td>Floors free of trip hazards, well maintained and clean.</td>
<td>(Floor surfaces are even, in good shape and clean. No cords or tubing should be laid across floors so as to create a trip hazard. (Carpet not frayed or torn.)</td>
</tr>
<tr>
<td><strong>6.</strong></td>
<td>Items/supplies are not stored directly on the floor.</td>
<td>(This includes storerooms, under work stations and passage ways. Items approved for storage should be on a pallet) or shelving.</td>
</tr>
<tr>
<td><strong>7.</strong></td>
<td>Clinical staff wears no-slip shoes?</td>
<td>(Consult with Human Resources as to the appropriate foot wear.)</td>
</tr>
<tr>
<td><strong>8.</strong></td>
<td>Emergency exits clear of any obstructions.</td>
<td>(Staff should know where these exits are located)</td>
</tr>
<tr>
<td><strong>9.</strong></td>
<td>Fire Equipment present &amp; clear of any obstructions.</td>
<td>(There is no exception to this rule; fire extinguishers, and fire pulls can never be blocked.)</td>
</tr>
<tr>
<td><strong>10.</strong></td>
<td>Fire Equipment inspected.</td>
<td>(The Safety Officer / designee inspects them monthly.)</td>
</tr>
<tr>
<td><strong>11.</strong></td>
<td>Emergency lights have been inspected within the month due.</td>
<td>(The Safety Officer inspects them monthly.)</td>
</tr>
<tr>
<td><strong>12.</strong></td>
<td>Exit lights are working.</td>
<td>(The Safety Officer / designee inspects them monthly.)</td>
</tr>
<tr>
<td><strong>13.</strong></td>
<td>Receptacles and light switches have covers.</td>
<td>(Any covers that are cracked or damaged should be replaced.)</td>
</tr>
<tr>
<td><strong>14.</strong></td>
<td>No use of electrical extension cords unless approved by the Safety Officer/ Designee.</td>
<td>(Using the wrong extension cord can possibly damage the equipment in use and may be a fire hazard. When using an extension cord make sure it doesn’t become a trip hazard.)</td>
</tr>
</tbody>
</table>
EOC Quality Improvement Strategies

- Root-cause analysis
- Failure Mode and Effects Analysis
- Plan, Do, Study/Check, Act Cycles
- ICRA + Infection Control Risk Mitigation

 Possible outcome measures (to prevent infection in immunocompromised populations):
- If IP personnel actively involved in all phases of construction/renovation projects
- Daily checks of negative/positive airflow
- Monthly checks of water quality
- Checks of specimen contaminants
Resources

• CDC Guidelines for Environmental Infection Control in Health-Care Facilities:  
  http://www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf

• CDC Options for Evaluating Environmental Cleaning:  
  https://www.cdc.gov/hai/toolkits/Evaluating-Environmental-Cleaning.html


• The Joint Commission:  
Questions?