TB Infection Prevention

Objectives

• Identify 3 of 6 contributing factors to possible TB transmission.

• Name two new practices you can add for safely collecting blood samples for expedited IGRA in the field.

• Name three important factors for a good N95 fit test.

Agenda

• Review of TB Transmission

• Review of TB Infection Prevention Measures

• Safe Blood Specimen Collection

• Practice N95 Fit Testing
**TB Transmission**

**Mycobacterium Tuberculosis**
- Carried in airborne particles
- Infectious droplet nuclei
  - Generated when persons who have pulmonary or laryngeal TB disease cough, sneeze, shout, or sing
  - Tiny particles can remain suspended in the air for several hours (depending on the local environment)

Transmission occurs when:
1. a person inhales droplet nuclei containing *M. tuberculosis* AND
2. the droplet nuclei traverse the mouth or nasal passages, upper respiratory tract, and bronchi to reach the alveoli of the lungs

**Drug Resistant TB**

Why?
- Not completing treatment of active disease
- Lack of availability of drugs
- Ineffective treatment prescribed
- Incomplete LTBI treatment does not contribute to drug resistance

Multidrug resistance (MDR)
- Resistance to two main drugs
- Treatment up to 2 years
- ~$250,000 to treat
- Higher risk of death

Extremely drug resistant (XDR TB)
- Resistant to 2 main drugs AND 2 second line drugs
- Higher risk of death
Airborne (droplet nuclei)

Very small particles of evaporated droplets or dust with infectious agent

- Remain in air for a long time
- Travel farther than droplets
- Become aerosolized during procedures

Examples:
- Tuberculosis
- Measles (Rubeola)
- Varicella

Epidemiologic Triad

What if I was around someone who was coughing?

- How long?
- How close?
- Coughing a lot?
- Looks really sick?
- Adequate Ventilation?
- Your own medical status (immunocompromised, comorbidities)
Transmission of TB

Frequency of Contact ↔ Risk of Infection
- Risk greater with frequent intimate contact
- Risk less with occasional contact
- In both cases, the risk accumulates with the number and length of contact

Duration and Intensity of TB Exposure
- Aerosolization key to transmission
  - Plumes of aerosolization intermittently
  - Patients vary greatly in infectivity
  - Treatment decreases aerosolization even if sputum remain positive

- Simple measures decrease transmission
  - Surgical masks on patients
  - Isolation and separation
  - Ventilation (air exchange >6 ACH or open window + fan)

Tuberculosis

Latent infection  Cavitary tuberculosis  Miliary tuberculosis
### TB Transmission Details

- AFB smear is a risk factor but not a useful indicator of infectivity once on treatment
- Not all sputum smear positive patients are infectious
- Most untreated TB patients are not very infectious (about 30% transmit to household contacts)
- Some TB patients are super spreaders
- 15% of untreated sputum smear negative are infectious
- Irrigation of a TB abscess can also aerosolize TB

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### Characteristics of a Patient with TB Disease that Are Associated with Infectiousness

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
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<tbody>
<tr>
<td>Clinical</td>
<td>• Presence of cough, especially lasting 3 weeks or longer</td>
</tr>
<tr>
<td></td>
<td>• Respiratory tract disease, especially with involvement of the larynx (highly infectious) • Failure to cover the mouth and nose when coughing • Inappropriate or inadequate treatment (drugs, duration)</td>
</tr>
<tr>
<td>Procedure</td>
<td>• Undergoing cough-inducing or aerosol-generating procedures (e.g., bronchoscopy, sputum induction, administration of aerosolized medications)</td>
</tr>
<tr>
<td>Radiographic and laboratory</td>
<td>• Cavitation on chest radiograph • Positive culture for <em>M. tuberculosis</em> • Positive AFB sputum smear result</td>
</tr>
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</table>

### TB Infection Control Measures

Hierarchy of Infection Control

- **Administrative Controls**
- **Environmental Controls**
- **Respiratory Protection**
TB Infection Control Measures

- **Administrative controls:**
  - Infection control plan, clinical protocol, training, coordinating efforts between settings

- **Environmental controls:**
  - Engineering systems to prevent the spread of TB nuclei in air (room air exchanges, HEPA filters)

- **Respiratory-protection controls:**
  - Personal protection to minimize risk for exposure to TB

Exposure Prevention Measures

Prevent spread of infection through inhalable airborne particles:

- Surgical mask for respiratory symptoms or suspected TB patient
- N-95 mask or surgical mask for provider extended exposure time or intensity of interaction
- Ventilate
  - Open windows or doors of field site
  - Use non-circulating fan system
- Sputum collection
  - Negative air pressure room
  - Home collection
  - Outdoor
- Transport
  - Limit time – mindful of distance
  - Open transport vehicle windows

Interferon-Gamma Release Assays

Interferon-gamma release assays (IGRAs) are blood tests that measure a person’s immune reactivity to *M. tuberculosis*.

Two IGRA tests available:

- QuantIFERON®-TB Gold In-Tube (QFT-GIT)
- T-SPOT®.TB
Safe Blood Specimen Collection

- Hand Hygiene:
  - BEFORE touching patient
  - BEFORE blood collection procedure
  - AFTER blood collection procedure
- Standard Precautions:
  - Gloves used and changed between patients
  - Use disposable tourniquets (25% have MRSA)
  - Use leak-proof specimen containers & transport in labeled sealable plastic bags
- Contact Public Health Lab for shipping protocols
- Blood spills cleaned adequately and safely:
  - Use commercial blood spill kit or
  - Disinfect spill area with bleach wipes

Safe Blood Specimen Collection (2)

- Disinfect skin at the venipuncture site and do not touch puncture site after disinfecting it
- Use a safety engineered device
- DO NOT recap a needle
- Discard the used device (a needle and syringe is a single unit) immediately into a robust sharps container
- Immediately report any incident or accident linked to a needle or sharp injury, and start PEP as soon as possible

Resources


CDC Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care 2012


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OSHA Standards

Some OSHA Standards…

- 1910.134 (a) (2) "A respirator shall be provided to each employee when such equipment is necessary to protect the health of such employees. The employer shall provide the respirators which are applicable and suitable for the purpose intended."

- 1910.134 (d) (1) (ii) "The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the condition of its certification."

- 1910.134 (d) (1) (iii) "…Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH."

What is an N95?

- An N95 is the lowest level of respirator
- Health care workers can use them to reduce their risk to airborne pathogens
- In order to wear an N95, you MUST complete the following:
  - Initial medical evaluation
  - Initial and annual fit testing
  - Initial and annual training
Types of Respirators

- N95
- N99
- N100
- PAPR/CAPR
- Re-usable half and full face mask respirators
- SAR (Supplied Air Respirators)
- SCBA (Self Contained Breathing Apparatus)

Respirator Use

Where We Require Respirators

Respirators are required in the following locations when s/s of a communicable disease are suspected, or a community outbreak is occurring:
- TB Clinic
- Medical Examiner’s Office
- EMS
- Jail Health
- PH Lab
- Medical/Dental Clinics
- Field Staff visiting patients

Respirator Use

We provide respirators for the following medical conditions to which you could be at risk for exposure:
- Influenza
- Measles
- N. Meningitidis
- Pertussis
- Rubella
- SARS
- Tuberculosis
- Variola (smallpox)
- Varicella (chicken pox)
How Respirators Work

When used properly, respirators prevent the inhalation of chemicals, dust, and droplets in the air and protect the lungs.

How Respirators Work

• When you inhale, air is pulled through the filter, where air contaminants are trapped.

Can Respirators Protect You From Biological Agents?

• Respirators reduce exposure of the wearer to airborne hazards.
• They do not eliminate the risk of exposure, infection, illness, or death.
• NIOSH approved N95 respirators are recommended by the WHO and the CDC for healthcare workers.
Can Surgical Masks Reduce Exposures to Airborne Biological Agents?

NO!

Medical, surgical, and patient care masks are not designed to protect the wearer from inhaling airborne hazards.

- They are not recommended to be used in place of an N95 respirator.

What is the Difference Between a Surgical Mask and an N95?

<table>
<thead>
<tr>
<th>N95</th>
<th>Surgical Mask</th>
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<tbody>
<tr>
<td>• Reduces exposure to airborne particles</td>
<td>• Reduces airborne particles from being expelled from the wearer</td>
</tr>
<tr>
<td>• Seals tightly to the face</td>
<td>• Does not seal tightly to the face (leaks around the edges)</td>
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Additional PPE

- Respirators may help protect your lungs, but, some biological contaminants may be absorbed through the skin or eyes.

- Additional personal protective equipment, such as gloves, eye shields or goggles, and gowns may be required.
Respirator Protection

Where Respirators Don’t Work

N95 respirators are not good for:
- large chemical spills
- thick dust clouds
- asbestos removal
- painting fumes

Respirator Protection

Where N95 Respirators Don’t Work

- Don’t use them in emergency situations – they won’t provide enough protection.
- In the event of a major leak or spill, leave the area.

Respirator Protection

Where N95 Respirators Don’t Work

N95 respirators don’t work where there is a lack of oxygen.

Confined spaces like tanks or manholes can have an oxygen deficiency or high levels of toxic chemicals.
Respirators and Physical Fitness

Medical Evaluations
Medical evaluations are required for anyone wearing respirators. Breathing through a respirator is work for the body. Respirators can be hazardous to people with heart or lung problems.

Respirator and Physical Fitness

Medical Questionnaire
- The employee completes a confidential medical questionnaire
- The program administrator reviews it
- Results are only used to determine if you are fit to wear a respirator

Respirator Training

Why Training Required?
- If you don't know how to use a respirator properly, you can get a false sense of protection.
Respirator Training

Training is required by WISHA for anyone who wears a respirator.

We also are providing this training so you will know how to protect your health.

Respirator Training

Respirator Program Administrator

The PHSKC respirator program administrator is:

Rebecca Schirle RN MN MPH COHN-S

Employee Health & Safety Coordinator

(206) 263-8735

This person is responsible for overseeing our respirator program.

Respirator Fit

Respirators Must Fit Properly

Respirators must fit properly to prevent leaks around the edges.

Fit-testing must be done before first wearing a respirator.
Respirator Fit

Respirators Must Fit Properly

- Beards are not allowed when wearing a respirator.

OSHA/WISHA

- Requires that employees be fit tested on any tight fitting respirator (e.g., N95) before the respirator is first worn in a contaminated atmosphere and annually thereafter, or sooner if changes in the employee’s physical condition affect the respirator fit.

Respirator Fit

Fit-testing

- Try on several types and sizes of respirators to find one that fits comfortably.
- Fit testing is conducted using either:
  - saccharine
  - bitrex

*(Smoke cannot be used with N95’s)
### Are Multiple Sizes of Respirators Needed?

**YES!**

- The respirator must fit the wearer.
- N95s come in the following sizes:
  - Small
  - Medium
  - Large

### How Important is Fit?

- Fit is very important!
- If a respirator does not seal tightly to the face, airborne hazards can penetrate or enter under the facepiece seal and into the breathing zone.
- A good fit can only be obtained if the face is clean-shaven in the area where the respirator seals against the face.

### Criteria in Choosing the Best Respirator Fit...

- Comfort
- Seals well on the nose bridge
- Room for eye protection/vision
- Room to talk
- Covers the nose bridge to the chin
- Adequate strap tension
Is the Fit Test Hood Safe From Contamination?

- The fit test hood is a closed environment.
- All subjects should wash their hands.
- The subject should not touch the hood.
- The test administrator handles the placement of the hood.
- If the subject coughs or sneezes during the test, the fit test hood should be disinfected with a typical disinfectant.

Respirator Fit

Respirator Seal Check

Whenever you first put on a respirator, you must do a seal check as illustrated.

Inhalation check  Exhalation check

Respirator User Seal Check

- It is very important to read and follow the donning instructions very carefully and to conduct a user seal check every time the respirator is put on.
- Put on N95 as directed, blow in and out feeling for any leaks. Continue to adjust N95 until no leaks are detected.
Can N95’s be Shared With Others?

**NO!**

N95 Respirator Maintenance

- Do not clean or launder
- Throw out when:
  - dirty
  - used with a patient with SARS, Smallpox, Viral Hemorrhagic Fever, or any other highly communicable disease
- Remove only in safe areas away from the infected patient

Respirator Storage

**How Should Respirators be Stored?**

- Store in a clean dry place
- Check with your site supervisor to determine the storage location for your respirators.
N95 Storage - Field Staff

- Store your N95 respirator in a clean, dry Zip-lock bag
- This will keep it clean and dry until you are ready to use it
- Store one in your work bag and car

Fit-testing using Bitrex or Saccharin

- Ask to shave if there are any beards, sideburns, mustache or anything that may interfere with the seal of the respirator, or cannot be fit tested.
- Did you eat, drink (except plain water), smoke and chew gum in the last 15 minutes?
- Check their medical clearance.
- Inform subject what kind of testing agent you are using and ask fit-test subject to open mouth and slightly extend tongue.
- Check sensitivity of the employee with the sensitivity solution using with an interval of 10 squeezes. Trial and error, up to 30 squeezes. (Note how many squeezes was solicited which is either 10, 20 or 30 squeezes)
- Ask test subject to gargle with water.
- Must ask to wear the respirator for approximately 5 minutes.
- Do positive and negative user seal check.
- Pump the number of squeezes solicited initially then pump half of the number of squeezes solicited every after 30 seconds.
- Each step of the test shall be performed for one minute.

Fit-testing using Bitrex or Saccharin

- **Steps** (Remember: Tell test subject to breathe through the mouth)
  
  1. Breathe normally
  2. Breathe deeply
  3. Turn head all the way from one side to another
  4. Nod head up-and-down
  5. Talking; (Ex. Rainbow Passage. Count backward from 100, recite a memorized poem or song, or engage in conversation (i.e., “Tell me about your last vacation or any upcoming vacations.”)
  6. Walking in place
  7. Breathe normally
**Conduct a Simple Training**

- During the test, you can conduct the training:
  1. How to put on a respirator
  2. How to do the user seal check
  3. Care and maintenance
  4. When to use a respirator
  5. When not to use a respirator
  6. Infection Control Issues (Hand Hygiene)

**Common Questions**

1. How about if a disposable respirator does not give good fit to the wearer or he/she has failed during the fit-testing?
   - Recommend another size/brand.
2. When is fit-testing required?
   a. Every year
   b. Weight change of 20 pounds or more
   c. Significant facial scarring in the area of the facepiece seal;
   d. Reconstructive or cosmetic surgery
   e. Significant dental changes; multiple extractions without prosthesis, dentures

**Questions?**

- Contact the Employee Health and Safety Coordinator with any questions or concerns.

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