TB Infection Control

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Objectives

• Name the three main components of a TB control program

• Identify appropriate precautions to prevent TB transmission in hospital settings including the selection of appropriate personal protective equipment

• Identify appropriate precautions to prevent TB transmission in selected non-hospital settings
Hierarchy of Infection Control

Administrative Controls

Environmental Controls

Respiratory Protection
Administrative Controls

- Assign responsibility for TB infection control (IC)
- Develop written TB IC plan
- Test and evaluate HCWs at risk for TB or for exposure to *M. tuberculosis*
- Educate HCWs about TB infection control
- Ensure timely lab processing and reporting
- Clean and disinfect equipment
- Use appropriate signage advising cough etiquette and respiratory hygiene
TB risk Classification

• Low risk: Persons with TB disease not expected to be encountered; exposure unlikely

• Medium risk: HCWs will or might be exposed to persons with TB disease

• Potential ongoing transmission: Temporary classification for any settings with evidence of person-to-person transmission of *M. tuberculosis*
**TB Risk Classifications: Traditional Medical Facilities**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Low</th>
<th>Medium</th>
<th>Potential Ongoing Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient, &lt;200 beds</td>
<td>&lt;3 TB patients/yr</td>
<td>≥3 TB patients/yr</td>
<td>Evidence of ongoing transmission</td>
</tr>
<tr>
<td>Inpatient, ≥200 beds</td>
<td>&lt;6 TB patients/yr</td>
<td>≥6 TB patients/yr</td>
<td></td>
</tr>
<tr>
<td>Outpatient</td>
<td>&lt;3 TB patients/yr</td>
<td>≥3 TB patients/yr</td>
<td></td>
</tr>
</tbody>
</table>
## HCW TB screening: How often?

<table>
<thead>
<tr>
<th>Risk classification</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Baseline on hire; further testing not needed unless exposure occurs</td>
</tr>
<tr>
<td>Medium</td>
<td>Baseline, then annually</td>
</tr>
<tr>
<td>Potential ongoing transmission</td>
<td>Baseline, then every 8–10 wks until transmission has ceased</td>
</tr>
</tbody>
</table>
HCW TB screening: Who to test?

• All HCWs with face-to-face contact with suspected or confirmed TB
• Paid and unpaid persons working in healthcare settings who share air space with infectious patient
• Includes part-time, full-time, temporary, and contract staff
Training and Educating HCWs

• Initial TB training and education
  • All HCWs
  • Clinical information
  • Epidemiology of TB: local, US, global
  • Recommended IC practices
  • Role of public health in TB control

• Follow-up TB training and education
  • Provide retraining if exposure occurs
  • Provide annual respiratory protection training for HCWs who use respirators
Evaluating TB IC and Identifying Problems

Factors to consider in TB IC evaluation

- Number of patients in AII
- Extent of meeting criteria for discontinuing AII precautions
- Number of patients with drug resistant TB
- Adequacy of discharge planning
- HCW TB skin test conversions
- Number of contact investigations due to unrecognized/improperly managed TB
Example of considerations in evaluating Administrative controls

- Admission of patient to hospital until placement in AII
- Presentation of patient until collection of specimen
- Specimen collection until receipt by laboratory
- Receipt of specimen by laboratory to smear results are provided to health-care provider
- Diagnosis until initiation of antituberculosis treatment
- Receipt of specimen by laboratory until culture results are provided
- Receipt of specimen by laboratory until drug-susceptibility results
- Receipt of drug-susceptibility results until adjustment of antituberculosis treatment, if needed
Environmental Controls
Environmental Control

Prevent spread and reduce concentration of infectious droplet nuclei through

- Primary controls: ventilation technologies
  - Natural ventilation: relies on open doors, windows
  - Mechanical ventilation: AII room

- Secondary controls: HEPA filters and ultraviolet germicidal irradiation (UVGI)
Characteristics of AII room

- Single-patient room with private bathroom, negative pressure
- Air sent outdoors or through HEPA filter
  - 6 air changes per hour (ACH) existing facility
  - 12 ACH in new construction
- Maintain adequate # of AII rooms
- Group AII rooms together
- Check room for negative pressure daily when in use
Criteria for Initiating All Precautions

- Patient has symptoms or signs of TB disease
  
  Or

- Patient has documented infectious TB disease and has not completed anti-TB treatment
AIRBORNE PRECAUTIONS

VISITORS

STOP: RESTRICTED ENTRY
Ask nursing staff for assistance before entering room for first time
Visitors are limited to close household contacts

- Clean hands before entering and leaving room
- N95 respirator may be required

STAFF

- Wear fit tested N95 respirator or PAPR
- Hand hygiene required
- Limit patient transport to essential tests/procedures
- Notify receiving area of necessary precautions if test/procedure scheduled
- Have patient wear surgical mask when out of room

DOOR MUST REMAIN CLOSED AT ALL TIMES
# Airborne Precautions

## Transport Card

<table>
<thead>
<tr>
<th>Before Transport</th>
<th>During Transport</th>
<th>Receiving Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Ensure patient</td>
<td>- Follow standard precautions</td>
<td>- Wear N95 respirator or PAPR if patient not masked</td>
</tr>
<tr>
<td>- Performs hand hygiene</td>
<td></td>
<td>- Keep door closed during procedure and for 60 minutes after patient leaves</td>
</tr>
<tr>
<td>- Wears surgical mask</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Notify receiving area of patient with Airborne Precautions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Disinfect equipment accompanying the patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Remove your N95 respirator or PAPR and perform hand hygiene before leaving room</td>
<td></td>
<td></td>
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</tbody>
</table>

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MAYO CLINIC CENTER FOR TUBERCULOSIS
Criteria for Discontinuing All Precautions

- Infectious TB is unlikely and another diagnosis is made that explains the syndrome
  
  OR

- Patient has 3 consecutive negative sputum smears
  - At least 8 hours apart
  - At least one collected during early morning

  AND

- Patient has received standard antituberculosis treatment (minimum of 2 weeks)

  AND

- Patient has demonstrated clinical improvement
Drug-Resistant Disease

• All precautions for MDR/XDR TB patients until discharge or culture conversion
  • Transmission from MDR TB patients may be extensive

• Risk for transmission not increased in TB/HIV coinfected patients vs. TB patients
Air-Cleaning Methods:

**HEPA filters:**
- Filters infectious droplet nuclei from the air
- Used
  - When discharging air from local exhaust ventilation booths directly into surrounding room
  - When discharging air from an AI room into the general ventilation

**UVGI:**
- Kills or inactivates *M. tuberculosis*
- Occupational exposure limits
  - Overexposure can cause damage to skin, eyes
  - UVGI systems must be properly installed and maintained
Evaluating Environmental Controls

- Determine if recommended environmental controls are in place
- Review environmental control maintenance procedures and logs
- Evaluate performance of installed systems
- Determine if the number of AII rooms is adequate for the setting based on AIA guidelines and the risk assessment
  - At least one AII room is needed per 120 beds for a medium risk facility
  - Additional AII rooms might be needed depending on the number of patient-days with suspected or confirmed TB disease
Discharge Planning

Patients can be sent home while still infectious if

• A follow-up plan has been made
• Patient is on treatment and DOT arranged
• No very young (under 4 years) or immunocompromised persons in household
• All in household previously exposed
• Patient willing to refrain from travel outside the home except for health-care visits
Respiratory Protection
Respiratory Protection

• Third level in the IC hierarchy
• Should be used by persons
  • Entering rooms of suspected/confirmed TB patients
  • Around cough- or aerosol-producing procedures
  • In settings where administrative and environmental controls will not prevent the inhalation of infectious droplet nuclei
• HCWs should
  • Be educated on use of respiratory protection
  • Fit -tested periodically
  • Have time to become proficient and comfortable with respirators
Respiratory Protection for HCWs

• Types of Respiratory Protection
  • Non-powered air-purifying respirators
  • Powered air-purifying respirators (PAPRs)

<table>
<thead>
<tr>
<th>Resistance to Degradation</th>
<th>Filter Efficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95%</td>
</tr>
<tr>
<td>N (not resistant to oil)</td>
<td>N95</td>
</tr>
<tr>
<td>R (resistant to oil)</td>
<td>R95</td>
</tr>
<tr>
<td>P (oil proof)</td>
<td>P95</td>
</tr>
</tbody>
</table>

• Respirators must be NIOSH approved
• Medical evaluation prior to participation in RP
• Must be fit tested annually
• Seal check with each use
Respirators are for HCWs

Designed to filter out droplet nuclei from being inhaled by the health-care worker. Should properly fit different face sizes and features. Should NOT be worn by the patient.
Surgical Masks for Persons with TB

Designed to stop droplet nuclei from being spread (exhaled) by the patient.
Are **NOT** adequate protection for healthcare workers.
Powered air purifying respirators (PAPRs)

- Loose-fitting facepiece (hood or helmet), breathing tube, air-purifying filter
- Air is drawn through the air-purifying element and pushed through the breathing tube and into the facepiece, hood, or helmet
- Loose-fitting PAPRs useful for persons with facial hair because they do not require a tight seal with the face.
TB Infection Control in the Home

• HCWs visiting patients at home should:
  • Instruct patients to cover mouth/nose when coughing or sneezing
  • Wear a respirator when visiting or transporting an infectious patient
  • Collect specimens in well-ventilated area

• HCWs whose responsibilities include visiting TB patients at home should participate in an annual TB testing program
# Precautions for Operating Rooms (OR)

<table>
<thead>
<tr>
<th>Administrative Controls</th>
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<th>Respiratory Protection Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postpone non-urgent procedures on suspected/confirmed TB patients until known to be non-infectious. Pathology lab needs to be notified if TB specimens sent to lab.</td>
<td>OR anteroom should be either positive pressure relative to both OR and corridor, or negative relative to both OR and corridor. If no anteroom, keep OR door closed, minimize traffic.</td>
<td>Use RP with a valveless filtering face piece, e.g., N95 disposable. PAPR is not appropriate for sterile procedures. Irrigation of TB abscesses requires RP.</td>
</tr>
</tbody>
</table>
## Precautions for Laboratories

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</thead>
<tbody>
<tr>
<td>Lab-specific risk assessment and IC plan</td>
<td>Handle specimens suspected to contain <em>M. tuberculosis</em> and aerosol-producing procedures in class I or II biological safety cabinet (BSC).</td>
<td>Lab specific based on risk assessment</td>
</tr>
<tr>
<td>Biosafety level (BSL) 2 for non-aerosol-producing procedures</td>
<td></td>
<td>At least N95. Use if aerosol-producing procedures performed outside BSC</td>
</tr>
<tr>
<td>Annual HCW <em>M. tuberculosis</em> testing in med. and high-risk settings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*IC = Infection Control*
# Precautions for Bronchoscopy Suites

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<th>Respiratory Protection Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid bronchoscopy on suspected or confirmed TB patients or</td>
<td>AII room. In mechanically ventilated patients, keep circuitry</td>
<td>At least N95 respiratory protection for HCWs present for</td>
</tr>
<tr>
<td>postpone until noninfectious.</td>
<td>closed.</td>
<td>bronchoscopy procedures on patients with suspected or</td>
</tr>
<tr>
<td>When sputum collection is not possible, use sputum induction.</td>
<td></td>
<td>confirmed TB</td>
</tr>
</tbody>
</table>
# Precautions for Autopsy Suites/Embalming Rooms

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</tr>
</thead>
<tbody>
<tr>
<td>Ensure communication of TB status from healthcare facility to those performing autopsies/embalming.</td>
<td>Meet or exceed requirements for AII room. Exhaust air to outside.</td>
<td>At least N95 disposable respiratory protection for HCWs performing autopsies on bodies with suspected or confirmed infectious TB disease.</td>
</tr>
<tr>
<td>Allow sufficient time to elapse for adequate removal of <em>M. tuberculosis</em> contaminated air before performing another procedure.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Precautions in Correctional Facilities

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<tr>
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<th>Respiratory Protection Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop setting-specific IC plan. Test staff for TB annually. Test inmates for TB and maintain tracking system. Collaborate with local health department on TB contact investigations, discharge planning, and training/education of staff and inmates.</td>
<td>≥1 AII room based on risk assessment Place inmates with suspected or confirmed TB in AII or transfer to AII setting Collect sputum AII room, not in cell.</td>
<td>Implement RP program. Provide surgical mask to inmates who must leave AII room. Consider N95 RP for staff transporting inmates with infectious TB</td>
</tr>
</tbody>
</table>
Evaluating Problems in Infection Control

• Conduct contact investigation for problems such as
  • Conversions in HCW
  • TB disease diagnosis in HCW
  • Suspected person-to-person transmission of *M. tuberculosis*
  • IC lapses that expose HCWs to *M. tuberculosis*
  • TB outbreaks
Questions & Discussion
Question #1

You work in an ambulatory-care setting where a TB clinic is held 2 days/week. In past year, 6 TB patients and 50 LTBI patients were treated. There is no evidence of transmission. The risk classification of this setting is:

A. No risk
B. Low risk
C. Medium risk
D. High risk
E. Potential ongoing transmission

Answer C
Question # 2

A 43 year old immigrant from a country with high rate of TB undergoes a cervical LN biopsy in the OR. TB skin test is negative, CXR is normal. Which of the following Infection Control measures is appropriate:

A. Scheduling the case for the end of the day
B. Closing the operating room for 2 hours after case is completed
C. Use of a PAPR by OR personnel
D. Use of frozen section on biopsy specimen to rule out lymphoma
E. None of the above

Answer E
Question # 3

An elderly man comes in to the clinic and says he was told to come in because one of his friends has TB. He is coughing frequently. The waiting room is busy. The most appropriate next step is:

A. Provide the patient with an N95 mask
B. Send the patient for a chest X-ray
C. Admit the patient to an AI1 room in the hospital
D. Continue evaluation as an outpatient
E. Call the Public Health authorities immediately

Answer D