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Introduction

Purpose
The purpose of this guide is to provide facilitators guidance and tips for leading a training using the Self-Study Modules on Tuberculosis, 1-5 Slide Sets.

Slide Set Training Package
The Self-Study Modules on Tuberculosis, 1-5 Slide Sets training package consists of:
- Facilitator guide
- Presentation slides for each module
- Participant slide handouts for each module

Facilitator Guide
The facilitator guide is divided into sections that contain
- An overview of the Self-Study Modules on Tuberculosis, 1-5 Slide Sets
- Preparation information for conducting a training
- Training basics
- Sample agenda
- Additional information
- Facilitation tips for each of the five module presentations
- Sample course evaluation

Overview

Target Audiences
The target audiences for trainings using the modules slide set are outreach workers, nurses, physicians, administrators, health educators, and students from a variety of settings, including
- Tuberculosis (TB) programs
- Managed care organizations
- Correctional facilities
- Community-based organizations
- Homeless shelters
- Migrant clinics
- Substance abuse facilities
- Nursing and medical schools
- Community health centers
- Other facilities and programs serving persons with or at risk for TB
About the Slide Sets
The Self-Study Modules on Tuberculosis, 1-5 are a series of modules designed to provide education on TB in a self-study format. The Self-Study Modules on Tuberculosis, 1-5 Slide Sets were developed as an accompaniment to the print-based modules to aid in the presentation of module content in a facilitator-led training.

The Self-Study Modules on Tuberculosis Slide Sets consist of five presentations:
- Module 1: Transmission and Pathogenesis of Tuberculosis
- Module 2: Epidemiology of Tuberculosis
- Module 3: Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease
- Module 4: Treatment of Latent Tuberculosis Infection and Tuberculosis Disease
- Module 5: Infectiousness and Infection Control

The content and organizational flow of the slide sets matches that of the print-based modules. Each module presentation contains the following sections:
- **Overview and Objectives**: A guide to the information participants should learn from the module.
- **Learning Material**: The material for the module, including bullet points, diagrams, charts, illustrations, and photographs.
- **Study Questions**: Sets of questions, spread throughout the presentations, designed to help participants assess how well they have learned the content of the module.
- **Case Studies**: Case studies designed to help participants apply the concepts they have learned in the module.

**Note:** The study questions and case studies in the slide sets are the same as those in the print-based modules (e.g., study question 1.1 is the same in both the print-based module and the slide set presentation). Answers to the study questions and case studies are animated and appear on-click throughout the presentations. Answers are also provided in the facilitation notes and at the end of each print-based module. Participant handouts do not contain answers to study questions or case studies.

Customizing the Slide Sets
The Self-Study Modules on Tuberculosis, 1-5 Slide Sets are in the public domain and therefore you are free to adapt and revise these materials. For example, content and images may be removed or added based on the training needs and background of the participants. However, you must remove the Department of Health and Human Services (DHHS) and Centers for Disease Control and Prevention (CDC) names and logos if changes are made.
To View or Order Module Materials
To view or download the *Self-Study Modules on Tuberculosis, 1-5 Slide Set* materials (facilitator guide, presentation slides, and participant slide handouts) please visit www.cdc.gov/tb/publications/slidesets/selfstudymodules/default.htm.

To view or download the *Self-Study Modules on Tuberculosis, 1-5* please visit www.cdc.gov/tb/education/ssmodules/default.htm. If you would like to request a print copy of the *Self-Study Modules on Tuberculosis, 1-5* please use the CDC Division of Tuberculosis Elimination’s online ordering system: wwwn.cdc.gov/pubs/CDCInfoOnDemand.aspx.

Preparation for Training

Know the Content
For a training to be successful, it is critical to know the content of what you are training about. Even a facilitator with the best of training skills cannot hide the fact that he or she does not know the content.

- Study and review the content prior to the training (not at the last minute) so you will be prepared.
  - Read the print-based *Self-Study Modules on Tuberculosis, 1-5*
  - Read the *Self-Study Modules on Tuberculosis, 1-5 Slide Sets* facilitator guide
  - Work through study questions
  - Work through case studies
  - Review *Self-Study Modules on Tuberculosis, 1-5* presentation slides
- Anticipate areas of confusion
- Be prepared to answer questions and explain concepts
- Think about topics participants may find confusing
- Plan ways to help with difficult sections and topics and how to answer any possible questions

Event Set-Up
It is important to have a comfortable learning environment during the training. The room should be set up in such a way as to allow for group discussions and ensuring that each participant can easily see the presenters and the slides. Two recommended styles include the banquet or chevron style (Figure 1). Generally, the U-shape is not recommended because it can limit some participants’ ability to see the slides and presenters.

Before the training, it is important to prepare the training room. This includes:
- Checking the room before the training day (if possible)
- Ensuring materials and supplies are available
- Making sure equipment works
- Arriving at least an hour early on the training day
Materials Checklist
You should have the following materials when you conduct a training on the *Self-Study Modules on Tuberculosis, 1-5*:

<table>
<thead>
<tr>
<th>✓</th>
<th>Materials and Supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Materials and Supplies for Facilitator</td>
</tr>
<tr>
<td></td>
<td><em>Self-Study Modules on Tuberculosis, 1-5 Slide Set</em> presentations (electronic and print)</td>
</tr>
<tr>
<td></td>
<td>Facilitator guide for use during presentations</td>
</tr>
<tr>
<td></td>
<td>Pens and/or pencils</td>
</tr>
<tr>
<td></td>
<td>Print-based <em>Self-Study Modules on Tuberculosis, 1-5</em> for reference</td>
</tr>
<tr>
<td></td>
<td>Materials and Supplies for Participants</td>
</tr>
<tr>
<td></td>
<td>Participant handouts of <em>Self-Study Modules on Tuberculosis, 1-5 Slide Set</em> presentations</td>
</tr>
<tr>
<td></td>
<td>Print-based <em>Self-Study Modules on Tuberculosis, 1-5</em> (optional)</td>
</tr>
<tr>
<td></td>
<td>Course evaluations</td>
</tr>
<tr>
<td></td>
<td>Materials and Supplies for Training Classroom</td>
</tr>
<tr>
<td></td>
<td>Projection monitor (LCD) compatible with computer</td>
</tr>
<tr>
<td></td>
<td>Computer</td>
</tr>
<tr>
<td></td>
<td>Screen or wall for viewing presentations</td>
</tr>
<tr>
<td></td>
<td>Extension cord</td>
</tr>
<tr>
<td></td>
<td>Dry erase board, poster paper, or flip chart with markers</td>
</tr>
<tr>
<td></td>
<td>Sign in sheet for participants</td>
</tr>
<tr>
<td></td>
<td>Name tags/tents</td>
</tr>
<tr>
<td></td>
<td>Pens and/or pencils</td>
</tr>
</tbody>
</table>
Training Basics

Understand Your Role as the Facilitator
The facilitator plays a unique role in facilitating the learning experience. One of the most important things a facilitator can do is to create a safe and supportive environment for participants. Participants need to feel comfortable to
- Ask any questions – even simple questions
- Share answers to the study questions and case study questions – even if the answers might be incorrect

Know Your Audience
One of the most important aspects of training is knowing your audience. Knowing your target audience will help you best design your training. Things to think about in terms of your audience include:
- Knowledge regarding topic (i.e., are participants new to the topic area or do they have pre-existing knowledge?)
- Training needs
- Skills or abilities
- Attitudes
- Experience
- Jobs/positions

There are various ways to get to know your audience. You could get to know your audience by doing a “get-to-know-you” exercise at the beginning of the training. It is also a good idea to share their expectations of the course.

Apply Adult Learning Principles
Adults learn differently from children and therefore require different training approaches. Knowing how adults learn is critical to the success of the training course. Understanding adult learning principles helps you use the right training techniques to enhance learning.

The following table provides principles of adult learning and describes some important training techniques you can use to engage the course participants.

<table>
<thead>
<tr>
<th>Principle</th>
<th>Training Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adults bring a wealth of knowledge and experience which they want to share.</td>
<td>Encourage participants to share their knowledge and experiences. Include activities that utilize their knowledge and experience.</td>
</tr>
<tr>
<td>2. Adults are decision-makers and self-directed learners.</td>
<td>Include problem-solving activities.</td>
</tr>
<tr>
<td>3. Adults have different learning styles that must be respected.</td>
<td>Provide multiple ways for participants to learn the material.</td>
</tr>
</tbody>
</table>
4. Adults want to participate rather than just listen to a lecture. Create a participatory learning environment with various types of activities.

5. Adults are motivated by information or tasks that are meaningful and applicable to their jobs. Relate the content to problems participants encounter in their jobs.

6. Adults prefer training that focuses on real-life problems. Relate content to the types of problems they encounter in their jobs.

7. Adults expect their time during training to be used carefully. Follow a realistic time schedule.

8. Adults feel anxious when participating in a group that makes them look uninformed, either professionally or personally. Avoid criticism. Acknowledge all participants’ contributions.

9. Adults learn best in a positive environment where they feel respected and confident. Create a positive environment by providing positive feedback and showing respect to all participants.

10. Adults come from different cultures, life-styles, religious preferences, genders, and ages. Respect all differences and encourage participants to respect each other’s differences as well.

Discuss Ground Rules
At the beginning of the training, it is very helpful to discuss “Ground Rules.” These are expectations of both the participants and the trainers on basic rules to follow during the training.

- Ask the participants to share their ideas for ground rules for the training
- Write suggestions on a flip chart
- Review the items on the flip chart
- Use the list below as a guide. Include any of the items below if participants do not mention them:
  - Arrive on time for the beginning of each session and after each break
  - Keep each session on time
  - Put cell phones on silent while in the training room
  - Treat each other as equals in the training room
  - Show respect to everyone regardless of age, gender, religion, or culture
  - Share experience and expertise. Many participants have previous experience and background in training.
  - All questions are good questions. Feel free to ask questions at any time.
  - Only one person should speak at a time
  - Everyone should participate and contribute. To ensure that the quieter voices are heard, do not allow 1 or 2 people to dominate the conversation.
  - No side-bar conversations. Comments should be made to the whole group.
  - Provide feedback, as long as it is constructive, not critical
  - Be flexible with differences in culture and language
  - Accept mispronunciation of names
Wear name tags

- Mention that ground rules are used throughout the training and new rules can be added. Facilitators and participants can refer to the ground rules during the training to remind each other about what was agreed to.

Utilize the “Parking Lot”
The “Parking Lot” is a place where topics can be “parked” for later discussion. You can write questions, concerns, or topics on sticky notes to place on a board marked as the Parking Lot so that it can be discussed at a later time. This is a great way to manage discussions that are taking too long, or those that are getting off topic.

Communicate Effectively and Engage Participants

Communicate Effectively
In order to be a good facilitator, you need to have good communication skills. For instance, facial expressions and tone of voice can influence the tone of the training (e.g., either friendly or unfriendly). Thus, it is important to have an approachable, friendly face during trainings so that people feel comfortable asking questions.

When conducting a training, it is important to remember to use a “trainer’s voice.” This includes:
- Projecting your voice so everyone can hear you
- Varying your pitch
- Using a comfortable and varied pace
- Speaking at the right technical level
- Using a friendly tone
- Using a microphone, if necessary

Engage Participants
It is very important to engage participants throughout the training. One way to do this is to use various types of questions to
- Encourage all participants to contribute
- Allow for differences of opinions
- Keep participants alert
- Help you determine participant’s knowledge and understanding

Types of Questions

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Description</th>
<th>Examples</th>
<th>How to use</th>
</tr>
</thead>
</table>
| Close-ended     | Generates short final answers such as “yes” or “no” or just a few words | • Is it …?
• Do you need…?
• Have you ever…? | Obtain a final answer, or conclusion, or for confirmation |
Open-ended
Generates descriptive answers that encourage discussion

- What are some ways…?
- How can you…?
- Why would you…?

Encourage participation and sharing of knowledge and experiences

Probing
Generates additional discussion or can be used to probe for more information

- Tell me more about…?
- Would you elaborate….?
- What is an example…?

Encourage participants to explain in greater detail about a subject

Other Methods for Engaging the Participants

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogies</td>
<td>Compare two or more situations to help explain complex material. Analogies are helpful for teaching about a complex concept or process.</td>
</tr>
<tr>
<td>Stories</td>
<td>Provide real-life situations from your experience (or the experience of others you know) to explain situations or provide examples. Stories are compelling and bring the content to life.</td>
</tr>
<tr>
<td>Statistics</td>
<td>Provide statistics (especially from your jurisdiction) that can demonstrate the importance of collecting information or illustrate results of the data.</td>
</tr>
<tr>
<td>Energizers</td>
<td>Use short physical activities to increase the energy level of participants (especially after lunch or when participants are getting tired).</td>
</tr>
</tbody>
</table>

Manage the Training
As the facilitator, you are the manager of the training and it is up to you to keep the training on schedule and under control. There may be difficult situations, difficult participants, and unexpected circumstances to deal with. It is your responsibility to keep control and manage the problem, whatever it may be.

Manage time
Participants typically enjoy group discussions and want to share their ideas and experiences. As a result, it is easy for discussions to take too much time or get focused on topics that may not be critical to the training. It is important to know when to quit discussing a topic and move on to the next part of the training. ELMO (Enough, Let’s Move On) can be used as a code word to bring a discussion to a close.

Manage difficult participants
Throughout the training, continually assess the dynamics of the group. Occasionally, the learning environment might be disrupted by individual participants. Some characteristics of a difficult participant include
- Dominating the conversation
• Interrupting others
• Acting as a know-it-all
• Not participating

The following table includes suggestions for dealing with difficult participants.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain control</td>
<td>You are the manager of the training and need to stay in control. There may be a participant who challenges this, but it is up to you to control the situation in a professional manner.</td>
</tr>
</tbody>
</table>
| Use body language                                | • Stand next to or behind participants who are having side-bar conversations or are being disruptive  
                                     • Look at someone “a little too long” if they are being disruptive  
                                     • Avoid looking at a participant who tries to dominate the conversation                                                               |
| Use verbal cues                                  | • For a participant who is dominating the conversation, thank him/her for contributing and then ask participants  
                                              ○ “Are there any other opinions?”  
                                              ○ “Can we hear from some other participants?”  
                                     • Encourage participants who are quiet by  
                                              ○ Asking for opinions from people who haven't been commenting and then looking at those specific people |
| Refer to the “ground rules” and the “parking lot”| It can be helpful to remind participants of the ground rules established at the beginning of the course. You can always add to the ground rules throughout the training. If someone is talking too much about a certain topic, use the parking lot. |
| Give the person a specific task                  | If the person is busy, he/she will be less likely to be disruptive. For example, have the person write comments on the flip chart or have them help keep time. |
| Change the dynamics of the group by changing seating arrangements | If a participant is disruptive, change the seating arrangements.  
                                              • Strategically seat the difficult participant up front near you.  
                                              • During breaks or lunch change the seating arrangement by moving the name tents. Make a general statement when participants return: “In order to help you get acquainted with as many other participants as possible, the seating arrangements have been changed.” This is effective for separating participants who are having side bar conversations. |
Talk to the person outside the classroom

- Address such behaviors in private at your earliest convenience (during a break or lunch). Tactfully tell the participant how he/she is being disruptive. Refer to the ground rules, and reinforce the importance of adhering to those rules.
- Never reprimand a difficult participant in front of the larger group! When training adults, it is important to show respect. If you do not, they may become resentful and try to challenge you throughout the remaining of the training.

Never lose your “cool” or be rude
Always treat participants in a professional manner.

Sample Agenda

The Self-Study Modules on Tuberculosis, 1-5 Slide Sets may be used either as a complete course or as stand-alone presentations. The sample one-day agenda (below) could serve as the basis for a comprehensive training that integrates the information from all five module presentations.

Note: Times allocated for each section in the agenda are suggestions. All of the curriculum content is important; however, every training is different and the facilitator should adjust the times allocated according to the needs, knowledge, and experience of the group.

Sample One-Day Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 – 8:30 am</td>
<td>Course Introduction/Overview</td>
</tr>
<tr>
<td>8:30 – 9:30 am</td>
<td>Module 1, Transmission and Pathogenesis of Tuberculosis</td>
</tr>
<tr>
<td>9:30 – 9:45 am</td>
<td>BREAK</td>
</tr>
<tr>
<td>9:45 – 10:45 am</td>
<td>Module 2, Epidemiology of Tuberculosis</td>
</tr>
<tr>
<td>10:45 – 12:15 pm</td>
<td>Module 3, Targeted Testing and the Diagnosis of LTBI and TB Disease</td>
</tr>
<tr>
<td>12:15 – 1:15 pm</td>
<td>LUNCH</td>
</tr>
<tr>
<td>1:15 – 2:45 pm</td>
<td>Module 4, Treatment of LTBI and TB Disease</td>
</tr>
<tr>
<td>2:45 – 3:00 pm</td>
<td>BREAK</td>
</tr>
<tr>
<td>3:00 – 4:15 pm</td>
<td>Module 5, Infectiousness and Infection Control</td>
</tr>
<tr>
<td>4:15 – 5:00 pm</td>
<td>Summary and Evaluations</td>
</tr>
</tbody>
</table>
Additional Information

Continuing Education Units
Continuing education units (CEUs), continuing medical education (CME), continuing nursing education (CNEs), and continuing education contact hours (CECH) are free of charge for the print-based *Self-Study Modules on Tuberculosis, 1-5*. For more information on CEUs for this activity, please visit the CDC Division of Tuberculosis Elimination’s website at www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

Additional Information on TB
For additional information on TB, visit the CDC Division of Tuberculosis Elimination’s website at www.cdc.gov/tb. If you have questions on state-specific TB guidelines, please contact your state TB control office. A list of state TB control offices can be found on the CDC Division of Tuberculosis Elimination’s website at www.cdc.gov/tb.
Self-Study Modules on Tuberculosis, 1-5 Slide Sets
Facilitation Tips
Module 1: Transmission and Pathogenesis of Tuberculosis

Facilitation Tips

Background
In this module, participants will learn about the history of tuberculosis (TB). Participants will also learn how TB is spread from person to person (transmission) and how TB disease develops in the body (pathogenesis). Our understanding of the transmission and pathogenesis of TB has guided us in developing strategies for controlling the spread of TB and for treating latent TB infection (LTBI) and TB disease. As public health workers, participants should understand these concepts so that they can educate the patients they serve.

Learning Objectives
After this presentation, participants will be able to
1. Briefly describe the history of TB.
2. Explain how TB is spread (transmission).
3. Define drug-resistant TB.
4. Explain the difference between LTBI and TB disease.
5. Explain how LTBI and TB disease develop (pathogenesis).
6. Describe the classification system for TB.

Module Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Content</th>
<th>Resources Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Presentation</td>
<td>Introduction</td>
<td>Slides 1-5</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>History of TB</td>
<td>Slides 6-15</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>TB Transmission</td>
<td>Slides 16-24</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>Drug-Resistant TB</td>
<td>Slides 25-30</td>
</tr>
<tr>
<td>10 min.</td>
<td>Presentation</td>
<td>TB Pathogenesis</td>
<td>Slides 31-47</td>
</tr>
<tr>
<td>10 min.</td>
<td>Presentation</td>
<td>Progression from LTBI to TB Disease</td>
<td>Slides 48-56</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>Sites of TB Disease</td>
<td>Slides 57-60</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>TB Classification System</td>
<td>Slides 61-64</td>
</tr>
<tr>
<td>5 min.</td>
<td>Case Studies</td>
<td>Case Studies</td>
<td>Slides 65-69</td>
</tr>
<tr>
<td>60 min.</td>
<td>Total Time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Slide 1

**Self-Study Modules on Tuberculosis, 1-5**

Centers for Disease Control and Prevention  
Division of Tuberculosis Elimination  
2016

- Introduce yourself to participants. Include your name and what organization you represent.
- Ask participants to introduce themselves, stating their names and organizations.
- Provide information about the following:
  - Location of restrooms
  - Refreshments, if provided
- Discuss ground rules and the parking lot.
- Ask participants to sign participant roster.

### Slide 2

**CDC Self-Study Modules on Tuberculosis, 1-5**

- Module 1: Transmission and Pathogenesis of TB
- Module 2: Epidemiology of TB
- Module 3: Targeted Testing and the Diagnosis of Latent TB Infection and TB Disease
- Module 4: Treatment of Latent TB Infection and TB Disease
- Module 5: Infectiousness and Infection Control

- Explain to participants that the presentations were created using the print-based *Self-Study Modules on Tuberculosis, 1-5*.
- Ask who has worked through the print-based modules before.
- Review slide content.
- Mention that each module includes content about that topic.
- State that study questions and case studies are included in each module to help reinforce and apply content.
Module 1: Objectives
At completion of this module, learners will be able to
1. Describe the history of tuberculosis (TB).
2. Explain how TB is spread (transmission).
3. Define drug-resistant TB.
4. Explain the difference between latent TB infection (LTBI) and TB disease.
5. Explain how LTBI and TB disease develop (pathogenesis).
6. Describe the classification system for TB.

Module 1: Overview
- History of TB
- TB Transmission
- Drug-Resistant TB
- TB Pathogenesis
- Progression from LTBI to TB disease
- Sites of TB disease
- TB Classification System
- Case Studies
History of TB

• TB has affected humans for millennia
• Historically known by a variety of names, including:
  – Consumption
  – Wasting disease
  – White plague
• TB was a death sentence for many

Before showing slide, ask participants if they know of other names for TB

Review slide content

Review slide content

Note that the image is of Mycobacterium tuberculosis
History of TB (3)

Sanatoriums

- Before TB antibiotics, many patients were sent to sanatoriums.
- Patients followed a regimen of bed rest, open air, and sunshine.
- TB patients who could not afford sanatoriums often died at home.

Breakthrough in the Fight Against TB (1)

Drugs that could kill TB bacteria were discovered in 1940s and 1950s.
- Streptomycin (SM) discovered in 1943.
- Isoniazid (INH) and p-aminosalicylic acid (PAS) discovered between 1943 and 1952.

Breakthrough in the Fight Against TB (2)

- TB death rates in U.S. began to drop dramatically.
- Each year, fewer people died from TB.
- Most TB sanatoriums in U.S. had closed by mid 1970s.

Review slide content.

Explain that the image is of women at a sanatorium resting outside.

Note that it used to be believed that cool, fresh air was beneficial for TB patients.

Review slide content.

Mention that as the number of cases and deaths declined, many people began to hope that TB could be eliminated from the U.S., like smallpox and polio.
TB Resurgence
• Increase in TB in mid 1980s
• Contributing factors:
  – Inadequate funding for TB control programs
  – HIV epidemic
  – Increased immigration from countries where TB is common
  – Spread of TB in homeless shelters and correctional facilities
  – Increase and spread of multidrug-resistant TB

• Before showing the slide, ask participants why there was an increase in TB in the U.S. during the mid-1980s
• Review slide content

TB Prevention and Control Efforts
• Increased governmental funding for TB control programs began in 1992
• Number of TB cases declined from 1993 to 2014

• Point out the increase (1980s) and decrease (after 1993) in TB cases on the graph
• Stress that prevention and control efforts must be maintained since TB continues to be reported in almost every state and not all states have seen a decrease in TB cases

TB History Timeline
• Recap the major events in the history of TB

TB Resurgence - Module 1, p. 5 and Module 2, p. 4
TB Prevention and Control Efforts - Module 2, pp. 4-5
TB History Timeline - Module 1, p. 6
History of TB
Study Question 1.1
In what year was each of the following discoveries made?

a. TB was shown to be contagious
   1865
b. The bacterium that causes TB was discovered
   1882
c. The first drug that could kill TB bacteria was discovered
   1943

Module 1 – Transmission and Pathogenesis of Tuberculosis

- Introduce study questions
- Ask participants to turn to p. 6 (if participants have print-based modules)
- Ask for a volunteer to read question
- Ask participants for answers
- Click enter for the answer to appear

Note: All study questions and case studies are animated. The question appears first. Click “enter” and the answer will appear.

Answers – Module 1, p. 26

TB Transmission

- Introduce section
- Ask participants how TB is transmitted

Module 1 – Transmission and Pathogenesis of Tuberculosis

Transmission is defined as the spread of an organism, such as *M. tuberculosis*, from one person to another.

Definition of Transmission – Module 1, p. 7
• **M. tuberculosis** causes most TB cases in U.S.
• Mycobacteria that cause TB:
  - **M. tuberculosis**
  - **M. bovis**
  - **M. africanum**
  - **M. microti**
  - **M. canetti**
• Mycobacteria that do not cause TB
  - e.g., **M. avium-complex**

### Slide 19

- TB is spread person to person through the air via droplet nuclei
- **M. tuberculosis** may be expelled when an infectious person:
  - Coughs
  - Speaks
  - Sings
- Transmission occurs when another person inhales droplet nuclei

### Slide 20

- Note that this image depicts airborne transmission. The individual on the left has infectious TB disease and is expelling it into the air. The individual on the right is inhaling the droplet nuclei into their lungs.

Note: Dots in the image are animated. Click “enter” once to start animation.
Slide 21

**TB Transmission (5)**

- Probability that TB will be transmitted depends on:
  - Infectiousness of the TB patient
  - Environment in which the exposure occurred
  - Frequency and duration of the exposure
  - Susceptibility (immune status) of the exposed individual
- The best way to stop transmission is to:
  - Isolate infectious persons
  - Provide treatment to infectious persons as soon as possible

*Module 1 – Transmission and Pathogenesis of Tuberculosis*

---

Slide 22

**TB Transmission Study Question 1.2**

What organism causes TB?

*M. tuberculosis*

What are four other tuberculous mycobacteria?

*M. bovis, M. africanum, M. microti, and M. canetti*

*Module 1 – Transmission and Pathogenesis of Tuberculosis*

---

Slide 23

**TB Transmission Study Question 1.3**

How is TB spread?

TB is spread from person to person through the air via droplet nuclei containing *M. tuberculosis*.

*Module 1 – Transmission and Pathogenesis of Tuberculosis*

---

TB Transmission - Module 1, p. 8

- Emphasize that not everyone who is exposed to TB becomes infected; it depends on many factors
- Review slide content
- Note that the length of time required for a patient to be considered noninfectious after starting treatment varies

---

**Answers – Module 1, p. 26**

- Introduce study questions
- Ask participants to turn to p. 10 (if participants have print-based modules)
- Ask for a volunteer to read question
- Ask participants for answers

---

Answers – Module 1, p. 26

- Read question
- Ask participants for answers
The probability that TB will be transmitted depends on what four factors?

- Infectiousness of the TB patient
- Environment in which exposure occurred
- Frequency and duration of the exposure
- Susceptibility (immune status) of the exposed individual

Drug-Resistant TB

- Caused by *M. tuberculosis* organisms resistant to at least one TB treatment drug
- Resistant means drugs can no longer kill the bacteria

Drug-Resistant TB (1)

- Read question
- Ask participants for answers

- Introduce section

- Review slide content
- Note that drug-resistant TB is more difficult to treat because there are fewer treatment options
Drug-Resistant TB (2)

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono-resistant</td>
<td>Resistant to any one TB treatment drug</td>
</tr>
<tr>
<td>Poly-resistant</td>
<td>Resistant to at least any 2 TB drugs (but not both isoniazid and rifampin)</td>
</tr>
<tr>
<td>Multidrug-resistant (MDR TB)</td>
<td>Resistant to at least isoniazid and rifampin, the 2 best first-line TB treatment drugs</td>
</tr>
<tr>
<td>Extensively drug-resistant (XDR TB)</td>
<td>Resistant to isoniazid and rifampin, PLUS resistant to any fluoroquinolone AND at least 1 of the 3 injectable anti-TB drugs (e.g., amikacin, kanamycin, or capreomycin)</td>
</tr>
</tbody>
</table>

Drug-Resistant TB (3)

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Resistance</td>
<td>Caused by person-to-person transmission of drug-resistant organisms</td>
</tr>
<tr>
<td>Secondary Resistance (acquired)</td>
<td>Develops during TB treatment:</td>
</tr>
<tr>
<td></td>
<td>• Patient was not treated with an appropriate regimen OR</td>
</tr>
<tr>
<td></td>
<td>• Patient did not follow treatment regimen as prescribed</td>
</tr>
</tbody>
</table>

Drug-resistant TB Study Question 1.5

What is drug-resistant TB?

Drug-resistant TB is caused by *M. tuberculosis* organisms that are resistant to at least one anti-TB drug.

Drug-resistant TB can be difficult to treat.
Drug-resistant TB
Study Question 1.6
What is the difference between primary and secondary drug resistance?

- Primary resistance is caused by person-to-person transmission of drug-resistant organisms.
- Secondary resistance develops during TB treatment. Either the patient was not treated with the right TB drugs or the patient did not follow the prescribed treatment regimen.

Answers – Module 1, p. 26

TB Pathogenesis

Pathogenesis is defined as the way an infection or disease develops in the body.
**Slide 33**

**TB Pathogenesis (2)**

**Latent TB Infection (LTBI)**

- LTBI occurs when tubercle bacilli are in the body, but the immune system is keeping them under control.
- LTBI is detected by the Mantoux tuberculin skin test (TST) or by an interferon-gamma release assay (IGRA), such as:
  - QuantiFERON®-TB Gold In-Tube (QFT-GIT)
  - T-Spot®.TB test (T-SPOT)
- People with LTBI are NOT infectious.

**LTBI – Module 1, p. 12**

---

**Slide 34**

**TB Pathogenesis (3)**

**TB Disease**

- TB disease develops when the immune system cannot keep tubercle bacilli under control.
  - May develop very soon after infection or many years after infection.
- About 10% of all people with normal immune systems who have LTBI will develop TB disease at some point in their lives.
- People with TB disease are often infectious.

**TB Disease – Module 1 p. 16**

---

**Slide 35**

**TB Pathogenesis (4)**

1. Droplet nuclei containing tubercle bacilli are inhaled, enter the lungs, and travel to small air sacs (alveoli).

**TB Pathogenesis – Module 1 p. 16**
Tubercle bacilli multiply in alveoli, where infection begins.

A small number of tubercle bacilli enter bloodstream and spread throughout body.

Within 2 to 8 weeks the immune system produces special immune cells called macrophages that surround the tubercle bacilli. These cells form a barrier shell that keeps the bacilli contained and under control (LTBI).

State that tubercle bacilli can reach any part of the body, but areas where TB disease is more likely to develop include:
- Lungs
- Kidneys
- Brain
- Bones

Call attention to the barrier shell around the bacilli that is keeping the tubercle bacilli contained (upper left corner of figure).
TB Pathogenesis (8)

TB Disease

- If the immune system CANNOT keep tubercle bacilli under control, bacilli begin to multiply rapidly and cause TB disease
- This process can occur in different places in the body

Note: The red circle around broken barrier shell is animated. Click “enter” for the circle to appear.

LTBI vs. TB Disease (1)

<table>
<thead>
<tr>
<th>Person with LTBI</th>
<th>Person with TB Disease (in the lungs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a small number of TB bacteria in his or her body that are alive, but under control</td>
<td>Has a large number of active TB bacteria in his or her body</td>
</tr>
<tr>
<td>Cannot spread TB bacteria to others</td>
<td>May spread TB bacteria to others</td>
</tr>
<tr>
<td>Does not feel sick, but may become sick if the bacteria become active in his or her body</td>
<td>May feel sick and may have symptoms such as cough, fever, or weight loss</td>
</tr>
<tr>
<td>TST or IGRA results usually positive</td>
<td>TST or IGRA results usually positive</td>
</tr>
<tr>
<td>Chest x-ray usually normal</td>
<td>Chest x-ray usually abnormal</td>
</tr>
</tbody>
</table>

LTBI vs. TB Disease (2)

<table>
<thead>
<tr>
<th>Person with LTBI</th>
<th>Person with TB Disease (in the lungs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum smears and cultures negative</td>
<td>Sputum smears and cultures may be positive</td>
</tr>
<tr>
<td>Should consider treatment for LTBI to prevent TB disease</td>
<td>Needs treatment for TB disease</td>
</tr>
<tr>
<td>Does not require respiratory isolation</td>
<td>May require respiratory isolation</td>
</tr>
<tr>
<td>Not a case of TB</td>
<td>A case of TB</td>
</tr>
</tbody>
</table>
Study Question 1.7

When a person inhales droplet nuclei containing *M. tuberculosis*, where do the droplet nuclei go?

- Most of the larger droplet nuclei become lodged in the upper respiratory tract, where infection is unlikely to develop.
- However, droplet nuclei may reach the small air sacs of the lung (the alveoli), where infection may begin.

Answers – Module 1, p. 26

Study Question 1.8

After the tubercle bacilli reach the small air sacs of the lung (the alveoli), what happens to the tubercle bacilli?

- Tubercle bacilli multiply in alveoli and some enter the lymph nodes and bloodstream and spread throughout the body.
- Bacilli may reach any part of the body.
- Within 2 to 8 weeks, the immune system usually intervenes, halting multiplication and preventing further spread.

Answers – Module 1, p. 27

Study Question 1.9

In people with LTBI (but not TB disease), how does the immune system keep the tubercle bacilli under control?

The immune system produces special immune cells that surround the tubercle bacilli. The cells form a shell that keeps the bacilli contained and under control.

Answers – Module 1, p. 27
How is LTBI detected?

LTBI is detected by the Mantoux tuberculin skin test (TST) or blood tests such as interferon-gamma release assays (IGRAs), which include the QuantiFERON®-TB Gold In-tube (QFT-GIT) or the T-SPOT®. TB test (T-SPOT).

What are the major similarities and differences between LTBI and TB disease? List characteristics of each.

<table>
<thead>
<tr>
<th>Person with Latent TB Infection (LTBI)</th>
<th>Person with TB Disease (in the lung)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a small number of TB bacteria in his or her body that are not active</td>
<td>Has a large number of active TB bacteria in his or her body</td>
</tr>
<tr>
<td>Often has some TB bacteria in sputum</td>
<td>May not have TB bacteria in sputum</td>
</tr>
<tr>
<td>Does not have symptoms</td>
<td>May feel sick and have symptoms such as a cough, fever, or weight loss</td>
</tr>
<tr>
<td>The skin test is usually negative</td>
<td>The skin test is usually positive</td>
</tr>
<tr>
<td>Spontaneous sputum culture is usually negative</td>
<td>Spontaneous sputum culture is usually positive</td>
</tr>
<tr>
<td>Tuberculosis skin test or interferon-gamma release test is usually positive</td>
<td>Tuberculosis skin test or interferon-gamma release test is usually negative</td>
</tr>
<tr>
<td>Can be treated with chemotherapy</td>
<td>May require hospitalization</td>
</tr>
<tr>
<td>May be treated with medications</td>
<td>May require hospitalization</td>
</tr>
</tbody>
</table>

What happens if the immune system cannot keep the tubercle bacilli under control and the bacilli begin to multiply rapidly?

When this happens, TB disease develops. The risk that TB disease will develop is higher for some people than for others.
Progression from LTBI to TB Disease

- Introduce section

Progression to TB Disease (1)

- Risk of developing TB disease is highest the first 2 years after infection
- People with LTBI can be given treatment to prevent them from developing TB disease
- Detecting TB infection early and providing treatment helps prevent new cases of TB disease

Progression to TB Disease (2)

Some conditions increase probability of LTBI progressing to TB disease

- Infection with HIV
- History of untreated or inadequately treated TB disease
- Recent TB infection (within the past 2 years)
- Immunosuppressive therapy such as tumor necrosis factor-alpha (TNF) antagonists, systemic corticosteroids, or immunosuppressive drug therapy following organ transplantation
- Abusing drugs or alcohol or smoking cigarettes
- Silicosis
- Diabetes mellitus
- Chronic renal failure
- Certain types of cancer (e.g., leukemia, cancer of the head, neck, or lung)
- Certain intestinal conditions
- Low body weight

Review slide content

- Explain that since the risk of progressing to TB disease is the highest in the first two years after infection, it is important to detect TB infection early

Review slide content

- Tell participants that some of these terms can be found in the glossary of print-based Module 1, pp. 2-4

Progression to TB Disease – Module 1, pp. 18-19
Progression to TB Disease (3)

- Review slide content
- Emphasize that not everyone exposed to TB becomes infected with TB, and not everyone that becomes infected with TB develops TB disease

Progression to TB Disease (4)

- Before showing slide, ask participants what is the strongest known risk factor for the progression of TB disease in people with TB infection
- Note that worldwide TB is responsible for the deaths of 1 in 3 people living with HIV/AIDS; making it the leading cause of death for people infected with HIV
- Review slide content

Progression to TB Disease (5)

- Review slide content
- Ask why the risk is so much greater with HIV infection
Progression to TB Disease
Study Question 1.13
What percentage of people who have LTBI (but not HIV infection) usually develop TB disease?

- About 10% of all people with LTBI will develop TB disease at some point
  - In U.S., about 5% of recently infected will develop TB disease in first year or two after infection
  - Additional 5% will develop disease later in life
- Remaining 90% will remain free of disease for the rest of their lives

Answers – Module 1, p. 28

Progression to TB Disease
Study Question 1.14
What conditions appear to increase the risk that LTBI will progress to TB disease?

- Infection with HIV
- History of untreated or inadequately treated TB disease
- Recent TB infection (within the past 2 years)
- Immunosuppressive therapy such as tumor necrosis factor-alpha (TNF) antagonists, systemic corticosteroids, or immunosuppressive drug therapy following organ transplantation
- Abusing drugs or alcohol or smoking cigarettes
- Silicosis
- Diabetes mellitus
- Chronic renal failure
- Certain types of cancer (e.g., leukemia, cancer of the head, neck, or lung)
- Certain intestinal conditions
- Low body weight

Answers – Module 1, pp. 28-29

Progression to TB Disease
Study Question 1.15
How does being infected with both M. tuberculosis and HIV affect the risk for TB disease?

- Much more likely to develop TB disease
- Risk of developing TB disease is 7% to 10% EACH YEAR (if HIV is not being treated)
- In an HIV-infected person, TB disease can develop in two ways:
  1. Person with LTBI becomes infected with HIV and then develops TB disease as the immune system is weakened
  2. Person with HIV infection becomes infected with M. tuberculosis and then rapidly develops TB disease

Answers – Module 1, p. 29
TB Pathogenesis

Sites of TB Disease

- Introduce section
- Note that some patients who have extrapulmonary TB also have pulmonary TB

 Sites of TB Disease, Module 1, p. 22

Bacilli may reach any part of the body, but common sites include:

- Pulmonary TB: Lungs
- Extrapulmonary TB: Larynx, Lymph nodes, Pleura, Brain, Kidneys, Bones and joints, Pleura
- Disseminated TB: Carried to all parts of the body, through bloodstream

Location Frequency
Pulmonary TB Lungs Most TB cases are pulmonary
Extrapulmonary TB Places other than lungs such as: Larynx, Lymph nodes, Pleura, Brain, Kidneys, Bones and joints Found more often in: HIV-infected or other immunosuppressed persons Young children
Disseminated TB Carried to all parts of body, through bloodstream Rare

Sites of TB Disease – Module 1, p. 22
Sites for TB
Study Question 1.16
What part of the body is the most common site for TB disease?

Lungs are the most common site

What are some other common sites?
- Larynx
- Lymph nodes
- Pleura (membrane around the lungs)
- Brain
- Kidneys
- Bones and joints

TB Pathogenesis

TB Classification System

Class | Type | Description
--- | --- | ---
0 | No TB exposure | No history of TB exposure
No infected | Negative result to a TST or an IGRA
1 | TB exposure | History of TB exposure
No evidence of infection | Negative result to a TST or an IGRA (done at least 8 to 10 weeks after exposure)
2 | TB infection | Positive result to a TST or an IGRA
No TB disease | Negative smears, molecular tests, and cultures
No clinical or x-ray evidence of active TB disease
**TB Classification System (2)**

Based on pathogenesis of TB

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>TB, clinically active</td>
<td>Positive culture for <em>M. tuberculosis</em> OR Positive result to a TST or to an IGRA, and clinical, bacteriological, or x-ray evidence of current active TB disease</td>
</tr>
<tr>
<td>4</td>
<td>Previous TB disease (not clinically active)</td>
<td>Medical history of TB disease Abnormal but stable x-ray findings Positive result to a TST or to an IGRA Negative smears, molecular tests, and cultures (if done) No clinical or x-ray evidence of active TB disease</td>
</tr>
<tr>
<td>5</td>
<td>TB suspected</td>
<td>Signs and symptoms of TB disease, but diagnostic evaluation not complete</td>
</tr>
</tbody>
</table>

*Based on TB Classification System – Module 1, p. 23*

- Review slide content
- State that any TB patient with a classification of 3 or 5 should receive treatment for TB, and should be reported to the health department

---

**TB Classification System**

*Study Question 1.17*

What is the classification system for TB based on? What is it used for?

The current classification system is based on the pathogenesis of TB. Many health departments and private health care providers use this system when describing patients.

*Answers – Module 1, p. 29*

- Ask participants to turn to p. 24 (if participants have print-based modules)
- Read question
- Ask participants for answers

---

**Case Studies**

- Introduce case studies
Module 1: Case Study 1.1 (1)

A 30-year-old man visits the health department for a TST because he is required to have one before starting his new job as a health care worker. He has an 18 mm positive reaction to the TST. He has no symptoms of TB, and his chest x-ray findings are normal.

Module 1: Case Study 1.1 (2)

Should this be considered a case of TB?
No. The man described above has LTBI. He has an 18 mm positive reaction to the TST, but no evidence of TB disease. Therefore, this is not a case of TB.

Should this man be considered infectious?
No, he should not be considered infectious. This man has LTBI, not TB disease. People with TB infection and no evidence of TB disease are not infectious.

Module 1: Case Study 1.2 (1)

A 45-year-old woman is referred to the health department by her private physician because she was found to have LTBI as part of an employee testing program. She is overweight, with high blood pressure. Upon further questioning, she reports that she has injected illegal drugs in the past, but has never been tested for HIV infection.
Module 1: Case Study 1.2 (2)

What conditions does this woman have that increase the risk that she will develop TB disease?

Drug abuse increases the risk that LTBI will progress to TB disease. This woman may also be at risk for HIV infection because of her injection drug use. HIV is the strongest known risk factor for developing TB disease. This woman should be offered HIV counseling, testing, and referral. Overweight and high blood pressure are NOT risk factors for TB disease.

- Read case study question
- Ask participants for answers
- Ask if there are any questions about Module 1 before moving on to Module 2

Answers – Module 1, p. 30
Module 2: Epidemiology of Tuberculosis

Facilitation Tips

Background
Epidemiology is the study of diseases and other health problems in groups of people. Epidemiologists determine the frequency and pattern (the distribution) of health problems in different communities. In other words, they find out who has a specific health problem, how often the problem occurs, and where the problem occurs. Using this information about who, when, and where, epidemiologists try to determine why the health problem is occurring.

Public health officials use epidemiologic information to design ways to prevent and control the diseases in the community. By finding out who is at risk for a specific health problem, they can target their prevention and control strategies at this group.

This module examines recent trends in TB in the United States and describes groups of people who are at higher risk for latent TB infection (LTBI) and TB disease. Groups of people who are at higher risk for TB vary from area to area; state and local health departments are responsible for determining specifically who is at risk in their area.

Learning Objectives
After this presentation, participants will be able to
1. Describe how the number of TB cases reported in the United States has changed over the last 60 years.
2. List five factors that contributed to the increase in the number of TB cases between 1985 and 1992.
3. List three improvements TB programs were able to make with increased federal, state, and other funds and resources that have contributed to a decrease in TB cases since 1993.
4. List the groups of people who are more likely to be exposed to or infected with \( M. \) \( tuberculosis \).
5. List the groups of people who are more likely to develop TB disease once infected with \( M. \) \( tuberculosis \).

Module Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Content</th>
<th>Slides</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>Introduction</td>
<td>Slides 1-3</td>
</tr>
<tr>
<td>15 min.</td>
<td>Presentation</td>
<td>Epidemiology of TB</td>
<td>Slides 4-31</td>
</tr>
<tr>
<td>35 min.</td>
<td>Presentation</td>
<td>People at High Risk for TB Infection and TB Disease</td>
<td>Slides 32-59</td>
</tr>
<tr>
<td>5 min.</td>
<td>Case Studies</td>
<td>Case Studies</td>
<td>Slides 60-62</td>
</tr>
<tr>
<td>60 min.</td>
<td>Total Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slide 1</td>
<td>Facilitation Tips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Self-Study Modules on Tuberculosis** | • Introduce Module 2  
• Ask participants if they know what epidemiology is |

<table>
<thead>
<tr>
<th>Slide 2</th>
<th>Module 2: Objectives</th>
</tr>
</thead>
</table>
| **Module 2: Objectives** | At completion of this module, learners will be able to:  
1. Describe how the number of TB cases reported in the U.S has changed over the last 60 years  
2. List 5 factors that contributed to the increase of TB cases between 1985 and 1992  
3. List 3 improvements TB programs made with increased funds that have contributed to a decrease in TB cases since 1993  
4. List groups of people who are more likely to be exposed to or infected with *M. tuberculosis*  
5. List groups of people who are more likely to develop TB disease once infected with *M. tuberculosis* |

<table>
<thead>
<tr>
<th>Slide 3</th>
<th>Module 2: Overview</th>
</tr>
</thead>
</table>
| **Module 2: Overview** | • Introduction to TB Epidemiology  
• People at High Risk for TB Infection and TB Disease  
• Case Studies |

---

*Background and Objectives - Module 2, p. 1*
Introduction to TB
Epidemiology

Epidemiology (1)

Epidemiology is the study of the distribution and causes of disease and other health problems in groups of people.

Epidemiology (2)

- Epidemiologists:
  - Determine frequency and pattern of health problems in communities
  - Try to figure out why health problems are occurring

Epidemiology of TB - Module 2, pp. 3-5
Epidemiology - Module 2, p. 1
Epidemiology definition - Module 2, p. 1

Module 2 - Epidemiology of Tuberculosis

Global Epidemiology of TB

- TB is one of the leading causes of death due to infectious disease in the world
- Almost 2 billion people are infected with *M. tuberculosis*
- Each year about:
  - 9 million people develop TB disease
  - 1.5 million people die of TB

TB Reporting in U.S.

- The Report of Verified Case of Tuberculosis (RVCT) is the national TB surveillance data collection form and is used for reporting all verified TB cases to CDC
  - The 50 states, District of Columbia, New York City, Puerto Rico, and 7 other jurisdictions in the Pacific and Caribbean report TB cases to CDC
- Health care providers are required by law to report TB cases to state or local health departments

U.S. Epidemiology of TB 1953 - 1986

- 1953:
  - More than 84,000 cases of TB
- 1953-1984:
  - TB cases declined about 6% each year
- 1985:
  - TB cases reached a low of 22,201
- 1986:
  - Significant increase in TB cases began

Before showing slide, ask how many people in the world are infected with TB

State that 1/3 of the world’s population is infected with TB

Review slide content

Review slide content

Review slide content

Emphasize that from 1953-1984 TB cases were declining

Explain that one of the main reasons for this decline was that TB treatment drugs were discovered in the 1940s and 1950s

Review slide content
**Slide 10**

**U.S. TB Resurgence (1)**

1986 - 1992

- Review slide content
- Call attention to the increase in TB cases on the graph (1980s)
- Ask participants why they think there was 20% increase in TB cases in the 1980s

**Slide 11**

**U.S. TB Resurgence (2)**

1986 - 1992

- Contributing factors:
  - Inadequate funding for TB control and other public health efforts
  - HIV epidemic
  - Increased immigration from countries where TB is common
  - Spread of TB in certain settings (e.g., homeless shelters and correctional facilities)
  - Spread of multidrug-resistant TB (MDR TB)

- Explain that there were several contributing factors to the TB resurgence in the U.S.
- Review slide content

**Slide 12**

**U.S. TB Control and Prevention (1)**

1993 - 2014

- 1993-2014:
  - Number of TB cases reported annually in U.S. steadily declined
- Increased federal funds and other resources allowed TB programs to improve control efforts to:
  - Promptly identify persons with TB
  - Start appropriate initial treatment for TB cases
  - Ensure patients complete treatment
  - Conduct contact investigations

- Review slide content
- Stress that prevention and control efforts must be maintained in order to prevent another resurgence

---

*U.S. TB Resurgence - Module 2, p. 4*

*U.S. TB Control and Prevention - Module 2, p. 5*
Slide 13

- Call attention to the decrease in TB cases on the graph (after 1993)
- State that there were 9,421 TB cases in the U.S. in 2014

Slide 14

- Explain that there remain several areas of ongoing challenges in TB control
- Review slide content

Slide 15

- Review slide content

TB Case Rates (1)

- A case rate is the number of TB cases that occur during a certain time period, divided by size of the population at that time
- Often expressed in terms of a population size of 100,000 persons
TB Case Rates (2)

Example:
• In the U.S. in 2014, there were 9,421 new TB cases in a population size of 318,857,056

\[
\frac{9,421}{318,857,056} \times 100,000 = 2.96
\]

• In 2014, the U.S. TB case rate was 2.96 TB cases per 100,000 persons (rounded to 3.0)

TB Case Rates (3)

• Health departments, CDC, and others can compare the occurrence of TB in different places, time periods, and groups of people using case rates

• Comparisons have shown that rates of TB are higher in certain groups than in others

Use the example on slide to demonstrate how to calculate a case rate

Module 2 – Epidemiology of Tuberculosis

TB Case Rates by State, 2014

• Explain that this map shows TB case rates by state

• Ask which states had higher rates and which had lower rates

• Point out the case rates for your area

Note: Slide reflects 2014 surveillance data

Module 2 – Epidemiology of Tuberculosis

Review slide content

• Ask which groups have higher TB case rates

Module 2 – Epidemiology of Tuberculosis
Epidemiology of TB

Study Question 2.1

What happened to the number of TB cases in the United States between 1953 and 1984?

From 1953 - 1984, the number of TB cases reported in the U.S. decreased by an average of 6% each year.

Study Question 2.2

What happened to the number of TB cases in the United States between 1985 and 1992?

From 1985 - 1992, the number of new TB cases increased by 20%.

Study Question 2.3

Name 5 factors that may have contributed to the increase in the number of TB cases between 1985 and 1992.

- Inadequate funding for TB control and other public health efforts
- HIV epidemic
- Increased immigration from countries where TB is common
- Spread of TB in certain settings (e.g., correctional facilities and homeless shelters)
- Spread of MDR TB

Answers - Module 2, p. 22
Slide 22

**Epidemiology of TB**

**Study Question 2.4**

What happened to the number of TB cases in the United States from 1993 to 2014?

From 1993 to 2014, there was a steady decline in the number of TB cases reported annually in the United States.

*Answers - Module 2, p. 22*

---

Slide 23

**Epidemiology of TB**

**Study Question 2.5**

Name 3 improvements TB programs were able to make with increased federal, state, and other funds that contributed to the decrease in TB cases since 1993.

- Promptly identify persons with TB
- Start appropriate initial treatment for TB cases
- Ensure patients complete treatment
- Conduct contact investigations

*Answers - Module 2, p. 22*

---

Slide 24

**Race and Ethnicity (1)**

- TB affects certain racial and ethnic minorities disproportionately
- In 2014, about 85% of TB cases in the U.S. were among racial and ethnic minorities
- Percentage of TB cases in racial and ethnic minorities is higher than expected based on percentage of these minorities in the U.S. population

*Race and Ethnicity - Module 2, p. 8*
- Explain that this pie chart shows the reported TB cases in the U.S. in 2014 by race and ethnicity.

- Ask participants which groups made up the greatest percentage of TB cases, and which groups made up the least.

Reported TB Cases by Race and Ethnicity – Module 2, p. 8

- Explain that this pie chart shows the U.S. population broken down by race and ethnicity.

- Ask participants what they notice when comparing this pie chart to the one on the previous slide (e.g., even though non-Hispanic whites make up more than 60% of the U.S. population, they only account for 13% of the TB cases).

- Explain that this means that the percentage of TB cases that occur in minorities is higher than expected based on their percentages in the U.S. population.

Reported TB Cases by Race and Ethnicity – Module 2, p. 9
• Disparities may exist due to racial and ethnic minorities having other risk factors for TB, such as:
  – Birth in a country where TB is common
  – HIV infection
  – Low socioeconomic status
  – Exposure to TB in high-risk settings

---

**Reported TB Cases by Race and Ethnicity**

Module 2 – Epidemiology of Tuberculosis

---

• Ask for a volunteer to read the definition of relative risk

---

• Use the example on slide to demonstrate how to calculate relative risk

---

Note: Slide reflects 2014 surveillance data
### Relative Risk for TB (3)
**Race and Ethnicity, 2014**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>TB Case Rate</th>
<th>Relative Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asians</td>
<td>17.8</td>
<td>29.6</td>
</tr>
<tr>
<td>Native Hawaiians or Other Pacific Islanders</td>
<td>16.9</td>
<td>28.1</td>
</tr>
<tr>
<td>Blacks or African Americans</td>
<td>5.1</td>
<td>8.5</td>
</tr>
<tr>
<td>American Indians or Alaska Natives</td>
<td>5.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Hispanics or Latinos</td>
<td>5.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Multiple Race</td>
<td>2.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>0.6</td>
<td>1</td>
</tr>
</tbody>
</table>

- Explain that in this table all case rates are compared to the case rate for non-Hispanic whites because non-Hispanic whites have the lowest case rate.

### Race and Ethnicity
**Study Question 2.6**
Which racial and ethnic groups are disproportionately affected by TB?

Asians, Native Hawaiians or Other Pacific Islanders, non-Hispanic blacks, Hispanics, and American Indians or Alaska Natives are disproportionately affected by TB.

- Introduce study questions.
- Ask participants to turn to p. 10 (if participants have print-based modules).
- Ask for a volunteer to read question.
- Ask participants for answers.

### People at High Risk for TB
**Infection and TB Disease**

- Introduce section.
- Ask participants who they think should be considered at high risk for TB infection.
High-Risk Groups

- High-risk groups can be divided into two categories:
  - High risk for exposure to or infection with *M. tuberculosis*
  - High risk for developing TB disease after infection with *M. tuberculosis*

People at High Risk for Exposure to or Infection with *M. tuberculosis*

- Contacts
- People who have come to the U.S. within the last 5 years from areas of the world where TB is common
- Persons who visit areas with a high prevalence of TB disease
- People who live or work in high-risk congregate settings
- Health care workers who serve patients at increased risk
- Populations defined locally as having an increased incidence of LTBI or TB disease, possibly medically underserved, low-income populations, or persons who abuse drugs or alcohol
- Infants, children, and adolescents exposed to adults who are at increased risk for LTBI or TB disease

People at High Risk for Developing TB Disease after Infection with *M. tuberculosis* (1)

- People living with HIV
- Children younger than 5 years of age
- People infected with *M. tuberculosis* within past 2 years
- People with a history of untreated or inadequately treated TB disease
- People who are receiving immunosuppressive therapy
- People with silicosis, diabetes mellitus, chronic renal failure, leukemia, or cancer of the head, neck, or lung
People at High Risk for Developing TB Disease after Infection with *M. tuberculosis* (2)

- Persons who have had a gastrectomy or jejunoileal bypass
- Low body weight
- Cigarette smokers and persons who abuse drugs or alcohol
- Populations defined locally as having an increased risk

High-Risk Groups for TB Infection (1)

Contacts

- Contacts are persons who have spent time with someone who has infectious TB disease
- May include:
  - Family members
  - Coworkers
  - Friends

High-Risk Groups for TB Infection (2)

Foreign-Born Persons/Immigrants

In the U.S., LTBI and TB disease often occur among people born in areas of the world where TB is common:

- Asia
- Africa
- Russia
- Eastern Europe
- Latin America
- Other Countries
- Mexico
- Philippines
- Vietnam

**Explain that the pie chart shows the overall distribution of the countries of birth of foreign-born persons reported with TB in 2014 in the U.S. The top 7 countries are highlighted.**

**Ask which of these foreign-born groups live in the participants’ areas**

High-Risk Groups for TB Infection (3)
Foreign-Born Persons/Immigrants

- Explain that the two pie charts show the percentage of TB cases by foreign-born and U.S. born persons in 1992 and 2014
- Explain that the percentage of TB cases in the U.S. that are among foreign-born persons has increased over the years (27% in 1992 vs. 66% in 2014)

Foreign-Born Persons/Immigrants – Module 2, p. 12

High-Risk Groups for TB Infection (4)
Foreign-Born Persons/Immigrants

- To address high rates of TB in foreign-born persons, CDC and other public health organizations are working to:
  - Improve the overseas and domestic screening process for immigrants and refugees
  - Strengthen the notification system that alerts health departments about the arrival of immigrants and refugees with suspected TB disease
  - Test recent arrivals from countries where TB is common for TB infection and ensure completion of treatment

Foreign-Born Persons/Immigrants – Module 2, p. 12

High-Risk Groups for TB Infection (5)
Foreign-Born Persons/Immigrants

- Individuals applying for immigration and refugee status from overseas:
  - Must be screened for TB by panel physicians before entering the U.S.
  - Must have completed treatment before entering the U.S. if diagnosed with TB disease

Foreign-Born Persons/Immigrants – Module 2, p. 12
High-Risk Groups for TB Infection (6)
Foreign-Born Persons/Immigrants
• Immigrants living in the U.S. who apply for permanent residence or citizenship:
  – Must be tested for TB infection and evaluated for TB disease by U.S.-based civil surgeons

High-Risk Groups for TB Infection (7)
Congregate Settings
• In certain congregate settings, the risk of being exposed to TB is higher than other places. This may include:
  – Correctional facilities
  – Homeless shelters
  – Nursing homes
  – Health care facilities

High-Risk Groups for TB Infection (8)
Congregate Settings
• Risk of exposure to TB is higher than in other settings
• Risk is higher if facility is crowded
High-Risk Groups for TB Infection (9)

**Correctional Facilities**
- Higher risk in correctional facilities may be due to:
  - Incarcerated population includes a high proportion of people at greater risk for TB than overall population (risk factors may include HIV-infection and a history of homelessness or drug use)
  - Physical structure of correctional facilities (e.g., close living quarters, overcrowding, potential for inadequate ventilation)
  - Movement of inmates into and out of facilities can lead to interruption of therapy

*Module 2 - Epidemiology of Tuberculosis*

Before showing slide, ask why groups in correctional settings are at higher risk for TB infection
- Review slide content
- Explain that being infected with HIV puts individuals at a higher risk of developing TB disease

---

High-Risk Groups for TB Infection (10)

**Health Care Workers**
- Might be exposed to TB at work
- Risk depends on:
  - Number of persons with TB in facility
  - Job duties
  - Infection control procedures

*Module 2 - Epidemiology of Tuberculosis*

Before showing slide, ask participants which factors can increase the risk for health care workers
- Review slide content
- Explain that facilities with a high risk of TB transmission should ensure appropriate TB prevention and control measures are taken
- Note that infection control procedures are discussed more in Module 5

---

High-Risk Groups for TB Infection (11)

**Populations Defined Locally**
- Populations that may have an increased risk include
  - Persons experiencing homelessness
  - Medically underserved populations
  - Low-income groups
  - Persons who abuse drugs or alcohol

*Module 2 - Epidemiology of Tuberculosis*

Before showing slide, ask why groups in correctional settings are at higher risk for TB infection
- Review slide content

---

*Correctional Facilities - Module 2, p. 13*
*Health Care Workers - Module 2, p. 13*
*Populations Defined Locally - Module 2, p. 14*
High-Risk Groups for TB Infection (12)
Populations Defined Locally

- Low-income is linked to higher risk of TB exposure
- Possible reasons include factors associated with low-income:
  - Inadequate living conditions
  - Crowding
  - Malnutrition
  - Poor access to health care
- TB rates are 10 times higher for people experiencing homelessness

Module 2 – Epidemiology of Tuberculosis

Review slide content

Populations Defined Locally - Module 2, p. 14

High-Risk Groups for TB Infection (13)
Children and Adolescents

- High risk if exposed to adults in high-risk groups
- If a child has TB infection or disease, it suggests that:
  - TB was transmitted relatively recently
  - Person who transmitted TB to child may still be infectious
  - Others may have been exposed

Module 2 – Epidemiology of Tuberculosis

Review slide content

Children and Adolescents - Module 2, p. 14-15

High-Risk Groups for TB Disease (1)
Infants and Children Younger than 5 Years

High risk for rapidly developing TB disease due to underdeveloped immune system

Module 2 – Epidemiology of Tuberculosis

Review slide content

Infants and Children - Module 2, p. 14-15
People Living with HIV

- HIV is the strongest known risk factor for developing TB disease.
- TB is the leading cause of death for people with HIV/AIDS.
- Risk of developing TB disease is 7% - 10% each year for people who are infected with both TB and HIV (if the HIV is not treated).

Module 2 – Epidemiology of Tuberculosis 51

People Living With HIV - Module 2, p. 15

Introduce study questions
- Ask participants to turn to p. 16 (if participants have print-based modules)
- Ask for a volunteer to read question
- Ask participants for answers

Answers - Module 2, p. 23

Ask for a volunteer to read question
- Ask participants for answers

Answers - Module 2, p. 23
Why is the risk of being exposed to TB higher in certain settings, such as nursing homes or correctional facilities?

• Many people in these facilities are at risk for TB disease
• Risk of exposure is higher if facility is crowded

Answers - Module 2, p. 23

What are some reasons why rates of TB disease are higher in correctional facilities?

• The incarcerated population contains a higher proportion of people at greater risk for TB than the general population
• An increasing number of inmates are infected with HIV, which means that they are more likely to develop TB disease if they become infected with M. tuberculosis
• Some correctional facilities are crowded and may have inadequate ventilation, which promotes the spread of TB
• Therapy can be interrupted when inmates are moved into and out of facilities

Answers - Module 2, p. 24

When a child has TB infection or disease, what does it tell us about the spread of TB in the child’s home or community? Name 3 things.

• TB was transmitted relatively recently
• The person who transmitted TB to the child may still be infectious
• Other adults and children in the home or community have probably been exposed to TB

Answers - Module 2, p. 24
Name 8 groups of people who are more likely to develop TB disease once infected.

- People living with HIV
- Children younger than 5 years of age
- People infected with *M. tuberculosis* within the past 2 years
- People with a history of untreated or inadequately treated TB disease
- People receiving immunosuppressive therapy
- People with silicosis, diabetes mellitus, chronic renal failure, leukemia, or cancer of the head, neck, or lung
- Persons who have had a gastrectomy or jejunoileal bypass
- Low body weight
- Cigarette smokers and person who abuse drugs or alcohol
- Populations defined locally as having an increased incidence of disease due to *M. tuberculosis*
- People living with HIV
- Children younger than 5 years of age
- People infected with *M. tuberculosis* within the past 2 years
- People with a history of untreated or inadequately treated TB disease
- People receiving immunosuppressive therapy

What is the strongest known risk factor for the development of TB disease?

HIV infection is the strongest known risk factor for developing TB disease. HIV infection weakens the body's immune system, making it more likely for a person who has TB infection to develop TB disease.

If a person is infected with both *M. tuberculosis* and HIV, what are his or her chances of developing TB disease? How does this compare to the risk for people who are infected only with *M. tuberculosis*?

- Risk is 7% to 10% each year if person is infected with both *M. tuberculosis* and HIV and the HIV is not treated
- Risk is 10% over a lifetime if person is only infected with *M. tuberculosis*
Module 2: Case Study 2.1
For each of the following people, choose the factor(s) known to increase the risk of being exposed to or infected with TB disease.

<table>
<thead>
<tr>
<th>Person</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Petrov</td>
<td>Works at a nursing home &lt;br&gt; Rides the subway every day &lt;br&gt; Emigrated from Russia</td>
</tr>
<tr>
<td>Ms. Montoya</td>
<td>Was born in Latin America &lt;br&gt; Has a father who had pulmonary TB disease</td>
</tr>
<tr>
<td>Ms. Parker</td>
<td>Volunteers in the emergency room of an inner-city hospital &lt;br&gt; Works in a day care center</td>
</tr>
<tr>
<td>Mr. Dudley</td>
<td>Was released from prison last year &lt;br&gt; Sleeps in a homeless shelter</td>
</tr>
</tbody>
</table>

Module 2: Case Study 2.2
For each of the following people, indicate the factor(s) known to increase the risk of developing TB disease once infected.

<table>
<thead>
<tr>
<th>Person</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Sims</td>
<td>Injects heroin &lt;br&gt; Has HIV</td>
</tr>
<tr>
<td>Mr. Allen</td>
<td>Has diabetes &lt;br&gt; Has high blood pressure</td>
</tr>
<tr>
<td>Ms. Li</td>
<td>Has chest x-ray findings suggestive of previous TB disease &lt;br&gt; Has heart problems</td>
</tr>
<tr>
<td>Mr. Vinson</td>
<td>Is overweight &lt;br&gt; Became infected with M. tuberculosis 6 months ago</td>
</tr>
</tbody>
</table>

Answers - Module 2, p. 26

Answers - Module 2, p. 27
Module 3: Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease

Facilitation Tips

Background
In this module, participants will learn about targeted testing and the diagnosis of latent tuberculosis (TB) infection (LTBI) and TB disease. Targeted testing is a TB control strategy that is used to identify people who have LTBI and are at high risk for developing TB disease and would benefit from treatment. LTBI is diagnosed with the Mantoux tuberculin skin test (TST) or an interferon-gamma release assay (IGRA), such as the QuantiFERON®-TB Gold In-Tube test (QFT-GIT) or the T-SPOT®.TB test (T-Spot).

It is important to medically evaluate people who have symptoms of TB disease; if they are found to have TB disease, they need treatment to be cured and to help stop the transmission of TB to others. For this reason, the diagnosis of TB disease is crucial to controlling the spread of TB in homes and communities. In most cases, TB disease is diagnosed with certain laboratory tests. For patients who may have pulmonary TB disease, a chest x-ray is also useful for diagnosis.

Learning Objectives
After this presentation, participants will be able to
1. Identify high-risk groups for targeted testing.
2. Describe how to place, read, and interpret a Mantoux tuberculin skin test.
3. Describe how to interpret an interferon-gamma release assay.
4. Discuss considerations for using either the Mantoux tuberculin skin test or an interferon-gamma release assay for diagnosing latent tuberculosis infection.
5. Describe the components of a medical evaluation for diagnosing TB disease.

Module Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Content</th>
<th>Slides</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 min.</td>
<td>Presentation</td>
<td>Introduction</td>
<td>Slides 1-3</td>
</tr>
<tr>
<td>10 min.</td>
<td>Presentation</td>
<td>Targeted Testing</td>
<td>Slides 4-12</td>
</tr>
<tr>
<td>30 min.</td>
<td>Presentation</td>
<td>Diagnosis of LTBI</td>
<td>Slides 13-75</td>
</tr>
<tr>
<td>35 min.</td>
<td>Presentation</td>
<td>Diagnosis of TB Disease</td>
<td>Slides 76-129</td>
</tr>
<tr>
<td>3 min.</td>
<td>Presentation</td>
<td>Reporting TB Cases</td>
<td>Slides 130-134</td>
</tr>
<tr>
<td>10 min.</td>
<td>Case Studies</td>
<td>Case Studies</td>
<td>Slides 135-150</td>
</tr>
<tr>
<td>90 min.</td>
<td>Total Time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Facilitation Tips

- Introduce Module 3
- State objectives of presentation
- Review slide content

Slide 1

Self-Study Modules on Tuberculosis

Module 3
Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease

Slide 2

Module 3: Objectives

At completion of this module, learners will be able to:

1. Identify high-risk groups for targeted testing
2. Describe how to place, read, and interpret a Mantoux tuberculin skin test (TST)
3. Describe how to interpret an interferon-gamma release assay (IGRA)
4. Discuss considerations for using either the TST or IGRA for diagnosing latent tuberculosis infection (LTBI)
5. Describe the components of a medical evaluation for diagnosing TB disease

Slide 3

Module 3: Overview

- Targeted Testing
- Diagnosis of latent tuberculosis infection (LTBI)
  - TST
  - IGRA
  - TB Testing Programs, the Booster Phenomenon, and Two-Step Testing
- Diagnosis of TB Disease
- Reporting TB Cases
- Case Studies

Background and Objectives - Module 3, p. 1

Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease
Targeted Testing

- Introduce section
- Ask participants if they know what targeted testing is

Targeted Testing (1)

- Targeted testing is a TB control strategy used to identify and treat persons:
  - At high risk for latent TB infection (LTBI)
  - At high risk for developing TB disease once infected with *M. tuberculosis*

Targeted Testing (2)

- Identifying persons with LTBI is an important goal of TB elimination because LTBI treatment can:
  - Prevent the development of TB disease
  - Stop the further spread of TB to others
Targeted Testing (3)
A Decision to Test is a Decision to Treat

- TB testing activities should be done only when there is a plan for follow-up care
- Health care workers (HCWs) should identify and test persons who are at high risk
  - People who are not at high risk generally should not be tested

Targeted Testing – Module 3, p. 6

- Review slide content
- Explain that testing people who are not at high risk can take resources away from important activities. Also, positive test results in low-risk populations can be inaccurate.
- Note that health care agencies and other facilities should consult with their local health department before starting a TB testing program

Targeted Testing (4)
High-Risk Groups

- High-risk groups can be divided into two categories:
  - People who are at high risk for exposure to or infection with M. tuberculosis
  - People who are at high risk for developing TB disease once infected with M. tuberculosis

Targeted Testing – Module 3, pp. 6-7

- Review slide content
- Explain that these are the high-risk groups that should be tested for TB
- Note that definition of high risk should be made at the local (city, county, state) level according to local demographics and TB epidemiology

Targeted Testing (5)
High-Risk Groups for TB Infection

- Contacts of people known or suspected to have TB disease
- People who have come to U.S. within 5 years from areas of the world where TB is common
- People who visit areas with a high prevalence of TB disease
- People who live or work in high-risk congregate settings

Groups at High Risk for TB Infection – Module 3, p. 7

- Review slide content
- Tell participants that TB is more common in parts of Asia, Africa, Russia, Eastern Europe, and Latin America
- Ask participants what settings they think could be considered “high-risk congregate settings” (examples include nursing homes, homeless shelters, and correctional facilities)
Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease

**Slide 10**

**Targeted Testing (6)**

High-Risk Groups for TB Infection

- HCWs who serve patients at increased risk for TB disease
- Populations defined locally as having an increased incidence of LTBI or TB disease (e.g., medically underserved, low income, or people who abuse drugs or alcohol)
- Infants, children, and adolescents exposed to adults in high-risk groups

**Groups at High Risk for TB Infection – Module 3, p. 7**

**Slide 11**

**Targeted Testing (7)**

High-Risk Groups for TB Disease after Infection with *M. tuberculosis*

- People living with HIV
- Children younger than 5 years of age
- People recently infected with *M. tuberculosis* (within the past 2 years)
- People with a history of untreated or inadequately treated TB disease
- People receiving immunosuppressive therapy

**Groups at High Risk for TB Disease – Module 3, p. 7**

**Slide 12**

**Targeted Testing (8)**

High-Risk Groups for TB Disease after Infection with *M. tuberculosis*

- Persons with silicosis, diabetes mellitus, chronic renal failure, leukemia, or cancer of the head, neck, or lung
- Persons who have had a gastrectomy or jejunoileal bypass
- Low body weight
- Cigarette smokers and persons who abuse drugs and alcohol
- Persons defined locally as having an increased incidence of disease due to *M. tuberculosis*

**Groups at High Risk for TB Disease – Module 3, p. 7**
### Diagnosis of Latent TB Infection (LTBI)

#### Available testing methods for *M. tuberculosis* infection:
- Mantoux tuberculin skin test (TST)
- Blood tests known as interferon-gamma release assays (IGRAs):
  - QuantiFERON®-TB Gold In-Tube (QFT-GIT)
  - T-SPOT®.TB test (T-Spot)

---

### Mantoux Tuberculin Skin Test

**Administering the Test**

- Ask who has had a Mantoux tuberculin skin test (TST)
- Ask (if appropriate) how many participants have administered a TST to others
- Ask if the TST can detect TB disease
Mantoux Tuberculin Skin Test (1)
- TST is administered by injection
- Tuberculin is made from proteins derived from inactive tubercle bacilli
- Most people who have TB infection will have a reaction at injection site

Mantoux Tuberculin Skin Test (2)
0.1 ml of 5 tuberculin units of liquid tuberculin are injected between the layers of skin on forearm

Mantoux Tuberculin Skin Test (3)
- Forearm should be examined within 48 to 72 hours by HCW
- Reaction is an area of induration (swelling) around injection site
  - Induration is measured in millimeters
  - Erythema (redness) is not measured

- Review slide content
- Explain that most people who have TB infection will have a reaction. Their immune system will recognize tuberculin because it is similar to tubercle bacilli.
- Note that the tuberculin used for the skin test is also known as purified protein derivative, or PPD. TST is also sometimes called a PPD skin test.
- Explain that the TST is given by using a single dose disposable syringe
- Explain that a tuberculin unit is a standard strength of tuberculin
- State that tuberculin is NOT a vaccine
- Review slide content
- Explain that patients should NOT be asked to read their own skin test results
- Explain that presence of erythema does NOT indicate a person has TB infection
- State that if the patient does not return in 48-72 hours the test must be repeated
Slide 19

Mantoux Tuberculin Skin Test
Study Question 3.1

What is the TST used for?
The TST is used to determine whether a person has TB infection.

Answers – Module 3, p. 73

Slide 20

Mantoux Tuberculin Skin Test
Study Question 3.2

How is the TST given?
The TST is given by a needle and syringe to inject 0.1 ml of 5 tuberculin units of liquid tuberculin between the layers of the skin, usually on the forearm.

Answers – Module 3, p. 73

Slide 21

Mantoux Tuberculin Skin Test
Study Question 3.3

With the TST, when is the patient’s arm examined?
The patient’s arm is examined by a health care worker 48 to 72 hours after the tuberculin is injected.

Answers – Module 3, p. 73
Mantoux Tuberculin Skin Test
Study Question 3.4

How is the induration measured?

The diameter of the indurated area is measured across the forearm; erythema (redness) around the indurated area is not measured.

---

Diagnosis of Latent TB Infection (LTBI)
Mantoux Tuberculin Skin Test
Interpreting the Reaction

Interpretation of TST reaction depends on size of induration and person's risk factors for TB
**Mantoux Tuberculin Skin Test (5)**
*Interpreting the Reaction*
- Induration of ≥ 5 mm is considered positive for:
  - People living with HIV
  - Recent contacts of people with infectious TB
  - People with chest x-ray findings suggestive of previous TB disease
  - People with organ transplants
  - Other immunosuppressed patients

**Mantoux Tuberculin Skin Test (6)**
*Interpreting the Reaction*
- Induration of > 10 mm is considered a positive reaction for:
  - People who have recently come to U.S. from areas where TB is common
  - People who abuse drugs
  - Mycobacteriology laboratory workers
  - People who live or work in high-risk congregate settings

**Mantoux Tuberculin Skin Test (7)**
*Interpreting the Reaction*
- Induration of ≥ 10 mm is considered a positive reaction for:
  - People with certain medical conditions that increase risk for TB (e.g., silicosis, diabetes mellitus, severe kidney disease, certain types of cancer, and certain intestinal conditions)
  - Children younger than 5 years of age
  - Infants, children, or adolescents exposed to adults in high-risk categories
### Slide 28

**Mantoux Tuberculin Skin Test (8)**

**Interpreting the Reaction**

- Induration of $\geq 15$ mm is considered a positive reaction for people who have no known risk factors for TB

- Review slide content
- Reiterate that targeted testing should only be done in high-risk groups

### Slide 29

**Occupational Exposure**

- For people who may be exposed to TB on the job (e.g., HCWs, staff of nursing homes or correctional facilities), interpretation of TST depends on:
  - The employee’s individual risk factors for TB
  - The risk of exposure to TB in the person’s job

- Review slide content

### Slide 30

**Mantoux Tuberculin Skin Test Study Question 3.5**

What two factors determine the interpretation of a skin test reaction as positive or negative? What additional factor is considered for people who may be exposed to TB on the job?

- Size of induration and risk factors for TB
- An additional factor is the risk of exposure to TB in the person’s job

- Ask participants to turn to p. 14 (if participants have print-based modules)
- Read question
- Ask participants for answers

**Answers – Module 3, p. 73**
Mantoux Tuberculin Skin Test
Study Question 3.6
Name 5 groups of people for which ≥ 5 mm of induration is considered a positive reaction?

- People living with HIV
- Recent contacts of people with infectious TB
- People with chest x-ray findings suggestive of previous TB disease
- Patients with organ transplants
- Other immunosuppressed patients

Answers – Module 3, p. 73

Mantoux Tuberculin Skin Test
Study Question 3.7
Name seven groups of people for which ≥ 10 mm of induration is considered a positive reaction.

- People who have recently come to the U.S. (within the last 5 years) from areas where TB is common
- People who abuse drugs
- Mycobacteriology lab workers
- People who live or work in high-risk congregate settings
- People with certain medical conditions
- Children younger than 5 years of age
- Infants, children, and adolescents exposed to adults in high-risk categories

Answers – Module 3, p. 74

Mantoux Tuberculin Skin Test
Study Question 3.8
For which group of people is ≥ 15 mm of induration considered a positive reaction?

People with no risk factors for TB.

Answers – Module 3, p. 74
Diagnosis of Latent TB Infection (LTBI)

Mantoux Tuberculin Skin Test

Factors that Affect the Reaction

- Factors that may cause people to have a positive reaction even if they do not have TB infection:
  - Infection with nontuberculous mycobacteria (NTM)
  - BCG vaccination
  - Administration of incorrect antigen
  - Incorrect measuring or interpretation of TST reaction

Mantoux Tuberculin Skin Test (9)
False-Positive Reaction

- People who have been vaccinated with BCG may have a false-positive TST reaction
  - However, there is no reliable way to distinguish a positive TST reaction caused by BCG vaccination from a reaction caused by true TB infection
- Individuals should always be further evaluated if they have a positive TST reaction

Mantoux Tuberculin Skin Test (10)
BCG Vaccine

- Explain that BCG is a vaccine for TB that is used in many countries. However, it is rarely used in the U.S. because studies have shown that it is not completely effective

• Introduce section
• Explain that the TST is a valuable tool, but it is not perfect
• Review slide content

False-Positive Reaction – Module 3, p. 17

BCG Vaccine – Module 3, p. 17
**Mantoux Tuberculin Skin Test (11)**

**False-Negative Reaction**

- Factors that may cause false-negative reactions:
  - Anergy
  - Recent TB infection (within past 8 to 10 weeks)
  - It can take 2 to 8 weeks after TB infection for body’s immune system to react to tuberculin
  - Very young age (younger than 6 months)
  - Recent live-virus measles or smallpox vaccination
  - Incorrect method of giving the TST
  - Incorrect measuring or interpretation of TST reaction

**Mantoux Tuberculin Skin Test (12)**

**Anergy**

- Inability to react to skin tests due to weakened immune system
- Anergy testing is no longer routinely recommended

**Mantoux Tuberculin Skin Test (13)**

Any patient with symptoms of TB disease should be evaluated for TB disease, regardless of his or her skin test reaction.

- Review slide content
- Note that HIV infection is an important cause of anergy, but other conditions, such as cancer, measles, or other viral infections can also weaken the immune system
- Stress that people with symptoms of TB should be evaluated for TB disease right away
Name four factors that may cause false-positive reactions to the TST.

• Infection with nontuberculous mycobacteria (NTM)
• BCG vaccination
• Administration of incorrect antigen
• Incorrect measuring or interpretation of TST reaction

Is there a reliable way to distinguish a positive TST reaction caused by vaccination with BCG from a reaction caused by true TB infection?

No. Individuals who have had the BCG vaccine should be further evaluated for LTBI or TB disease the same as if they were not vaccinated with BCG.

Name six factors that may cause false-negative reactions to the TST.

• Anergy
• Recent TB infection (within past 8 to 10 weeks)
• Very young age (younger than 6 months)
• Recent live-virus measles or smallpox vaccination
• Incorrect method of giving the TST
• Incorrect measuring or interpretation of TST reaction
Mantoux Tuberculin Skin Test

**Study Question 3.12**

What is anergy?

The inability to react to skin tests because of a weakened immune system.

---

Mantoux Tuberculin Skin Test

**Study Question 3.13**

After TB germs have been transmitted to someone, how long does it take before TB infection can be detected by the TST?

2 to 8 weeks

---

Mantoux Tuberculin Skin Test

**Study Question 3.14**

What should be done if a patient has a negative TST result, but has symptoms of TB disease?

Any patient with symptoms of TB disease should be evaluated for TB disease, regardless of his or her skin test reaction.
Diagnosis of Latent TB Infection (LTBI)

Interferon-Gamma Release Assays (IGRAs)

- Introduce section
- Ask who has had an IGRA test before
- Ask what an IGRA detects

Types of IGRAs

- QuantiFERON®-TB Gold In-Tube (QFT-GIT)
  – Approved in 2007
- T-Spot®.TB test (T-SPOT)
  – Type of ELISpot assay
  – Approved in 2008
- CDC guidelines for IGRAs published in 2010

IGRAs (1)

- Blood tests that help diagnose *M. tuberculosis* infection
- Measures a person’s immune reactivity to *M. tuberculosis*
IGRAs (2)
Conducting the Test
- Confirm arrangements for testing in a qualified laboratory
- Arrange for delivery of the blood sample to the laboratory in the time the laboratory specifies
- Draw a blood sample from the patient according to the manufacturer’s instructions
- Schedule follow-up appointment for patient to receive test results
- Based on test results, provide follow-up evaluation and treatment as needed

Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease 49

Conducting an IGRA – Module 3, p. 25

IGRAs (3)
How it Works
- Blood samples are mixed with antigens (protein substances that can produce an immune response) and incubated
- If the person is infected with M. tuberculosis, blood cells will recognize antigens and release interferon gamma (IFN-γ) in response

Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease 50

How IGRAs Work – Module 3, p. 26

IGRAs (4)
Interpreting Results
- QFT-GIT Results
  - Based on amount of IFN-γ released in response to M. tuberculosis antigens and control substances
- T-Spot Results
  - Based on number of IFN-γ producing cells (spots) produced

Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease 51

Interpreting IGRA Results – Module 3, pp. 26-27
IGRAs (5)
Interpreting Results

- Qualitative test interpretation and quantitative assay measurements should be reported.
- Laboratories use software provided by manufacturer to calculate results.
- Results are sent to requesting health care provider.

Interpreting IGRA Results – Module 3, pp. 26-27

IGRAs (6)
Report of Results

<table>
<thead>
<tr>
<th>IGRA Result</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>M. tuberculosis infection likely</td>
</tr>
<tr>
<td>Negative</td>
<td>M. tuberculosis infection unlikely, but cannot be excluded especially if</td>
</tr>
<tr>
<td></td>
<td>1. Patient has signs and symptoms of TB</td>
</tr>
<tr>
<td></td>
<td>2. Patient has a high risk for developing TB disease once infected with M. tuberculosis</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>The test did not provide useful information about the likelihood of M. tuberculosis infection. Repeating an IGRA or performing a TST may be useful.</td>
</tr>
<tr>
<td>Borderline (T-Spot only)</td>
<td>The test did not provide useful information about the likelihood of M. tuberculosis infection. Repeating an IGRA or performing a TST may be useful.</td>
</tr>
</tbody>
</table>

Interpreting IGRA Results – Module 3, pp. 26-27

IGRA Recommendations (1)

- IGRA Recommendations
  - IGRA Recommendations are the preferred method of testing in
    - Groups of people who might be less likely to return for TST reading and interpretation
    - Persons who have received the BCG vaccine
    - TST is the preferred method of testing for children younger than 5 years of age

IGRA Recommendations – Module 3, p. 28
### Slide 55

**IGRA Recommendations (2)**
- Routine testing using both TST and IGRAs is **NOT** recommended
- Certain situations where results from both tests may be useful:
  - When the initial test is **negative** and:
    - Risk for infection, progression to disease, or a poor outcome is high
    - There is clinical suspicion for TB disease and confirmation of *M. tuberculosis* infection is desired

**IGRA Recommendations (2)** – Module 3, p. 28

### Slide 56

**IGRA Recommendations (3)**
- Certain situations where results from both tests may be useful
  - When the initial test is **positive** and:
    - Additional evidence of infection is required to encourage the patient’s acceptance and adherence to treatment
    - Person has a low risk of both infection and progression from infection to TB disease

**IGRA Recommendations (3)** – Module 3, p. 28

### Slide 57

**IGRA Advantages**
- Requires single patient visit to conduct test
- Results can be available in 24 hours
- Does not cause booster phenomenon which can happen with repeat TSTs
- BCG vaccination does not affect IGRA results

**IGRA Advantages** – Module 3, pp. 29-30

Note: Booster phenomenon is presented on slides 68-69
### Slide 58
**IGRA Disadvantages and Limitations (1)**
- Blood samples must be processed within 8 to 30 hours after collection
- Errors in collecting or transporting blood specimens or in running and interpreting test can decrease accuracy
- Limited data on its use in certain populations (e.g., children younger than 5, persons recently infected, immunocompromised persons, and serial testing)

**IGRA Disadvantages and Limitations – Module 3, p. 30**

### Slide 59
**IGRA Disadvantages and Limitations (2)**
- Limited data on its use to predict who will progress to TB disease
- Tests may be expensive

**IGRA Disadvantages and Limitations – Module 3, p. 30**

### Slide 60
**IGRAs Study Question 3.15**
- What are the steps for conducting an IGRA?
  - Confirm arrangements for testing in a qualified laboratory
  - Arrange for delivery of the blood sample to the laboratory
  - Draw a blood sample from the patient according to the manufacturer’s instructions
  - Schedule follow-up appointment for patient to receive test results
  - Based on test results, provide follow-up evaluation and treatment as needed

**Answers – Module 3, p. 75**

- Ask participants to turn to p. 32 (if participants have print-based modules)
- Read question
- Ask participants for answers
**IGRAs Study Question 3.16**

How are IGRA results interpreted?

- QFT-GIT results are based on the amount of IFN-γ that is released in response to the antigens and control substances
- T-Spot results are based on the number of IFN-γ producing cells (spots) produced
- Both the standard qualitative test interpretation and the quantitative assay measurements should be reported

**IGRAs Study Question 3.17**

How should negative IGRA results be interpreted?

- If the result is negative, the patient is unlikely to have *M. tuberculosis* infection
- Patient may not require further evaluation unless they have signs and symptoms of TB disease

**IGRAs Study Question 3.18**

What are 5 advantages for using an IGRA as compared to the TST?

- Requires a single patient visit
- Results can be available in 24 hours
- Does not cause the booster phenomenon
- Laboratory test not affected by health care worker perception or bias
- BCG vaccine does not affect IGRA results

Answers – Module 3, p. 76
Diagnosis of Latent TB Infection (LTBI)

TB Testing Programs, the Booster Phenomenon, and Two-Step Testing

- Introduce section

TB Testing Programs, Booster Phenomenon, and Two-Step Testing – Module 3, pp. 33-36

TB Testing Programs (1)
- Many residential facilities, health care settings, and other settings have TB testing programs
  - Employees and residents are periodically given TSTs or IGRAs
- Testing programs:
  - Identify people who have LTBI or TB disease so they can be given treatment as needed
  - Determine whether TB is being transmitted in facility

- Review slide content
- Ask participants what types of TB testing programs are used where they work

TB Testing Programs – Module 3, pp. 33-36

TB Testing Programs (2)
- Employees or residents are given TSTs or IGRAs when they first enter facility
  - If person is negative, they may be retested at regular intervals thereafter

- Review slide content

Baseline Test – Module 3, p. 33
**TB Testing Programs (3)**

**Conversion**

- Persons whose TST or IGRA result converts from negative to positive may have been infected with *M. tuberculosis*
  
  - TST or IGRA conversions may indicate that TB is being transmitted in facility

**Booster Phenomenon**

- Phenomenon in which people who are skin tested many years after they became infected with TB have:
  
  - Negative reaction to initial TST
  
  - Positive reaction to subsequent TST given up to one year later

- Occurs mainly in older adults

- May affect accuracy of baseline skin test

- TST can boost subsequent IGRA results

**Figure 3.6**

- The booster phenomenon with the TST

- Person becomes infected with *M. tuberculosis*

- Person is skin tested years later

- Person has negative reaction due to lessered ability to react to tuberculin

  - However, this skin test “jogs the memory” of the immune system to recognize and react to tuberculin

- Person is skin tested again, up to 1 year later

  - Person has a positive reaction. This is a boosted reaction due to TB infection that occurred a long time ago, not during the time between the two skin tests

  - Occurs mainly in previously infected, older adults whose ability to react to tuberculin has decreased over time

- As years pass, person’s ability to react to tuberculin lessens

**Review slide content**

- Explain that people with skin test conversions are at high risk for developing TB disease because a conversion indicates that a person was infected relatively recently

**Review slide content**

- Explain the booster phenomenon using the flowchart

*Conversion – Module 3, p. 33*

*Booster Phenomenon – Module 3, pp. 33-35*
Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease

Two-Step Testing

- Only conducted when TST is used
- Distinguishes between boosted reactions and reactions caused by recent infections
- Should be used for initial skin testing of persons who will be retested periodically
- If person’s initial skin test is negative, they should be given a second test 1 to 3 weeks later
  - Second test positive: probably boosted reaction
  - Second test negative: considered uninfected

Two-Step Testing

Baseline skin test

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Retest 1-3 weeks later</th>
<th>Person probably has TB infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>Retest 1-3 weeks later</td>
<td>Person probably has TB infection</td>
</tr>
<tr>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>Negative</td>
<td>Reaction is considered a boosted reaction (due to TB infection that occurred a long time ago)</td>
<td>Retesting not necessary</td>
</tr>
<tr>
<td>Positive</td>
<td>Reaction is considered a boosted reaction (due to TB infection that occurred a long time ago)</td>
<td>Retesting not necessary</td>
</tr>
</tbody>
</table>

Booster Phenomenon

Study Question 3.19

What is the booster phenomenon?

- Phenomenon in which people who are skin tested many years after becoming infected with *M. tuberculosis* have a negative reaction to an initial skin test, followed by a positive reaction to a skin test given up to a year later
- Occurs because the ability to react to tuberculin lessens over time in some people

Review slide content

Explain two-step testing using the flowchart

Introduce study questions

Ask participants to turn to p. 37 (if participants have print-based modules)

Read question

Ask participants for answers

Answers – Module 3, p. 76
Two-Step Testing
Study Question 3.20
What is the purpose of two-step testing?
To distinguish between boosted reactions and reactions caused by recent infection.

Two-Step Testing
Study Question 3.21
In what type of situation is two-step testing used?
It is used in many programs for skin testing employees when they start their job.

Two-Step Testing
Study Question 3.22
How is two-step testing done?
If a person has a negative reaction to an initial skin test, he or she is given a second test 1 to 3 weeks later.

– If reaction to second test is positive, it is considered a boosted reaction
– If reaction to second test is negative, person is considered to be uninfected
### Diagnosis of TB Disease

**Medical Evaluation**
- Anyone with TB symptoms or positive TST or IGRA result should be medically evaluated for TB disease
- Components of medical evaluation:
  1. Medical history
  2. Physical examination
  3. Test for TB infection
  4. Chest x-ray
  5. Bacteriological examination

---

**Medical Evaluation**

<table>
<thead>
<tr>
<th>Medical History</th>
<th>Physical Examination</th>
<th>Test for TB Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Medical history</td>
<td>2. Physical examination</td>
<td>3. Test for TB infection</td>
</tr>
</tbody>
</table>

---

**Medical History, Physical Examination, and Test for TB Infection**

---

**Introduce section**

---

**Review slide content**

- Note that they key to diagnosing TB is for clinicians to “think TB” when they see a patient with symptoms of TB or abnormal chest x-ray findings

---

**Introduce section**

---

**Introduce section**

---
1. Medical History (1)

- Clinicians should ask patients if they have:
  - Symptoms of TB disease
  - Been exposed to a person with infectious TB or have risk factors for exposure to TB
  - Any risk factors for developing TB disease
  - Had LTBI or TB disease before

• Review slide content

• Explain that patients who have had TB disease before should be asked when they had disease and if it was treated

Medical History – Module 3, pp. 39-41

1. Medical History (2)

General Symptoms of TB Disease

- Fever
- Chills
- Night sweats
- Weight loss
- Appetite loss
- Fatigue
- Malaise

• Review slide content

• Explain that people with TB disease may or may not have symptoms. However, most people with TB disease will have one or more symptoms.

• Explain that usually when patients have symptoms, the symptoms have developed gradually and have been present for week or months

General Symptoms of TB Disease – Module 3, p. 40

1. Medical History (3)

Symptoms of Pulmonary TB Disease

- Cough lasting 3 or more weeks
- Chest pain
- Coughing up sputum or blood

• Review slide content

Symptoms of Pulmonary TB Disease – Module 3, p. 40
1. Medical History (4)
Symptoms of Extrapulmonary TB Disease

- Symptoms of extrapulmonary TB disease depend on part of body that is affected
- For example:
  - TB disease in spine may cause back pain
  - TB disease in kidneys may cause blood in urine

2. Physical Examination
A physical examination cannot confirm or rule out TB disease, but can provide valuable information

3. Test for TB Infection (1)
- Types of tests available for diagnosing TB infection in U.S.:
  - Mantoux TST
  - IGRAs:
    - QFT-GIT
    - T-SPOT
3. Test for TB Infection (2)

- Patients with symptoms of TB disease should always be evaluated for TB disease, regardless of their TST or IGRA test result

  - Clinicians should not wait for TST or IGRA results before starting other diagnostic tests
  - TST or IGRA should be given at the same time as other steps in the diagnosis of TB disease

Diagnosis of TB Disease

Study Question 3.23

What are the 5 components for conducting a medical evaluation for diagnosing TB disease?

- Medical history
- Physical examination
- Test for TB infection
- Chest x-ray
- Bacteriologic examinations

Diagnosis of TB Disease

Study Question 3.24

What parts of a patient’s medical history should lead a clinician to suspect TB?

- Symptoms of TB disease
- Exposure to a person who has infectious TB or has other risk factors for exposure to TB
- Risk factors for developing TB disease
- TB infection or TB disease in the past

Testing for TB Infection – Module 3, p. 42

Answers – Module 3, p. 77

• Introduce study questions
  - Ask participants to turn to p. 43 (if participants have print-based modules)
  - Read question
  - Ask participants for answers

Answers – Module 3, p. 77
What are the symptoms of pulmonary TB disease? What are the symptoms of extrapulmonary TB disease?

- General symptoms of TB disease: Weight loss, fatigue, malaise, fever, and night sweats
- Pulmonary: Coughing, pain in chest, coughing up sputum or blood
- Extrapulmonary: Depends on the part of the body that is affected by the disease. For example, TB of the spine may cause pain in the back; TB of the kidney may cause blood in the urine.

For patients with symptoms of TB disease, should clinicians wait for TST or IGRA results before starting other diagnostic tests?

No, clinicians should not wait for TST or IGRA results before starting other diagnostic tests.

Chest X-Ray

- Introduce section
Module 3 – Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease

4. Chest X-Ray (1)

- When a person has TB disease in the lungs, the chest x-ray usually appears abnormal. It may show:
  - Infiltrates (collections of fluid and cells in lung tissue)
  - Cavities (hollow spaces within the lung)

Abnormal chest x-ray with cavity

4. Chest X-Ray (2)

- Chest x-rays can:
  - Help rule out possibility of pulmonary TB disease in persons who have a positive TST or IGRA result
  - Check for lung abnormalities

4. Chest X-Ray (3)

- Chest x-rays cannot confirm TB disease
  - Other diseases can cause lung abnormalities
  - Only bacteriologic culture can confirm patient has TB disease
  - Chest x-ray may appear unusual or even appear normal for persons living with HIV

Chest X-Ray – Module 3, p. 45

Chest X-Ray – Module 3, p. 45

Chest X-Ray – Module 3, p. 46
Name 2 purposes of the chest x-ray.

- Help rule out possibility of pulmonary TB disease in a person who has positive TST or IGRA result and no symptoms of TB.
- Check for lung abnormalities in people who have symptoms of TB disease.

Can the results of a chest x-ray confirm that a person has TB disease? Why or why not?

No. A variety of illnesses may produce abnormalities on chest x-ray. Only bacteriologic culture can prove whether or not a patient has TB disease.

### Diagnosis of TB Disease

**Medical Evaluation**

5. Bacteriologic Examination

---

Bacteriological Examination – Module 3, pp. 48-68
5. Bacteriologic Examination (1)

- TB bacteriologic examination is done in a laboratory that specifically deals with *M. tuberculosis* and other mycobacteria
  - Clinical specimens (e.g., sputum, urine) are examined and cultured in laboratory

5. Bacteriologic Examination (2)

- Bacteriologic examination has 5 parts
  - Specimen collection
  - Examination of acid-fast bacilli (AFB) smears
  - Direct identification of specimen (nucleic acid amplification)
  - Specimen culturing and identification
  - Drug susceptibility testing

5. Bacteriologic Examination (3)

**Specimen Collection**

- For pulmonary TB, specimens can be collected by:
  - Coughing up sputum sample
  - Inducing sputum sample
  - Bronchoscopy
  - Gastric washing

- Review slide content

- Explain that the image is of a TB patient coughing up sputum. The patient is sitting in a special sputum collection booth that prevents the spread of tubercle bacilli.

Slide 97

Slide 98

Slide 99

**Bacteriological Examination – Module 3, p. 48**

**Bacteriologic Examination – Module 3, p. 48**

**Specimen Collection – Module 3, pp. 48-51**
5. **Bacteriologic Examination (4)**

**Sputum Sample Specimen Collection**

- Easiest and least expensive method is to have patient cough into sterile container
- HCWs should coach and instruct patient
- Should have at least 3 sputum specimens examined
  - Collected in 8 to 24 hour intervals
  - At least one early morning specimen

*Review slide content

- Note that health care workers should always supervise the patient when sputum is collected since patients are not always successful in providing an adequate specimen

*Specimen Collection – Module 3, pp. 48-51*

---

5. **Bacteriologic Examination (5)**

**Induced Sputum Collection**

- Induced sputum collection should be used if patient cannot cough up sputum on their own
- Patient inhales saline mist, causing deep coughing
- Specimen often clear and watery, should be labeled “induced specimen”

*Review slide content

*Induced Sputum Collection – Module 3, p. 49*

---

5. **Bacteriologic Examination (6)**

**Bronchoscopy**

- Bronchoscopy may be used:
  - If patient cannot cough up enough sputum
  - If an induced sputum cannot be obtained
- Procedure: instrument is passed through the mouth into the diseased portion of the lung to obtain sputum or lung tissue

*Review slide content

*Bronchoscopy – Module 3, p. 49*
5. **Bacteriologic Examination (7)**

**Gastric Washing**
- Usually only used if sample cannot be obtained from other procedures
- Often used with children
- Tube is inserted through nose and into stomach to obtain gastric secretions that may contain sputum

*Gastric Washing – Module 3, p. 50*

---

5. **Bacteriologic Examination (8)**

**Extrapulmonary TB**
- Specimens other than sputum may be obtained
- Depends on part of body affected
- For example:
  - Urine samples for TB disease of kidneys
  - Fluid samples from area around spine for TB meningitis

*Extrapulmonary TB – Module 3, p. 50*

---

5. **Bacteriologic Examination (9)**

**Examination of AFB Smears**
- Specimens are smeared onto glass slide and stained
- AFB are mycobacteria that remain stained after being washed in acid solution

*Examination of AFB Smears – Module 3, pp. 53-54*
• Review slide content

5. Bacteriologic Examination (10)
Examination of AFB Smears

- Number of AFB on smear are counted
- According to number of AFB seen, smears are classified as 4+, 3+, 2+, or 1+
  - For example, 4+ smear has 10 times as many AFB than 3+ smear
- If very few AFB are seen, the smear is classified by the actual number of AFB seen
- A negative smear does not rule out the possibility of TB

Examination of AFB Smears – Module 3, pp. 53-54

5. Bacteriologic Examination (11)
Examination of AFB Smears

<table>
<thead>
<tr>
<th>Classification of Smear</th>
<th>Smear Result</th>
<th>Infectiousness of Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>4+</td>
<td>Strongly positive</td>
<td>Probably very infectious</td>
</tr>
<tr>
<td>3+</td>
<td>Strongly positive</td>
<td>Probably very infectious</td>
</tr>
<tr>
<td>2+</td>
<td>Moderately positive</td>
<td>Probably infectious</td>
</tr>
<tr>
<td>1+</td>
<td>Moderately positive</td>
<td>Probably infectious</td>
</tr>
<tr>
<td>Actual number of AFB seen (no plus sign)</td>
<td>Weakly positive</td>
<td>Probably infectious</td>
</tr>
<tr>
<td>No AFB seen</td>
<td>Negative</td>
<td>May not be infectious</td>
</tr>
</tbody>
</table>

Examination of AFB Smears – Module 3, p. 54

Bacteriologic Examination Study Questions 3.29

What are the 4 ways to collect sputum specimens? Indicate which procedure is the least expensive and easiest to perform.

- Patient simply coughs up sputum and the sputum is collected in a sterile container. This is the least expensive and easiest procedure.
- Induced sputum
- Bronchoscopy
- Gastric washing

Answers – Module 3, p. 79
Slide 109

**Bacteriologic Examination**

**Study Question 3.30**

What do laboratory personnel look for in a smear?

Acid-fast bacilli (AFB)

---

Answers – Module 3, p. 79

Slide 110

**Bacteriologic Examination**

**Study Question 3.31**

What does a positive smear indicate about a patient’s infectiousness?

Patients who have many tubercle bacilli seen in their sputum have a positive smear. Patients who have positive smears are considered infectious because they can cough many tubercle bacilli into the air.

---

Answers – Module 3, p. 79

Slide 111

**Diagnosis of TB Disease**

**Medical Evaluation**

5. Bacteriologic Examination (continued)

---

• Read question
• Ask participants for answers
• Introduce section

111
5. Bacteriologic Examination (12)  
Nucleic Acid Amplification Tests (NAA)

- NAA tests directly identify *M. tuberculosis* from sputum specimens by:
  - Amplifying (copying) DNA and RNA segments
- Can help guide clinician’s decision for patient therapy and isolation
- Does not replace need for AFB smear, culture, or clinical judgment

---

5. Bacteriologic Examination (13)  
Nucleic Acid Amplification Tests (NAA)

- If NAA test and AFB smears are positive:
  - Patient is presumed to have TB and should begin treatment
- If NAA test is negative and AFB smears are positive:
  - Patient may have nontuberculous mycobacteria infection (NTM)

---

5. Bacteriologic Examination (14)  
Xpert MTB/RIF Assay

- Xpert MTB/RIF assay is a NAA test that simultaneously detects *Mycobacterium tuberculosis* complex (MTBC) and resistance to rifampin
- To conduct this test, a sputum sample is mixed with the reagent that is provided with the assay
- A cartridge containing the mixture is placed in the GeneXpert machine
- Results are available in less than 2 hours
5. Bacteriologic Examination (15)

Xpert MTB/RIF Assay

- Results that are positive for MTBC and for rifampin resistance indicate that the bacteria have a high probability of resistance to rifampin
  - Should be confirmed by additional rapid testing
- If rifampin resistance is confirmed, rapid molecular testing for drug resistance to both first-line and second-line drugs should be performed so an effective treatment regimen can be selected

5. Bacteriologic Examination (16)

Culturing and Identifying Specimen

- Culturing:
  - Determines if specimen contains *M. tuberculosis*
  - Confirms diagnosis of TB disease
- All specimens should be cultured

5. Bacteriologic Examination (17)

Culturing and Identifying Specimen

- Step 1: Detect growth of mycobacteria
  - Solid media: 3 to 6 weeks
  - Liquid media: 4 to 14 days
- Step 2: Identify organism that has grown
  - Nucleic acid probes: 2 to 4 hours

- Review slide content

*Review slide content*

*Review slide content*

- Explain that the image is of colonies of *M. tuberculosis* growing on solid media

- Explain that mycobacteria grow very slowly
- Explain that it is necessary to identify the organism that has grown because all types of mycobacteria can grow on media. Laboratory tests must be done to determine whether the organism is *M. tuberculosis* or one of the nontuberculous mycobacteria.
5. Bacteriologic Examination (18)
   Culturing and Identifying Specimen
   • Positive culture: *M. tuberculosis* identified in patient’s culture
     – Called *M. tuberculosis* isolate
     – Confirms diagnosis of TB disease

5. Bacteriologic Examination (19)
   Culturing and Identifying Specimen
   • Negative culture: *M. tuberculosis* NOT identified in patient’s culture
     – Does not rule out TB disease
     – Some patients with negative cultures are diagnosed with TB based on signs and symptoms

5. Bacteriologic Examination (20)
   Culturing and Identifying Specimen
   • Bacteriological examinations are important for assessing infectiousness and response to treatment
   • Specimens should be obtained monthly until 2 consecutive cultures are negative
   • Culture conversion is the most important objective measure of response to treatment
5. Bacteriologic Examination (21)
Drug Susceptibility Testing

- Conducted when patient is first found to have positive culture for TB
- Determines which drugs kill tubercle bacilli
- Tubercle bacilli killed by a particular drug are susceptible to that drug
- Tubercle bacilli that grow in presence of a particular drug are resistant to that drug

Review slide content

Explain that the drug susceptibility pattern of a strain of tubercle bacilli is the list of drugs to which the strain is susceptible and to which it is resistant

Stress that it is crucial to identify drug resistance as early as possible to ensure effective treatment

Drug Susceptibility Testing – Module 3, pp. 64-66

5. Bacteriologic Examination (22)
Drug Susceptibility Testing

- Tests should be repeated if:
  - Patient has positive culture after 3 months of treatment; or
  - Patient does not get better

Review slide content

Explain that the image is of drug susceptibility testing on solid media. Organisms are resistant to the drug in the upper right compartment and susceptible to the drugs in the lower compartments. The upper left contains no drugs.

Drug Susceptibility Testing – Module 3, pp. 64-66

5. Bacteriologic Examination (23)
Types of Drug-Resistant TB

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono-resistant</td>
<td>Resistant to any one TB treatment drug</td>
</tr>
<tr>
<td>Poly-resistant</td>
<td>Resistant to at least any two TB drugs (but not both isoniazid and rifampin)</td>
</tr>
<tr>
<td>Multidrug-resistant (MDR TB)</td>
<td>Resistant to at least isoniazid and rifampin, the two first-line TB treatment drugs</td>
</tr>
<tr>
<td>Extensively drug-resistant (XDR TB)</td>
<td>Resistant to isoniazid and rifampin, PLUS resistant to any fluoroquinolone AND at least 1 of the 3 injectable second-line drugs (e.g., amikacin, kanamycin, or capreomycin)</td>
</tr>
</tbody>
</table>

Review slide content

Explain that these are four types of drug-resistant TB

Types of Drug-Resistant TB – Module 3, p. 64
5. Bacteriologic Examination (24)
Growth-Based Drug Susceptibility Testing

- Growth-based susceptibility testing can be done using a liquid or solid medium method.
- Organisms that grow in media containing a specific drug are considered resistant to that drug.
- Liquid medium methods are faster than solid media methods for determining susceptibility to first-line TB medications.
- Results can be obtained within 7 to 14 days for liquid medium method and up to 21 days for solid medium method.

- Review slide content

5. Bacteriologic Examination (25)
Molecular Detection of Drug Resistance

- Molecular tests provide preliminary guidance on effective therapy for TB patients.
- These tests should be considered for patients with the following characteristics:
  - High risk of rifampin resistance, including MDR TB;
  - First-line drug susceptibility results are available and show resistance to rifampin;
  - Infectiousness poses a risk to vulnerable contacts; and
  - Contraindications to essential first-line medications.

- Review slide content

**Culture Specimen Study Question 3.32**

Why is it necessary to culture a specimen?

It is necessary to culture a specimen to determine whether the specimen contains *M. tuberculosis* and to confirm diagnosis of TB disease. Additionally, culture is needed for genotyping and for performing drug susceptibility testing.

- Introduce study questions
- Ask participants to turn to p. 67 (if participants have print-based modules)
- Read question
- Ask participants for answers

Answers – Module 3, p. 79
**Culture Specimen Study Question 3.33**

What does a positive culture for *M. tuberculosis* mean? How is this important for the TB diagnosis?

It means that *M. tuberculosis* has been identified in a patient's culture. A positive culture for *M. tuberculosis* confirms the diagnosis of TB disease.

**Answers – Module 3, p. 80**

• Read question
• Ask participants for answers

---

**Drug Susceptibility Study Question 3.34**

Why are drug susceptibility tests done?

To determine which drugs will kill the tubercle bacilli that are causing disease in a particular patient. Test results can help clinicians choose the appropriate drugs for each patient.

**Answers – Module 3, p. 80**

• Read question
• Ask participants for answers

---

**Drug Susceptibility Study Question 3.35**

How often should drug susceptibility tests be done?

• Should be done when the patient is first found to have a positive culture for *M. tuberculosis*

• Tests should be repeated if a patient has a positive culture for *M. tuberculosis* after 3 months of treatment or if a patient is not getting better

**Answers – Module 3, p. 80**

• Read question
• Ask participants for answers
Reporting TB Cases

- TB programs report TB cases to CDC using a standard case report form called the Report of Verified of Case of Tuberculosis (RVCT)
  - All cases that meet criteria are called verified TB cases

Criteria for Reporting TB Cases (1)
Cases that meet one of these four sets of criteria are counted as verified TB cases:

1. Patient has positive culture for *M. tuberculosis*
2. Patient has positive NAA test for *M. tuberculosis*
   - NAA test must be accompanied by culture for mycobacteria species
Criteria for Reporting TB Cases (2)

3. Patient has positive AFB smear, but culture has not been obtained or is falsely negative or contaminated

4. In the absence of laboratory confirmation, patient meets all of the following criteria:
   • Positive TST or IGRA,
   • Other signs and symptoms of TB disease,
   • Treatment with 2 or more TB drugs, and
   • A completed diagnostic evaluation.

Criteria for Reporting TB Cases (3)

- Cases that do not meet any of these sets of criteria may be counted as a verified TB case if health care provider has reported the case and decided to treat the patient for TB disease

Case Studies
Module 3: Case Study 3.1
Which of the following patients have a positive TST reaction? Circle the best answer(s).

a. Mr. West, 36 yrs. old, HIV infected, 8 mm induration
b. Ms. Hernandez, 26 yrs. old, native of Mexico, 7 mm induration
c. Ms. Jones, 56 yrs. old, diabetic, 12 mm induration
d. Mr. Sung, 79 yrs. old, nursing home resident, 11 mm induration
e. Mr. Williams, 21 yrs. old, no known risk factors, 13 mm induration
f. Miss Marcos, 42 yrs. old, chest x-rays findings suggestive of previous TB, 6 mm induration
g. Ms. Rayle, 50 yrs. old, husband has pulmonary TB, 9 mm of induration

Module 3: Case Study 3.2 (1)
A 30 year-old man who recently immigrated to the United States from India is given a TST and found to have 14 mm of induration. He reports that he was vaccinated with BCG as a child. He also says that his wife was treated for pulmonary TB disease last year.

Module 3: Case Study 3.2 (2)
How should this man’s results be interpreted?
• Positive反应 to TST
• Should be further evaluated for LTBI or TB disease

What factors make it more likely that this man’s positive reaction is due to TB infection?
• From area of the world where TB is common
• Wife had pulmonary TB

Answers – Module 3, p. 81

Answers – Module 3, p. 82
### Module 3: Case Study 3.3 (1)

Mr. Bell comes to the TB clinic for a TST. He believes that he has been exposed to TB, and he knows he is at high risk for TB because he is HIV infected. He is given a TST, and his reaction is read 48 hours later as 0 mm of induration.

*Ask participants to turn to p. 24 (if participants have print-based modules)*

*Read case study*

### Module 3: Case Study 3.3 (2)

What are 3 ways to interpret this result?

- May not have TB infection
- May be anergic
- It may be less than 8 to 10 weeks since he was exposed to TB

*Read case study question*

*Ask participants for answers*

### Module 3: Case Study 3.4 (1)

Ms. Wilson is a 60-year-old nurse. When she started a job at the local hospital, she was given a TST, her first test in 25 years. Her reaction was read 48 hours later as 0 mm induration. Six months later, she was retested as part of the TB testing program in the unit where she works. Her skin test reaction was read 48 hours later as 11 mm of induration.

*Ask participants to turn to p. 38 (if participants have print-based modules)*

*Read case study*
Module 3: Case Study 3.4 (2)

What are 2 ways to interpret this result?

- She was exposed to TB sometime in the 6 months between her first and second skin tests
- She had a boosted reaction

Answers – Module 3, p. 83

Module 3: Case Study 3.5 (1)

Mr. Lee has a cough and other symptoms of TB disease, and he is evaluated with a chest x-ray. However, he is unable to cough up any sputum on his own for the bacteriologic examination.

Case Study 3.5 – Module 3, p. 52

Module 3: Case Study 3.5 (2)

What should be done?

Since he is unable to cough up sputum, other techniques can be used to obtain sputum. First, clinicians can try to obtain an induced sputum sample. If they cannot obtain the sample, a bronchoscopy or gastric washing may be done.

Answers – Module 3, p. 83
Module 3: Case Study 3.6 (1)

Ms. Thompson gave three sputum specimens, which were sent to the laboratory for smear examination and culture. The smear results were reported as 4+, 3+, and 4+.

Case Study 3.6 – Module 3, p. 56

Module 3: Case Study 3.6 (2)

What do these results tell you about Ms. Thompson's diagnosis and her infectiousness?

- Results show that Ms. Thompson’s sputum specimens contain many acid-fast bacilli
- Clinicians should suspect that she has TB disease and should consider her infectious since her smears are positive
- It is possible that the AFB are mycobacteria other than tubercle bacilli
- Diagnosis cannot be confirmed until culture results are available

Answers – Module 3, p. 84

Module 3: Case Study 3.7 (1)

Mr. Sagoo has symptoms of TB disease and a cavity on his chest x-ray, but all of his sputum smears are negative for acid-fast bacilli.

Case Study 3.7 – Module 3, p. 57
Module 3: Case Study 3.7 (2)

Does this rule out the diagnosis of pulmonary TB disease?

No

Why or why not?

* M. tuberculosis may grow in the cultures even though there were no acid fast bacilli on the smear. Mr. Sagoo’s symptoms and his abnormal chest x-ray suggest that he has pulmonary TB disease.

Contents 3.7.2 – Module 3, p. 84

Module 3: Case Study 3.8 (1)

In the public health clinic, you see a patient, Ms. Sanchez, who complains of weight loss, fever, and a cough of 4 weeks duration. When questioned, she reports that she has been treated for TB disease in the past and that she occasionally injects heroin.

Contents 3.8.1 – Module 3, p. 68

Module 3: Case Study 3.8 (2)

What parts of Ms. Sanchez’s medical history lead you to suspect TB disease?

- Symptoms of TB disease (weight loss, fever, persistent cough)
- Past treatment for TB disease
- History of injecting illegal drugs

What diagnostic tests should be done?

- Chest x-ray
- Sputum smear and culture
- Drug susceptibility testing

Contents 3.8.2 – Module 3, p. 84
Module 4: Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

Facilitation Tips

Background
In this module, participants will learn about the principles of treating latent TB infection (LTBI) and TB disease. A person with LTBI is treated to prevent them from progressing to TB disease. Some people with LTBI are at very high risk of developing TB disease, and they should receive high priority for LTBI treatment. Patients with LTBI who do not complete treatment as prescribed can develop TB disease.

TB disease is treated to cure the patient and to stop the spread of TB. As a health care worker, participants may be responsible for ensuring that TB patients take their medications as prescribed. This is very important because patients with TB disease who do not complete treatment as prescribed may become infectious and spread TB to others or develop drug-resistant TB.

This module also explains the possible side effects of the drugs used to treat LTBI and TB disease. If participants work with TB patients, they should be aware of the signs and symptoms of these side effects.

Learning Objectives
After this presentation, participants will be able to
1. List the groups of people who should receive high priority for LTBI treatment.
2. Describe treatment regimens for LTBI.
3. Describe treatment regimens for TB disease.
4. Describe the principles of preventing drug resistance.
6. Describe TB treatment adherence strategies.
7. List the common adverse reactions to the drugs used to treat LTBI and TB disease.

Module Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Content</th>
<th>Slides</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>Introduction</td>
<td>Slides 1-4</td>
</tr>
<tr>
<td>35 min.</td>
<td>Presentation</td>
<td>Treatment of LTBI</td>
<td>Slides 5-67</td>
</tr>
<tr>
<td>40 min.</td>
<td>Presentation</td>
<td>Treatment of TB Disease</td>
<td>Slides 68-133</td>
</tr>
<tr>
<td>10 min.</td>
<td>Case Studies</td>
<td>Case Studies</td>
<td>Slides 134-150</td>
</tr>
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<td>90 min.</td>
<td>Total Time</td>
<td></td>
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<td>Slide 1</td>
<td>Self-Study Modules on Tuberculosis</td>
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<td></td>
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<td>---------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Treatment of Latent Tuberculosis Infection and Tuberculosis Disease</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Slide 2</th>
<th>Module 4: Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At completion of this module, learners will be able to:</td>
</tr>
<tr>
<td></td>
<td>1. List groups of people who should receive high priority for latent TB infection (LTBI) treatment</td>
</tr>
<tr>
<td></td>
<td>2. Describe treatment regimens for LTBI</td>
</tr>
<tr>
<td></td>
<td>3. Describe treatment regimens for TB disease</td>
</tr>
<tr>
<td></td>
<td>4. Describe principles of preventing drug resistance</td>
</tr>
<tr>
<td></td>
<td>5. Describe patient monitoring during LTBI and TB disease treatment</td>
</tr>
<tr>
<td></td>
<td>6. Describe TB treatment adherence strategies</td>
</tr>
<tr>
<td></td>
<td>7. List common adverse reactions to drugs used to treat LTBI and TB disease</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Slide 3</th>
<th>Module 4: Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Treatment of LTBI</td>
</tr>
<tr>
<td></td>
<td>– Patient Medical Evaluation</td>
</tr>
<tr>
<td></td>
<td>– LTBI Treatment Regimens</td>
</tr>
<tr>
<td></td>
<td>– Special Considerations for LTBI Treatment</td>
</tr>
<tr>
<td></td>
<td>• Treatment of TB Disease</td>
</tr>
<tr>
<td></td>
<td>– TB Disease Treatment Regimens</td>
</tr>
</tbody>
</table>

**Facilitation Tips**

- Introduce Module 4
- State objectives of presentation
- Review slide content

Background and Objectives - Module 4, p. 1
### Module 4: Overview (cont.)

- Treatment of TB Disease (cont.)
  - Special Considerations and Alternative Treatment Regimens
  - Treatment and Monitoring Plan and Adverse Reactions
  - Adherence and Evaluating Patients’ Response to Treatment
  - Role of Public Health Workers

- Case Studies

---

### Treatment of Latent TB Infection (LTBI)

- Introduce section
- Ask who should be treated for LTBI
- Ask why people with LTBI should be treated

*Treatment of LTBI - Module 4, pp. 4-21*

### Treatment of LTBI (1)

- LTBI is treated to prevent the development of TB disease
- LTBI is treated with medication

*Treatment of LTBI - Module 4, p. 4*
Treatment of LTBI (2)

- Targeted testing should be used to identify and treat people who are:
  - At high risk for exposure to or infection with *M. tuberculosis*
  - At high risk for developing TB disease once infected with *M. tuberculosis*
- People in these groups should receive high priority for LTBI treatment if they have a positive tuberculin skin test (TST) or interferon-gamma release assay (IGRA).

---

High Priority for LTBI Treatment (1)

- High-priority groups for LTBI treatment if positive IGRA or TST result of $\geq 5$ mm:
  - Recent contacts of people with infectious TB disease
  - People living with HIV
  - People with chest x-ray findings suggestive of previous TB disease
  - Patients with an organ transplant
  - Other immunosuppressed patients

---

High Priority for LTBI Treatment (2)

- High-priority groups for LTBI treatment if positive IGRA or TST result of $\geq 10$ mm:
  - People who have come to U.S. from countries where TB is common
  - People who abuse drugs
  - People who live or work in high-risk congregate settings
  - People who work in mycobacteriology laboratories

---

- Explain that some groups are at higher risk for TB than others
- Review slide content

- Review slide content
- Explain that other immunosuppressed patients include patients on prolonged therapy with corticosteroids equivalent to/greater than 15mg per day of prednisone for one month or more or those taking TNF-alpha antagonists

---

- Review slide content

---

High Priority for LTBI Treatment - Module 4, p. 4

High Priority for LTBI Treatment - Module 4, p. 5

---

Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

118
High Priority for LTBI Treatment (3)

- High-priority groups for LTBI treatment if positive IGRA or TST result of \( \geq 10 \) mm (cont.):
  - People with medical conditions that increase risk of TB disease
  - Children younger than 5 years of age
  - Infants, children, and adolescents exposed to adults in high-risk groups

Low Priority for LTBI Treatment

- Individuals without any risk factors generally should not be tested for TB infection
- However, individuals with no risk factors who are tested and have a positive IGRA or TST result of \( \geq 15 \) mm should be evaluated for LTBI treatment

Treatment of Latent TB Infection (LTBI)

Patient Medical Evaluation
Patient Medical Evaluation (1)
Medical evaluations should be done to:
1. Exclude possibility of TB disease
2. Determine whether patient has ever been treated for TB infection or TB disease
3. Find out if patient has any medical conditions that may complicate therapy
4. Establish and build rapport with patient

Patient Medical Evaluation (2)
1. Exclude possibility of TB disease
   - Treating TB disease with LTBI treatment regimen can lead to drug resistance
   - Clinicians should determine if the patient has symptoms of TB disease
   - Clinicians should evaluate the patient with a chest x-ray
   - Patients with symptoms or chest x-ray findings of TB disease should be given TB disease treatment, not LTBI treatment

Patient Medical Evaluation (3)
2. Determine whether patient has ever been treated for TB infection or TB disease
   - Patients who have been adequately treated should not be treated again
   - TST or IGRA results cannot determine if patient has received treatment for LTBI or TB disease; or if they have been re-infected after treatment

• Review slide content

Patient Medical Evaluation – Module 4, pp. 5-6
Patient Medical Evaluation (4)

3. Find out if patient has any medical conditions that may complicate therapy or require more careful monitoring. These patients include:
   - People living with HIV
   - People with history of liver disorder or disease
   - People who use alcohol regularly
   - Women who are pregnant or just had a baby (within 3 months of delivery)
   - People who are taking other medications that may increase the risk of hepatitis

Slide 16

Patient Medical Evaluation – Module 4, p. 6

Patient Medical Evaluation (5)

For patients with the medical conditions listed on the previous slide, baseline laboratory liver function tests (to detect injury to liver) are recommended before starting LTBI treatment.

Slide 17

Patient Medical Evaluation – Module 4, p. 6

Patient Medical Evaluation (6)

- It is important to find out if:
  - Patient has ever had adverse reactions to LTBI drugs
  - Patient is currently on medications that may interact with LTBI drugs

Slide 18

Patient Medical Evaluation – Module 4, p. 6
Patient Medical Evaluation (7)

4. Establish and build rapport with patient
   - Health care workers (HCWs) should highlight important aspects of treatment, such as:
     - Benefits of treatment
     - Importance of adherence to treatment
     - Possible adverse reactions
     - Establishment of a follow-up plan

Patient Medical Evaluation (8)

Because of the interaction between TB and HIV, HCWs should also recommend that patients undergo HIV counseling and testing

Treatment of Latent TB Infection (LTBI)

LTBI Treatment Regimens
LTBI Treatment Regimens (1)
Isoniazid
• Isoniazid (INH) daily for 9 months is very effective in preventing the development of TB disease
• INH may also be given for 6 months
  – Cost effective and patients may find it easier to adhere, BUT:
    • Not as effective if given for less than 6 months
    • Not recommended for people living with HIV, individuals with previous TB disease, or children

LTBI Treatment Regimens (2)
Isoniazid and Rifapentine (12-Dose Regimen)
• Combination of INH and rifapentine (RPT) given in 12, once-a-week doses under DOT, if possible
• Recommended for patients who:
  – Are 12 years of age or older
  – Were recently exposed to infectious TB
  – Have a TST or IGRA conversion from negative to positive
  – Have chest x-ray findings of previous TB disease
• Regimen may be used in otherwise healthy HIV-infected persons who are:
  – 12 years of age or older
  – Not on antiretroviral therapy (ART), except those taking an efavirenz or raltegravir-based ART regimen

LTBI Treatment Regimens (3)
Isoniazid and Rifapentine (12-Dose Regimen)
• This regimen is not recommended for
  – Children younger than 2 years of age
  – People with HIV/AIDS who are taking certain ART regimens
  – People presumed to be infected with isoniazid or rifampin-resistant M. tuberculosis
  – Pregnant women or women expecting to become pregnant within the 12-week regimen

Regimens for LTBI Treatment – Module 4, p. 7
LTBI Treatment Regimens (4)
Rifampin
- Rifampin (RIF) is also recommended for people with a positive TST or IGRA result
  - Especially if the person has been exposed to INH-resistant TB
- RIF should be given daily for 4 months
- RIF should not be used with certain combinations of ART
- In some cases, rifabutin (RFB) may be substituted when RIF cannot be used

• Rifampin (RIF) is also recommended for people with a positive TST or IGRA result
  - Especially if the person has been exposed to INH-resistant TB
  - RIF should be given daily for 4 months
  - RIF should not be used with certain combinations of ART
  - In some cases, rifabutin (RFB) may be substituted when RIF cannot be used

LTBI Treatment Regimens (5)
Rifampin and Pyrazinamide
- CDC advises against using a combination of RIF and pyrazinamide (PZA) due to serious side effects such as:
  - Severe liver injury
  - Death

LTBI Treatment Regimens (6)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Duration (months)</th>
<th>Frequency</th>
<th>Minimum Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>INH</td>
<td>9</td>
<td>Daily</td>
<td>270</td>
<td>1. Preferred regimen is daily treatment for 9 months 2. DOT must be used with twice-weekly dosing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Twice weekly</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>INH</td>
<td>6</td>
<td>Daily</td>
<td>180</td>
<td>1. NOT recommended for people living with HIV, children, or people with chest x-rays suggestive of previous TB disease 2. DOT must be used with twice-weekly dosing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Twice weekly</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

- Review slide content

- Review slide content

- Ask participants to turn to p. 8 (if participants have print-based modules)
- Explain that this table describes the various LTBI treatment regimens
- Review slide content

Regimens for LTBI Treatment – Module 4, p. 8
Regimens for LTBI Treatment – Module 4, pp. 8-9
### LTBI Treatment Regimens (7)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Duration (months)</th>
<th>Frequency</th>
<th>Minimum Dose</th>
<th>Comments</th>
</tr>
</thead>
</table>
| INH and RPT| 3                 | Once Weekly | 12           | 1. NOT recommended for children younger than 2 years of age, HIV-infected patients taking certain ART regimens, patients with resumed INH or RIF-resistant TB, pregnant women, or women expecting to become pregnant  
2. DOT is recommended, if possible |
| RIF        | 4                 | Daily     | 120          | 1. Recommended for patients who have INH-resistant TB  
2. NOT recommended for HIV-infected patients on certain combinations of ART. RFB may be used instead for some patients. |
| RIF/PZA    | Due to the reports of severe liver injury and deaths, RIF and PZA combinations generally should not be offered for treatment of LTBI |

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### Treatment of LTBI Study Question 4.1

**What is the purpose of LTBI treatment?**

To prevent people with latent TB infection from developing TB disease.

---

### Treatment of LTBI Study Question 4.2

**Which groups of people should receive high-priority for LTBI treatment if they have a positive IGRA or TST result of ≥ 5 mm? Name 5.**

- Recent contacts of people with infectious TB disease
- People living with HIV
- People with chest x-ray findings suggestive of previous TB disease
- Patients with an organ transplant
- Other immunosuppressed patients

---

**Regimens for LTBI Treatment – Module 4, pp. 8-9**

**Introduce study questions**

**Ask participants to turn to p. 10 (if participants have print-based modules)**

**Read question**

**Ask participants for answers**

**Answers – Module 4, p. 49**

---

**Introduce study questions**

**Ask participants for answers**

**Answers – Module 4, p. 49**
Which groups of people should receive high priority for LTBI treatment if they have a positive IGRA result or a TST reaction that is ≥ 10 mm? Name 7.

- People who come to the U.S. from areas of the world where TB is common
- People who abuse drugs
- People who live or work in high-risk congregate settings
- People who work in mycobacteriology laboratories
- People with medical conditions that increase risk of TB disease
- Children younger than 5 years of age
- Infants, children, and adolescents exposed to adults in high-risk groups

List 4 regimens that are approved for the treatment of LTBI.

- Isoniazid for 9 months
- Isoniazid for 6 months
- Isoniazid and rifapentine for 12, once-weekly doses (12-dose regimen)
- Rifampin for 4 months

Special Considerations for LTBI Treatment

- Ask for a volunteer to read question
- Ask participants for answers

- Read question
- Ask participants for answers

- Introduce section
Slide 34

**Special Considerations for LTBI (1)**

**Directly Observed Therapy (DOT)**
- DOT is when a HCW or another designated person watches a patient swallow each dose of medication
  - Used to help patients adhere to treatment
  - Should be considered for people who are at high risk for TB or suspected to be non-adherent
  - Recommended for intermittent therapy

Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

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Slide 35

**Special Considerations for LTBI (2)**

**Contacts**
- Contacts are people who have been exposed to someone with infectious TB disease
- Contacts should be quickly identified, located, and assessed for LTBI and TB disease
  - If TST or IGRA result is positive, contacts should be given high priority for LTBI treatment (once TB disease is ruled out)
  - If TST or IGRA result is negative, contacts should be retested in 8 to 10 weeks

Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

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Slide 36

**Special Considerations for LTBI (3)**

**Contacts**
- In general, contacts with positive test result and a documented history of completion of LTBI treatment do not need to be retreated
- However, retreatment may be necessary for persons at high risk of:
  - Becoming re-infected
  - Progressing to TB disease

Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

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Review slide content

Review slide content

- Explain that intermittent therapy is when regimens are given once or twice weekly

- Explain that contacts should be retested after 8 to 10 weeks if their result is negative because sometimes it can take 2 to 8 weeks after TB infection for the body’s immune system to produce a response to the TST or IGRA

Contacts – Module 4, p. 11
Special Considerations for LTBI (4)
Contacts at High Risk for Rapid Development of TB Disease
- Some contacts may be started on LTBI treatment even if their test result is negative, and less than 8 to 10 weeks have passed since last exposure to TB; this includes:
  - Children younger than 5 years of age
  - People living with HIV
- Expert consultation should be sought to determine if contacts with immunocompromised states other than HIV infection could benefit from treatment even if they have a negative TST or IGRA result

Contacts at High Risk for TB Disease – Module 4, p. 12

Special Considerations for LTBI (5)
Contacts at High Risk for Rapid Development of TB Disease
- Once active TB disease is ruled out, contacts at high risk for TB disease should:
  - Start LTBI treatment
  - Be retested 8 to 10 weeks after last exposure to TB
    - If negative test result: stop LTBI treatment
    - If positive test result: continue LTBI treatment
  - Contacts living with HIV may be given full course of LTBI treatment even if their second TST or IGRA result is negative

Contacts at High Risk for TB Disease – Module 4, p. 12

Special Considerations for LTBI (6)
Infants and Children
- Infants and children are more likely to develop life-threatening forms of TB disease
- Children younger than 5 years of age who have been exposed to TB should start taking LTBI treatment even if they have a negative TST or IGRA result because they:
  - Are at high risk for rapidly developing TB disease
  - May have a false-negative TST reaction

Infants and Children – Module 4, pp. 12-13
**Special Considerations for LTBI (7)**

**Infants and Children**
- Infants and children should be retested 8 to 10 weeks after last exposure
- LTBI treatment can be stopped if ALL of the following conditions are met:
  - Child is at least 6 months of age
  - Second TST or IGRA is negative
  - Second TST or IGRA was done at least 8 weeks after child was last exposed to a person with infectious TB disease
- The 12-dose regimen is not recommended for children younger than 2 years of age

**Special Considerations for LTBI (8)**

**Contacts of INH-Resistant TB**
- Contacts of patients with INH-resistant, but RIF-susceptible TB, may be treated with a 4-month daily regimen of RIF
- In some patients, rifabutin (RFB) may be substituted if RIF cannot be used

**Special Considerations for LTBI (9)**

**Contacts of Multidrug-Resistant TB (MDR TB)**
- The risk for developing TB disease should be considered before recommending LTBI treatment
- Contacts of patients with MDR TB
  - May be treated for 6 to 12 months with an alternative regimen of drugs to which the *M. tuberculosis* isolate is susceptible
  - Can be observed for signs and symptoms of TB disease without treatment
- All persons with suspected MDR LTBI should be followed and observed for signs and symptoms of TB disease for 2 years, regardless of the treatment regimen

**Note that an MDR TB treatment expert should be consulted**
Special Considerations for LTBI (10)

**Pregnant Women**
- For most pregnant women, LTBI treatment can be delayed until after delivery, unless they have certain risk factors.
- Immediate treatment should be considered if woman is living with HIV or is a recent TB contact.
- Preferred LTBI treatment regimen is 9 months of INH with a vitamin B6 supplement.
  - INH has not been shown to have harmful effects on the fetus.
- The 12-dose regimen is not recommended for pregnant women or women expecting to become pregnant within the 12-week regimen.

**Breastfeeding Women**
- Women who are breastfeeding can take INH, but should also be given a vitamin B6 supplement.
- Amount of INH in breast milk is not enough to be considered treatment for infant.

**People Living with HIV**
- Individuals living with HIV should be treated with 9-month regimen of INH.
- Rif should not be used for people who are taking certain combinations of ART.
  - Dose-adjusted rifabutin (RFB) may be given.
- The 12-dose regimen of INH and RPT may be used for people living with HIV who are:
  - 12 years of age or older.
  - Not on ART, except those taking an efavirenz or raltegravir-based ART regimen.
| Slide 46 | LTBI Treatment Regimens Study Question 4.5 |
|---------------------------------------------|
| What LTBI treatment regimen may be recommended for people with a positive TST or IGRA result who have been exposed to INH-resistant TB? |
| Treatment with rifampin for 4 months may be recommended in this situation. |

**Answers – Module 4, p. 50**

| Slide 47 | Special Considerations for LTBI Study Question 4.6 |
|---------------------------------------------|
| In what circumstances may LTBI treatment be given to people who have a negative TST or IGRA result? |
| Some contacts may start LTBI treatment if they have a negative TST or IGRA, but less than 8 to 10 weeks have passed since last exposed to TB; these contacts include: |
| • Children who are younger than 5 years of age |
| • People living with HIV |

**Answers – Module 4, p. 50**

| Slide 48 | Special Considerations for LTBI Study Question 4.7 |
|---------------------------------------------|
| What conditions must be met to stop LTBI treatment for children who are younger than 5 years of age and have been exposed to TB? |
| • LTBI treatment can be stopped if ALL the following conditions are met: |
| -- Child is at least 6 months of age |
| -- Second TST or IGRA is negative |
| -- Second TST or IGRA was done 8 to 10 weeks after the child was last exposed to TB |

**Answers – Module 4, p. 50**
Slide 49

**Special Considerations for LTBI**

**Study Question 4.8**

When should pregnant women be treated for LTBI and for how long?

- For most pregnant women with TB infection, LTBI treatment can be delayed until after delivery. If the pregnant woman is HIV-infected or a recent contact, immediate treatment should be considered.

- Preferred treatment regimen for pregnant women is 9 months of INH with a vitamin B6 supplement.

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**Answers – Module 4, p. 51**

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Slide 50

**Treatment of Latent TB Infection (LTBI)**

**Adverse Reactions and Patient Monitoring**

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**Adverse Reactions to INH (1)**

- About 10% to 20% of people treated with INH will have mild, abnormal liver test results during treatment
  - In most people, liver test results return to normal

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**Adverse Reactions and Patient Monitoring – Module 4, pp. 17-19**

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Slide 51

- Read question

- Ask participants for answers

- Introduce section

- Explain that some health care workers have concerns about treating patients for LTBI due to the length of treatment and the possibility of adverse reactions

- Stress that, as with any treatment, the risks and benefits of LTBI treatment must be weighed for each individual

- Review slide content

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**Adverse Reactions – Module 4, p. 17**

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132
Adverse Reactions to INH (2)
Hepatitis

- A major risk of INH is hepatitis (inflammation of the liver)
- Hepatitis prevents the liver from functioning normally, causing symptoms such as:
  - Nausea
  - Vomiting
  - Abdominal pain
  - Fatigue
  - Brown urine

Adverse Reactions to INH (3)
Hepatitis

- INH can cause hepatitis in anyone; however, hepatitis occurs in less than 1% of people taking INH
- Certain risk factors increase the risk of serious hepatitis, such as:
  - Older age
  - Alcoholism

Adverse Reactions to INH (4)
Peripheral Neuropathy

- INH can cause peripheral neuropathy
  - Damage to sensory nerves of hands and feet
  - Symptoms include a tingling sensation, weakened sense of touch, or pain in the hands, palms, soles and feet
- HIV, alcoholism, diabetes, and malnutrition increase risk for peripheral neuropathy
  - People with these conditions should be given vitamin B6

Adverse Reactions – Module 4, p.17
Adverse Reactions to RIF, RPT, and RFB

- Hepatitis is more likely to occur when RIF is combined with INH
- Other side effects of RIF, RPT, and RFB include:
  - Rash
  - Gastrointestinal symptoms
  - Orange discoloration of urine, saliva, and tears
  - Interaction with many other drugs, such as birth control pills and implants, warfarin, some HIV drugs, and methadone
  - Hypersensitivity

Adverse Reactions to RPT and RFB

- RPT may cause flu-like symptoms
- RFB may cause
  - Eye inflammation
  - Joint pain
  - Lower white blood cell count

Adverse Reactions

- Patients should be instructed to report any signs and symptoms of adverse drug reactions to their health care provider
- Patients should stop taking the medication and seek medical attention immediately if symptoms of serious adverse reactions occur
  - No appetite
  - Nausea
  - Vomiting
  - Yellowish skin or eyes
  - Fever for 3 or more days
  - Abdominal pain
  - Tingling in fingers and toes
  - Brown urine

Note: Adverse reactions to TB drugs are discussed more in-depth on slides 100-108
**Patient Monitoring (1)**
- All persons taking LTBI treatment should be educated about symptoms caused by adverse reactions
- Patients need to be evaluated at least monthly during therapy for:
  - Adherence to prescribed regimen
  - Signs and symptoms of TB disease
  - Adverse reactions

**Patient Monitoring (2)**
- During each monthly evaluation, patients should be:
  - Asked whether they have nausea, abdominal pain, or other symptoms of adverse reactions
  - Examined by HCW for adverse reactions
  - Instructed to stop medications and contact HCWs immediately if they have signs or symptoms of hepatitis

**Patient Monitoring (3)**
- People at greatest risk for hepatitis should have baseline liver function tests before starting LTBI treatment and every month during therapy. This includes:
  - People living with HIV
  - People with history of liver disorder or disease
  - People who use alcohol regularly
  - Women who are pregnant or just had a baby
  - People taking medications that may increase risk of hepatitis

- Review slide content
- Stress that patients should be instructed to stop taking the medication and seek medical attention immediately if symptoms of serious adverse reactions occur

*Patient Monitoring – Module 4, p. 18*
Slide 61

**Patient Monitoring (4)**

- For all patients, INH, RIF, and RPT should be stopped if liver function test results are:
  - 3 times higher than upper limit of the normal range and patient has symptoms
  
  OR
  
  - 5 times higher than upper limit of the normal range and patient has no symptoms

Patient Monitoring – Module 4, p. 19

Slide 62

**LTBI Treatment Follow-Up**

- Patients should receive documentation of TST or IGRA results, treatment regimens, and treatment completion dates
  
  - Patients should present these documents any time they are required to be tested for TB infection

- Patients should be re-educated about signs and symptoms of TB disease

LTBI Treatment Follow-Up – Module 4, p. 19

Slide 63

**Medical Evaluation Study Question 4.9**

Name 4 reasons why patients should receive a medical evaluation before starting LTBI treatment.

- Exclude possibility of TB disease
- Determine whether they have ever been treated for TB infection or TB disease
- Identify any medical conditions that may complicate therapy or require more careful monitoring
- Establish and build rapport with patient

Medical Evaluation Study Question 4.9 – Module 4, p. 63

- Introduce study questions
- Ask participants to turn to p. 20 (if participants have print-based modules)
- Read question
- Ask participants for answers

Answers – Module 4, p. 51
Why is it important to exclude the possibility of TB disease before giving a patient LTBI treatment?

Treating TB disease with LTBI treatment regimen (usually a single drug) can lead to drug resistance.

What are the symptoms of hepatitis?
- Nausea
- Vomiting
- Abdominal pain
- Fatigue
- Brown urine

Who is at greatest risk for hepatitis? What special precautions should be taken for these patients?
- People with greatest risk for hepatitis are:
  - People living with HIV
  - People with a history of liver disorder or disease
  - People who use alcohol regularly
  - Women who are pregnant or just had a baby
  - People who are taking other medications that may increase the risk of hepatitis
- These patients should have liver function tests before starting LTBI treatment and during therapy.
How often should patients be evaluated for signs and symptoms of adverse reactions during LTBI treatment?

All patients receiving LTBI treatment should be evaluated at least monthly during therapy.

Answers – Module 4, p. 52

Treatment of TB Disease

• Treating TB disease benefits both the person who has TB and the community
  – Patient: prevents disability and death; restores health
  – Community: prevents further transmission of TB
• TB disease must be treated for at least 6 months; in some cases, treatment lasts longer

Treatment of TB Disease – Module 4, pp. 22-30

Treatment of TB Disease – Module 4, p. 22
### Treatment of TB Disease (2)

**Intensive Phase**
- First 8 weeks of treatment
- Most bacilli killed during this phase
- 4 drugs used

**Continuation Phase**
- After first 8 weeks of TB disease treatment
- Bacilli remaining after intensive phase are treated with at least 2 drugs

**Relapse**
- Occurs when treatment is not continued for long enough
- Surviving bacilli may cause TB disease at a later time

---

### Treatment of TB Disease (3)

- Intensive phase should contain the following four drugs:
  - Isoniazid (INH)
  - Rifampin (RIF)
  - Pyrazinamide (PZA)
  - Ethambutol (EMB)

Example of pills used to treat TB disease. From left to right: isoniazid, rifampin, pyrazinamide, and ethambutol.

### Treatment of TB Disease (4)

- Treatment must contain multiple drugs to which organisms are susceptible
- Treatment with a single drug can lead to the development of drug-resistant TB
• Drug resistance can develop when patients are prescribed an inappropriate regimen
  – TB disease must be treated with at least 2 drugs to which bacilli are susceptible
  – Using only one drug can create a population of tubercle bacilli resistant to that drug
  – Adding a single drug to failing regimen may have the same effect as only using one drug

Preventing Drug Resistance (1)

• Resistance can develop when patients do not take drugs as prescribed
  – Patients do not take all of their pills
  – Patients do not take pills as often as prescribed
  – When this happens, patients may expose the bacilli to a single drug

Preventing Drug Resistance (2)

• Factors that increase the chance of patient having or developing drug-resistant TB:
  – Patient does not take their medicine regularly and completely
  – Patient comes from an area of the world where drug-resistant TB is common
  – Malabsorption of drugs
  – Patient is a contact to someone with drug-resistant TB
  – Failure to improve on drug-susceptible regimen
  – Patient develops TB disease again after having taken TB medicine in the past

Preventing Drug Resistance (3)

Preventing Drug Resistance – Module 4, pp. 23
Preventing Drug Resistance – Module 4, p. 23
Preventing Drug Resistance – Module 4, p. 23
Treatment of TB Disease

Treatment Regimens

- Introduce section

Slide 77

TB Treatment Regimens

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Intensive Phase</th>
<th>Continuation Phase</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INH, RIF, PZA, EMB</td>
<td>7 days/week for 56 doses (8 weeks) or 5 days/week for 40 doses (8 weeks)</td>
<td>This is the preferred regimen for patients with newly diagnosed pulmonary TB.</td>
</tr>
<tr>
<td>2</td>
<td>INH, RIF, PZA, EMB</td>
<td>3 times weekly for 54 doses (18 weeks)</td>
<td>Preferred alternative regimen in situations in which more frequent DOT during continuation phase is difficult to achieve.</td>
</tr>
<tr>
<td>3</td>
<td>INH, RIF, PZA, EMB</td>
<td>3 times weekly for 24 doses (8 weeks)</td>
<td>Use regimen with caution in patients with HIV and/or cavitary disease. Missed doses can lead to treatment failure, relapse, and acquired drug resistance.</td>
</tr>
<tr>
<td>4</td>
<td>INH, RIF, PZA, EMB</td>
<td>7 days/week for 14 doses then twice weekly for 12 doses</td>
<td>Do not use twice-weekly regimens in HIV-infected patients or patients with smear positive and/or cavitary disease. If doses are missed then therapy is equivalent to once weekly, which is inferior.</td>
</tr>
</tbody>
</table>

*For detailed information, refer to the Official American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America Clinical Practice Guidelines: Treatment of Drug-Susceptible Tuberculosis.

Slide 78

Treatment of TB Disease

Study Question 4.14

Why must TB disease be treated for at least 6 months?

Even though most bacilli are killed in the first 8 weeks, some bacilli can survive. Therefore, treatment must continue in order to kill all remaining bacilli.

- Introduce study questions

Answers – Module 4, p. 52
Which 4 drugs are recommended for the intensive phase of treatment for TB disease?
The intensive phase should include isoniazid, rifampin, pyrazinamide, and ethambutol.

Why should multiple drugs be used to treat TB disease?
Using only one drug can create a population of tubercle bacilli that is resistant to that drug. When multiple drugs are used together, each drug helps prevent the emergence of bacilli that are resistant to the other drugs.

Name 2 factors that can lead to drug resistance.
Drug resistance can develop when:
• Patients are prescribed an inappropriate regimen for treatment
• Patients do not follow treatment regimens as prescribed
### Slide 82

**Treatment of TB Disease**

**Special Considerations**

- Introduce section

### Slide 83

**Special Considerations (1)**

- TB medical experts should be consulted for complicated and challenging TB treatment issues
- Consultation can be provided by State TB Programs and the CDC-funded TB Regional Training and Medical Consultation Centers (RTMCCs)

[www.cdc.gov/TB/education/rtmc/default.htm](http://www.cdc.gov/TB/education/rtmc/default.htm)

- Review slide content
- Explain that the TB Regional Training and Medical Consultation Centers (RTMCCs) are regionally assigned to cover all 50 states and the U.S. territories
- Tell participants that they may learn more about the RTMCCs by going to the website shown on the slide

### Slide 84

**Special Considerations (2)**

- People Living with HIV

- For HIV-infected TB patients receiving ART, the recommended treatment is a 6-month daily regimen consisting of:
  - An intensive phase of INH, RIF, PZA, and EMB for 2 months
  - A continuation phase of INH and RIF for 4 months

- Review slide content
- Explain that the management of HIV-infected TB patients is complex and therefore medical experts should be involved in the care and treatment of patients with HIV and TB

*People Living with HIV – Module 4, p. 26*
Slide 85

Special Considerations (3)
People Living With HIV

- ART should be initiated during TB treatment to improve treatment outcomes for TB patients living with HIV.
- ART should ideally be initiated:
  - Within 2 weeks of starting TB treatment for patients with CD4 cell counts <50/mm³.
  - By 8 to 12 weeks of starting TB treatment for patients with CD4 cell counts >50/mm³.
- For patients with TB meningitis or TB involving the central nervous system, ART should NOT be initiated during the first 8 weeks of TB treatment.

Special Considerations (4)
People Living With HIV

- It is important to be aware of the interaction of RIF with some ART drugs.
  - Rifabutin has fewer drug interaction problems and may be used as a substitute for RIF for some patients.
- DOT should be provided for all TB patients living with HIV.
- For patients not receiving ART during TB treatment, it is recommended to extend treatment to 9 months.

Pregnant Women

- Treatment should begin as soon as TB disease is diagnosed.
- Regimen should consist of at least INH, RIF, and EMB for a minimum of 9 months.
- Clinicians should seek expert consultation to evaluate the risks and benefits of prescribing pyrazinamide (PZA) on a case-by-case basis.
- Streptomycin (SM) should NOT be used.
- Vitamin B6 supplements are recommended for all pregnant women taking INH.

People Living with HIV – Module 4, p. 26

People Living with HIV – Module 4, p. 26

Pregnant Women – Module 4, p. 27
**Special Considerations (6)**

**Breastfeeding**

- Women being treated with first-line TB drugs should *not* be discouraged from breastfeeding
  - Only a small concentration of the drugs is found in breast milk
  - Not harmful to infant

**Breastfeeding – Module 4, p. 27**

---

**Special Considerations (7)**

**Breastfeeding**

- Concentration of drugs in breast milk is not considered effective treatment for LTBI or TB disease for infant
- Vitamin B6 supplements are recommended for all women who are taking INH and are breastfeeding

**Breastfeeding – Module 4, p. 27**

---

**Special Considerations (8)**

**Children**

- Children younger than 5 years of age should start TB treatment as soon as the diagnosis is suspected
- Children can be treated with INH, RIF, PZA, and EMB for 2 months, followed by INH and RIF for 4 months
  - Children receiving EMB should be monitored for vision changes
- A 3 drug regimen (INH, RIF, PZA) can be considered in the intensive phase for children who are too young to have their vision monitored, are not infected with HIV, have no prior TB treatment history, and are not at risk for having drug-resistant TB

**Children – Module 4, p. 27**
Special Considerations (9)
People with Extrapulmonary Disease
- In general, regimens used for treating pulmonary TB are also effective for treating extrapulmonary TB
- 9 to 12 month regimen is recommended for TB of the meninges or central nervous system
- 6 to 9 month regimen is recommended for bone and joint TB

Review slide content
- Note that extending treatment should be considered for patients with TB in any site that is slow to respond

Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

People with Extrapulmonary Disease – Module 4, p. 28

Treatment of TB Disease
Alternative Regimens for Treating Drug-Resistant TB

Introduce section

Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

Drug-Resistant TB – Module 4, p. 28

Alternative Treatment Regimens (1)
Drug-Resistant TB
- Alternative regimens should be used for treating drug-resistant TB
- Treatment of drug-resistant TB should always be done under the supervision of a medical expert

Review slide content
**Slide 94**

**Alternative Treatment Regimens (2)**

**Drug-Resistant TB**

- INH-resistant TB can be treated with the following regimen:
  - RIF, EMB, and PZA for 6 months

**Drug-Resistant TB – Module 4, p. 28**

**Slide 95**

**Alternative Treatment Regimens (3)**

**MDR TB**

- MDR TB is resistant to INH and RIF, and is more difficult to treat than drug-susceptible TB
- Drugs that can be used are less effective and are more likely to cause adverse reactions
- Treatment can last 18 to 24 months after culture conversion
- As a last resort, some patients undergo surgery to remove part of the disease site
- Expert consultation should be sought

**Alternative Treatment Regimens – Module 4, p. 28**

**Slide 96**

**Alternative Treatment Regimens (4)**

**Extensively Drug-Resistant TB (XDR TB)**

- XDR TB is resistant to INH, RIF, plus any fluoroquinolone, and at least one injectable second-line drug (e.g., amikacin, kanamycin, or capreomycin)
- XDR TB patients have less effective treatment options
- XDR TB is very difficult to treat
- Expert consultation should be sought

**Alternative Treatment Regimens– Module 4, p. 28**
**Alternative Treatment Regimens (5)**

**XDR TB**

- Successful outcomes for the patient depend greatly on:
  - Extent of drug resistance
  - Severity of disease
  - Whether the patient’s immune system is compromised

---

**Special Considerations**

**Study Question 4.18**

What treatment regimen should be used for HIV-infected TB patients?

- 6-month daily regimen consisting of an intensive phase of INH, RIF, PZA, and EMB for 2 months followed by a continuation phase of INH and RIF for 4 months
- ART should ideally be initiated
  - Within 2 weeks of starting TB treatment for patients with CD4 cell counts <50/mm$^3$
  - By 8 to 12 weeks of starting TB treatment for patients with CD4 cell counts >50/mm$^3$
- For patients with TB meningitis or TB involving the central nervous system, ART should NOT be initiated during the first 8 weeks of TB treatment

---

**Study Question 4.19**

In what situations should treatment for TB disease last longer than the usual course of treatment?

- HIV-infected TB patients need a minimum of 6 months of treatment. If an HIV-infected patient is NOT receiving ART during TB treatment, it is recommended to prolong treatment to 9 months.
- Pregnant women with TB disease should receive at least 9 months of treatment
- Persons with TB disease of the meninges or central nervous system should receive a 9 to 12-month regimen
- Persons with bone or joint TB disease should receive a 6 to 9-month regimen
- Extending treatment should be considered for patients with TB disease in any site that is slow to respond
- Treatment for MDR TB disease can last 18 to 24 months

---

**Answers**

- Module 4, p. 28
- Module 4, p. 53
## Treatment of TB Disease

### Treatment and Monitoring Plan and Adverse Reactions

- Every TB patient should have a specific treatment and monitoring plan developed in collaboration with local health department.
- Plan should include:
  - Description of treatment regimen
  - Methods of:
    - Monitoring for adverse reactions
    - Assessing and ensuring adherence to treatment
    - Evaluating treatment response

### Monitoring Adverse Reactions (1)

- Before starting treatment for TB disease, patients should have baseline blood and vision tests to detect problems that may complicate treatment.
  - For example, patients who are taking ethambutol should have baseline visual acuity testing and testing of color discrimination.

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*Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease*
| Slide 103 | Monitoring Adverse Reactions (2)  
TB Disease  
- Follow-up tests should be done periodically if:  
  - Results of baseline tests indicate abnormalities  
  - Patient has symptoms that may be due to adverse reactions |
| Slide 104 | Monitoring Adverse Reactions (3)  
TB Disease  
- Patients should be educated about symptoms caused by adverse reactions to drugs  
- Patients should be seen by clinician at least monthly during treatment and evaluated for possible adverse reactions  
- Public health workers who have regular contact with patients should ask about adverse reactions to treatment |
| Slide 105 | Monitoring Adverse Reactions (4)  
TB Disease  
- If patient has symptoms of a serious adverse reaction, HCWs should:  
  - Instruct patient to stop medication  
  - Report situation to clinician and arrange for medical evaluation  
  - Note symptoms on the patient’s form |
Adverse Reactions to TB Drugs (1)

<table>
<thead>
<tr>
<th>Adverse Reaction</th>
<th>Caused by</th>
<th>Signs and Symptoms</th>
<th>Significance of Reaction*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergic</td>
<td>Any drug</td>
<td>Skin rash</td>
<td>May be serious or minor</td>
</tr>
<tr>
<td>Eye damage</td>
<td>EMB</td>
<td>Blurred or changed vision, Changed color vision</td>
<td>Serious</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>PZA, INH, RIF</td>
<td>Abdominal pain, Abnormal liver function test results, Brown urine, light colored stool, Fatigue, Fever for 3 or more days, Flu-like symptoms, Lack of appetite, Nausea, Vomiting, Yellowish skin or eyes</td>
<td>Serious</td>
</tr>
</tbody>
</table>

Adverse Reactions to TB Drugs (2)

<table>
<thead>
<tr>
<th>Adverse Reaction</th>
<th>Caused by</th>
<th>Signs and Symptoms</th>
<th>Significance of Reaction*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous system damage</td>
<td>INH</td>
<td>Dizziness, Tingling or numbness around the mouth</td>
<td>Serious</td>
</tr>
<tr>
<td>Peripheral neuropathy</td>
<td>INH</td>
<td>Tingling sensation, numbness, or pain in hands and feet</td>
<td>Serious</td>
</tr>
<tr>
<td>Stomach upset</td>
<td>PZA</td>
<td>Stomach upset, Vomiting, Lack of appetite</td>
<td>May be serious or minor</td>
</tr>
<tr>
<td>Gout</td>
<td>PZA</td>
<td>Abnormal uric acid level, Joint aches</td>
<td>Serious</td>
</tr>
</tbody>
</table>

Adverse Reactions to TB Drugs (3)

<table>
<thead>
<tr>
<th>Adverse Reaction</th>
<th>Caused by</th>
<th>Signs and Symptoms</th>
<th>Significance of Reaction*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding problems due to low platelets</td>
<td>RIF</td>
<td>Easy bruising, Slow blood clotting</td>
<td>Serious</td>
</tr>
<tr>
<td>Discoloration of body fluids</td>
<td>RIF</td>
<td>Orange urine, sweat, or tears, Permanently stained soft contact lenses</td>
<td>Minor</td>
</tr>
<tr>
<td>Drug interactions</td>
<td>RIF</td>
<td>Interferes with many medications, such as birth control pills or implants, blood thinners, some HIV medicines, and methadone</td>
<td>May be serious or minor</td>
</tr>
</tbody>
</table>

* Patients should stop medication for serious adverse reactions and consult a clinician immediately. Patients can continue taking medication if they have minor adverse reactions.

Adverse Reactions to TB Drugs – Module 4, p. 33
What should be included in each patient’s treatment plan?

- Description of treatment regimen
- Methods of monitoring for adverse reactions
- Methods of assessing and ensuring adherence to the treatment
- Methods for evaluating treatment response

**TB Treatment and Monitoring Plan**

**Study Question 4.20**

Name the drug or drugs that may cause each of the following symptoms or adverse reaction.

- Nervous system damage:
  - INH
- Hepatitis:
  - INH, PZA, RIF
- Eye damage:
  - EMB
- Orange discoloration of the urine:
  - RIF

**Adverse Reactions to TB Drugs**

**Study Question 4.21**

How often should patients be monitored for adverse reactions to TB drugs?

- All patients should be seen at least monthly during treatment and evaluated for possible adverse reactions.
- Also, DOT providers should ask about any adverse reactions.

**TB Treatment Monitoring**

**Study Question 4.22**

Answers – Module 4, p. 54
Treatment of TB Disease
Adherence and Evaluating Patients' Response to Treatment

Adherence to TB Treatment (1)
• Most effective strategy to encourage adherence to treatment is DOT
  – Should be considered for ALL patients
  – Should be used for all children and adolescents
  – Should be done at a time and place that is convenient for patients

Adherence to TB Treatment (2)
• Incentives and enablers can be used to improve patient adherence
  – Incentives are rewards given to patient, e.g., gift cards
  – Enablers help patient receive treatment, e.g., bus tokens

• Introduce section

• Explain that in order to cure TB and prevent drug resistance, TB patients must adhere to treatment

• Explain that adherence to TB treatment can be difficult because patients need to take several different medications for many months

• Review slide content

• Ask participants what adherence problems they have encountered with patients and strategies they have used to overcome them

Adherence to TB Treatment – Module 4, p. 37

• Review slide content

• Explain that incentives are small rewards given to patients to encourage them to take their medicines or keep DOT appointments

• Explain that enablers help patients receive treatment

• Mention that incentives and enablers are generally offered along with DOT

Adherence to TB Treatment – Module 4, p. 38
Adherence to TB Treatment (3)

- Patients should be educated about TB disease and treatment
  - Cause of TB, transmission, diagnosis, and treatment plan
  - How and when to take medication

Monitoring Patients’ Adherence to Therapy

- Patients not receiving DOT should be monitored for adherence to treatment:
  - Check if patient is reporting to clinic as scheduled
  - Ask about adherence
  - Ask patient to bring medications to clinic and count number of pills taken
  - Use urine tests to detect medication in urine
  - Assess patient’s clinical response to treatment

Evaluating Patients’ Response to Treatment (1)

Three methods to determine whether a patient is responding to treatment:

1. Check to see if patient has TB symptoms (clinical evaluation)
2. Conduct bacteriologic examination of sputum or other specimens
3. Use chest x-rays to monitor patient’s response to treatment
**Evaluating Patients’ Response to Treatment (2)**

1. Check to see if patient has TB symptoms (clinical evaluation)
   - TB symptoms should gradually improve and go away after starting treatment
   - Patients whose symptoms do not improve during the first 2 months of treatment, or whose symptoms worsen after initial improvement, should be reevaluated

**Evaluating Patients’ Response to Treatment – Module 4, pp. 39-40**

**Evaluating Patients’ Response to Treatment (3)**

2. Conduct bacteriologic examination of sputum or other specimens
   - Specimens should be examined every month until culture results have converted from positive to negative
   - Any patient whose culture results have not become negative after 2 months of treatment, or whose results become positive after being negative, should be reevaluated

**Evaluating Patients’ Response to Treatment – Module 4, pp. 39-40**

**Evaluating Patients’ Response to Treatment (4)**

3. Use chest x-rays to monitor patient’s response to treatment
   - Repeated x-rays are not as helpful as monthly bacteriologic and clinical evaluations
   - Chest x-rays taken at end of treatment can be compared to any follow-up x-rays

**Evaluating Patients’ Response to Treatment – Module 4, pp. 39-40**
Evaluating Patients’ Response to Treatment (5)

- TST or IGRA cannot be used to determine whether the patient is responding to treatment
- Treatment completion is defined by number of doses the patient takes within a specific time frame
- Length of treatment depends on drugs used, drug susceptibility test results, and the patient’s response to therapy

Reevaluating Patients Who Do Not Respond to Treatment (1)

- Reevaluating the patient means
  - Obtaining a new specimen for TB culture, and (if positive) drug susceptibility testing
  - Assessing whether the patient has taken medication as prescribed
  - Reviewing symptoms
  - Performing a clinical examination
  - Repeating chest x-rays

Reevaluating Patients Who Do Not Respond to Treatment (2)

- Patients should be reevaluated if:
  - Symptoms do not improve in first 2 months of therapy
  - Symptoms worsen after improving initially
  - Culture results have not become negative after 2 months of treatment
  - Culture results become positive after being negative
  - Chest x-rays show worsening

- Review slide content
- Explain that most people who have a positive TST result will have a positive result again if they are skin tested later in their lives, regardless of whether they have received treatment

Reevaluating Patients Who Do Not Respond to Treatment – Module 4, pp. 39-40
Adherence to Therapy
Study Question 4.23
Name 4 ways clinicians can assess whether a patient is adhering to treatment.
- Check whether patient is reporting to clinic as scheduled
- Ask patient to bring medications to each clinic visit and count the number of pills
- Use urine tests to detect medication
- Assess patient’s clinical response to therapy

Adherence to Therapy
Study Question 4.24
What is the best way to ensure that a patient adheres to treatment?
Directly observed therapy (DOT)

Adherence to Therapy
Study Question 4.25
How can clinicians determine whether a patient is responding to treatment?
- Clinical evaluations
- Bacteriologic evaluations
- Chest x-rays

Answers – Module 4, p. 54
Under what circumstances should patients be reevaluated?

- Symptoms do not improve during first 2 months of therapy
- Symptoms worsen after improving initially
- Culture results have not become negative after 2 months of treatment
- Culture results become positive after being negative
- Chest x-rays show worsening

Reevaluating the Patient
Study Question 4.26

What does reevaluating the patient mean?

Reevaluating the patient means obtaining a new specimen for TB culture, and (if positive) drug susceptibility testing, assessing whether the patient has been taking medication as prescribed, reviewing symptoms, performing a clinical evaluation, and repeating chest x-rays.

Reevaluating the Patient
Study Question 4.27

Role of Public Health Workers

Treatment of TB Disease
Module 4 – Treatment of Latent Tuberculosis Infection and Tuberculosis Disease

Role of Public Health Workers (1)

- Successful TB treatment is the responsibility of medical providers and HCWs, not the patient
- Case management can be used to ensure that patients complete TB treatment
- A health department employee is assigned responsibility for the management of specific patients

Role of Public Health Workers (2)

- Provide DOT
- Help monitor patients’ response to treatment
- Educate patients and families about TB
- Locate patients who have missed DOT visits or clinic appointments
- Act as interpreters, arrange and provide transportation for patients, and refer patients to other social services
- Work with private physicians to make sure TB patients complete an adequate regimen

Role of Public Health Workers

Study Question 4.28

What is the goal of case management?

To provide patient-centered care for completion of treatment and to ensure all public health activities related to stopping TB transmission are completed.

Answers – Module 4, p. 55
What should a public health worker do if he or she notices that a patient has symptoms of a serious adverse reaction?

- Instruct patient to stop taking medication
- Report situation to clinician and arrange for a medical evaluation right away
- Note symptoms on patient’s form

Role of Public Health Workers

Study Question 4.29

Answers – Module 4, p. 55

Case Studies

Module 4: Case Study 4.1 (1)

You are sent to visit the home of a TB patient who was admitted to the hospital last week and diagnosed with infectious TB disease. Living in the home are his wife and his 1-year-old daughter. Neither one has symptoms of TB disease. You give them both a TST and return 2 days later to read the results. You find that the wife has 14 mm of induration, but the daughter has no induration.

Module 4: Case Study 4.1 – Module 4, p. 16
Module 4: Case Study 4.1 (2)
Should either one receive further evaluation for LTBI or TB disease?

Yes, both should receive further evaluation for LTBI or TB disease.

Answers – Module 4, p. 56

Module 4: Case Study 4.1 (3)
Should either one start LTBI treatment? Explain.

Yes, both should start LTBI treatment. The wife is a contact of someone with infectious TB disease, and she has a positive TST. Therefore, after receiving a medical evaluation (and TB disease is ruled out), she should complete an entire course of LTBI treatment, regardless of her age.

Answers – Module 4, p. 56

Module 4: Case Study 4.1 (4)
Should either one start LTBI treatment? Explain. (cont.)
The daughter has a negative TST, but only one week has passed since her last TB exposure. It is possible that not enough time has passed for her to be able to react to the TST. Since it is currently impossible to tell whether she has TB infection and because she may develop TB disease very quickly after infection, she should start LTBI treatment now and be retested 8 to 10 weeks after last exposure to TB. If negative upon retest, she may stop taking medicine. If positive, she should complete the entire course of LTBI treatment (9 months for children).

Answers – Module 4, p. 56
Module 4: Case Study 4.2 (1)
A 65-year-old man is prescribed LTBI treatment with INH because he is a contact of a person with infectious TB disease and he has an induration of 20 mm to the TST. His baseline liver function tests are normal, but he drinks a six-pack of beer every day.

Module 4: Case Study 4.2 (2)
What kind of monitoring is necessary for this patient while he is taking INH?
• Although his liver function tests are normal, he is at high risk of INH-associated hepatitis because he is older and he abuses alcohol.
• He should be educated about the symptoms of adverse reactions to INH and instructed to seek medical attention immediately if these symptoms occur.
• He should be seen by a clinician monthly to ask about his symptoms, examine him for signs of adverse reactions, and consider performing liver function tests.

Module 4: Case Study 4.3 (1)
An 18-month-old girl is admitted to the hospital because of meningitis. Doctors discover that her grandmother had pulmonary TB disease and was treated with a 6-month regimen. The medical evaluation of the child confirms the diagnosis of TB meningitis.
Module 4: Case Study 4.3 (2)

How long should the child be treated?

The child should be treated for 9 to 12 months because she has TB meningitis.

Answers – Module 4, p. 57

Module 4: Case Study 4.4 (1)

You are assigned to deliver medications to TB patients as part of the DOT program where you work. When you visit Mr. Jackson’s house, you ask him how he is feeling. He tells you that he was up all night vomiting.

Case Study 4.4 – Module 4, p. 35

Module 4: Case Study 4.4 (2)

What are the possible causes? What should you do?

His vomiting may be a symptom of hepatitis (caused by INH, RIF, and PZA) or of stomach upset due to PZA. Mr. Jackson should be advised to stop his medication, and the situation should be reported to the clinician immediately. Mr. Jackson should be given a medical evaluation right away.

Answers – Module 4, p. 57
Module 4: Case Study 4.5 (1)
Ms. Young, a patient who started treatment for TB disease last week, calls the TB clinic to complain that her urine has changed to an odd color.

Module 4: Case Study 4.5 (2)
Name 2 possible causes, and explain how each would affect the color of urine.

- One possible cause is the discoloration of body fluids, a common side effect of RIF. This would cause Ms. Young’s urine to turn orange. This is NOT a serious condition.
- Another possible cause is hepatitis, which can be caused by INH, RIF, or PZA. Hepatitis, a serious condition, would cause Ms. Young’s urine to turn dark. If Ms. Young’s urine is brown, the situation should be reported to the clinician and Ms. Young should receive a medical examination right away.

Module 4: Case Study 4.6 (1)
Mr. Vigo was diagnosed with smear-positive pulmonary TB disease in January. He was treated with INH, RIF, and PZA by his private physician. He visited his physician again in March. His drug susceptibility test results were not available at the time of this appointment. Nevertheless, the physician discontinued his prescription of PZA and gave him refills of INH and RIF. Mr. Vigo visited his physician again in April. He had a persistent cough, and his sputum smear was found to be positive.
Module 4: Case Study 4.6 (2)

What should be done next?

Mr. Vigo’s persistent cough and positive sputum smear indicate that he is not responding to therapy. The most likely explanations are:

- He is not taking his medications as prescribed,
- The regimen he has been prescribed is not adequate to treat his TB and he may have drug-resistant TB, or
- A combination of the two factors listed above.

The initial drug susceptibility test results should be located, and susceptibility tests should be repeated on a recent sputum specimen. In addition, his adherence should be evaluated, and he should be given DOT if possible.

Module 4: Case Study 4.7 (1)

Ms. DeVonne began treatment for pulmonary TB disease 2 months ago, at the beginning of September. You have been supervising her DOT. During the first few weeks of therapy, you noticed that Ms. DeVonne’s symptoms were improving a little. However, at a visit in October, you see that Ms. DeVonne is coughing up blood, and she tells you that she feels like she has a fever.

Module 4: Case Study 4.7 (2)

What should you do?

You should report her symptoms to the clinician and arrange for her to receive a medical evaluation right away. Also, you should note her symptoms on her record. Symptoms becoming worse after improving initially indicates that she is not responding to therapy. Because she is receiving DOT, she is probably taking her medications as prescribed. Therefore, the most likely explanation is that she has drug-resistant TB.

Ms. DeVonne’s initial drug susceptibility test results should be located, and drug susceptibility tests should be repeated on a recent sputum specimen.

Answers – Module 4, p. 58
Answers – Module 4, p. 59
Module 5: Infectiousness and Infection Control

Facilitation Tips

Background
In this module, participants will learn about the factors that determine the infectiousness of a person with TB disease. This will help participants decide whether a particular patient should be considered infectious. Participants will also learn about the precautions they should take if they come in contact with patients who are considered infectious to prevent the spread of TB in health care settings and communities. These precautions, or measures, are part of a TB infection-control program that each health care setting should develop to minimize the risk for transmission of Mycobacterium tuberculosis.

Learning Objectives
After this presentation, participants will be able to
1. Describe the factors that determine the infectiousness of a TB patient.
2. Describe the main goals of a TB infection-control program.
3. Describe the three levels of control measures that are the basis of an effective infection-control program.
4. Describe the purpose and the characteristics of a TB airborne infection isolation room.
5. Describe the circumstances when personal respirators should be used.

Module Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Content</th>
<th>Resources Needed</th>
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<tbody>
<tr>
<td>2 min.</td>
<td>Presentation</td>
<td>Introduction</td>
<td>Slides 1-3</td>
</tr>
<tr>
<td>10 min.</td>
<td>Presentation</td>
<td>Infectiousness</td>
<td>Slides 4-12</td>
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<td>15 min.</td>
<td>Presentation</td>
<td>TB Infection Control</td>
<td>Slides 13-27</td>
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<td>25 min.</td>
<td>Presentation</td>
<td>TB Infection Control Measures</td>
<td>Slides 28-60</td>
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<tr>
<td>3 min.</td>
<td>Presentation</td>
<td>TB Risk Assessment</td>
<td>Slides 61-65</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>Infection Control in Nontraditional Facility-Based Settings</td>
<td>Slides 66-72</td>
</tr>
<tr>
<td>5 min.</td>
<td>Presentation</td>
<td>TB Infection Control in the Home</td>
<td>Slides 73-81</td>
</tr>
<tr>
<td>10 min.</td>
<td>Case Studies</td>
<td>Case Studies</td>
<td>Slides 82-93</td>
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<td>75 min.</td>
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### Slide 1

**Self-Study Modules on Tuberculosis**

Infectiousness and Infection Control

### Slide 2

**Module 5: Objectives**

At completion of this module, learners will be able to:

1. Describe the factors that determine the infectiousness of a TB patient
2. Describe the main goals of a TB infection-control program
3. Describe the three levels of control measures that are the basis of an effective TB infection-control program
4. Describe the purpose and the characteristics of a TB airborne infection isolation (AII) room
5. Describe the circumstances when personal respirators should be used

### Slide 3

**Module 5: Overview**

- Infectiousness
- TB Infection Control
  - TB Infection Control Measures
  - TB Risk Assessment
  - Infection Control in Nontraditional Facility-Based Settings
  - TB Infection Control in the Home
- Case Studies

| Module 5 – Infectiousness and Infection Control | 2 |
| Module 5 – Infectiousness and Infection Control | 3 |
Infectiousness

- Introduce section
- Ask participants which factors are associated with infectiousness

Infectiousness

- Infectiousness is directly related to number of tubercle bacilli TB patients expel into air
- TB patients generally expel more tubercle bacilli if their cough produces a lot of sputum
- Only people with TB of the lungs, airway, or larynx are infectious

Factors generally associated with infectiousness:
- Presence of cough
- Cavity in the lung
- Acid-fast bacilli on sputum smear
- TB of lungs, airway, or larynx
- Not covering mouth when coughing
- Not receiving adequate treatment or prolonged illness
- Undergoing cough inducing procedures
- Positive sputum cultures
Infectiousness (3)
• Infectiousness appears to decline rapidly after adequate treatment is started; however:
  – How quickly infectiousness declines varies from patient to patient (weeks to months)
  – Patients with drug-resistant TB may not respond to initial drug regimen; meaning they may remain infectious for longer

Infectiousness (4)
• Patients can be considered non-infectious when they meet all of the following criteria:
  – Received adequate treatment for 2 weeks or longer
  – Symptoms have improved
  – Three consecutive negative sputum smears from sputum collected in 8 to 24 hour intervals (at least one early morning specimen)

Infectiousness (5)
• Children are less likely than adults to be infectious
  – Children generally do not produce a lot of sputum when they cough
  – Young children can still transmit TB if they exhibit signs of infectiousness

Before showing slide, ask participants if children are more or less likely than adults to be infectious

Review slide content

Review slide content

Review slide content
Infectiousness
Study Question 5.1
List 7 factors that affect the infectiousness of a TB patient.

- Presence of a cough
- Chest x-ray showing cavity in lung
- Positive acid-fast bacilli sputum smear result
- TB of lungs, airway, or larynx
- Patient not covering mouth or nose when coughing
- Not receiving adequate treatment or having prolonged illness
- Undergoing cough-inducing procedures

Answers - Module 5, p. 37

Infectiousness
Study Question 5.2
Why does the site of disease affect the infectiousness of a TB patient?

- Usually only people with pulmonary or laryngeal TB are infectious. These people may be coughing and expelling tubercle bacilli into air.
- People with extrapulmonary TB are generally not infectious

Answers - Module 5, p. 37

Infectiousness
Study Question 5.3
When can a TB patient be considered noninfectious? List all 3 criteria.

When they meet all of the following criteria:
- Received adequate TB treatment for a minimum of 2 weeks
- Symptoms have improved
- 3 consecutive negative sputum smears from sputum collected in 8-24 hour intervals (one being early morning specimen)

Answers - Module 5, p. 37
Infection control is an important strategy to prevent the spread of TB. Several outbreaks of TB in health care settings, including multidrug-resistant TB (MDR TB) and extensively drug-resistant TB (XDR TB), have occurred. All health care and congregate settings should implement TB infection-control measures.

TB is most likely to be transmitted when health care workers (HCWs) and patients come in contact with persons who:

- Have unsuspected TB disease
- Are not receiving adequate treatment
- Have not been isolated from others
TB Infection Control (3)
Role of the Health Department

- Health department TB control programs should:
  - Ensure each of their clinics develop a TB infection-control program
  - Provide consultation about TB infection control to other health care and congregate settings

TB Infection Control (4)
Role of the Health Department

- Health departments should specifically assist health care settings with:
  - Understanding infection control principles
  - Reporting confirmed or suspected TB cases
  - Conducting contact investigations
  - Ensuring a plan for TB patients to receive follow-up care after discharge
  - Conducting risk assessments, testing, surveillance, and outbreak investigations
  - Planning and implementation of TB control activities

TB Infection-Control Program (1)

- Main goals of a TB infection-control program are to ensure early and prompt:
  - Detection of TB disease
  - Airborne precautions (e.g., isolation of people who have or are suspected of having TB disease)
  - Treatment of people who have or are suspected of having TB disease

Review slide content
Module 5 – Infectiousness and Infection Control

Slide 19

**TB Infection-Control Program (2)**
Detection of TB disease

- HCWs should suspect TB disease in anyone with any of these symptoms:
  - Persistent cough
  - Chest pain
  - Bloody sputum
  - Weight loss or loss of appetite
  - Fever
  - Chills
  - Night sweats

Module 5 – Infectiousness and Infection Control

- Review slide content
- Explain that in areas where TB is common staff at health care facilities should stay alert for TB; especially staff at public health and community clinics

Slide 20

**TB Infection-Control Program (3)**
Detection of TB disease

- When a health care worker suspects that a patient has TB disease, the patient should be:
  - Placed in an area away from other patients and evaluated
  - Given a surgical mask to wear
  - Given tissues and asked to cover nose and mouth when coughing or sneezing

Module 5 – Infectiousness and Infection Control

- Before showing slide, ask what a health care worker should do if they suspect a patient has TB disease
- Review slide content

Slide 21

**TB Infection-Control Program (4)**
Airborne Precautions

- Airborne precautions should be taken for any person who has signs or symptoms of TB disease
- If facility has an AII room, TB suspects and TB patients should be placed there
- Health care settings, such as TB clinics, should implement a respiratory-protection program

Module 5 – Infectiousness and Infection Control

- Before showing slide, ask what airborne precautions should be taken for a person who has signs or symptoms of TB disease
- Review slide content
- Explain that if a facility does not have an AII room, patients who have or are suspected of having TB should be placed in an area away from other patients
- Explain that for settings other than clinics, patients with suspected TB should be promptly referred for a medical evaluation

TB Infection Control Program - Module 5, p. 10

TB Infection Control Program - Module 5, pp. 11-12
Slide 22

**TB Infection-Control Program (5)**

**Treatment**

- Patients diagnosed with TB should start treatment immediately
- DOT should be used to ensure adherence

---

Slide 23

**TB Infection Control**

**Study Question 5.4**

Under what circumstances is TB most likely to be transmitted in health care facilities?

TB is most likely to be transmitted when health care workers and patients come into contact with persons who:
- Have unsuspected TB disease
- Are not receiving adequate treatment
- Have not been isolated from others

---

Slide 24

**TB Infection Control**

**Study Question 5.5**

How can the health department assist health care settings in preventing the spread of TB?

The health department can help health care facilities with:
- Understanding infection control principles
- Reporting confirmed or suspected TB cases
- Conducting contact investigations
- Ensuring there is a plan for TB patients to receive follow-up care after they are discharged
- Risk assessments, testing, surveillance, and outbreak investigations
- Planning and implementing TB control activities

---
Module 5 – Infectiousness and Infection Control

Slide 25: What are the main goals of a TB infection-control program?

The main goals are to detect TB disease early and to promptly isolate and treat people who have TB disease.

Slide 26: What would make a health care worker suspect that a patient has TB disease?

- Persistent cough
- Bloody sputum
- Weight loss or loss of appetite
- Fever
- Night sweats

Slide 27: What should be done when a health care worker suspects that a patient has TB disease?

The patient should be

- Placed in an area away from other patients and evaluated
- Given surgical mask to wear
- Given tissues and asked to cover nose and mouth when coughing or sneezing

Patients who are diagnosed with TB should start appropriate treatment at once.

Answers - Module 5, p. 38
TB Infection Control Measures (1)
Hierarchy of Infection Control

- Administrative Controls
- Environmental Controls
- Respiratory Protection

Three levels of control measures:
- **Administrative controls**: managerial measures to reduce risk of exposure to *M. tuberculosis*
- **Environmental controls**: engineering systems to prevent the spread of and reduce the concentration of infectious *M. tuberculosis* droplet nuclei in air
- **Respiratory-protection controls**: personal protection to further minimize risk for exposure to *M. tuberculosis*
TB Infection Control

TB Infection Control Measures

Administrative Controls

- Introduce section
- Ask participants what types of administrative controls should be used

Administrative Controls (1)

- Administrative controls:
  - First and most important level of TB infection-control program
  - Goal is to reduce risk of exposure to persons who might have TB disease

Administrative Controls (2)

- Administrative control activities:
  - Assigning someone responsibility for TB infection control
  - Developing and implementing a written TB infection control plan
  - Conducting a TB risk assessment
  - Ensuring availability of prompt laboratory processing, testing, and reporting of results

- Review slide content
- Explain that a TB risk assessment consists of evaluating the risk of transmission
- Explain that an infection control plan should specify policies and practices to ensure prompt detection, isolation, and treatment or transfer of persons who have suspected or confirmed disease
- Explain that laboratory services help to determine if patients are still infectious and if they need to remain in an AII room
• Review slide content

• Explain that all health care workers should be educated about basic TB concepts, infection control, and the importance of testing programs

• Explain that TB testing programs can protect both workers and patients. Each health care setting should determine if and how often serial testing is offered depending upon the risk of TB transmission in their setting

Administrative Controls - Module 5, p. 18

• Review slide content

• Emphasize that state or local health department TB control programs and high-risk health care and congregate settings should establish regular communication

Administrative Controls - Module 5, p. 19

• Introduce section

TB Infection Control Measures

Environmental Controls - Module 5, pp. 19-22
Environmental Controls

- Second level of infection-control program
- Consist of technologies that are designed to prevent the spread and reduce the concentration of TB in the air
  - Ventilation technologies
  - High efficiency particulate air filtration (HEPA)
  - Ultraviolet germicidal irradiation (UVGI)

Ventilation Technologies (1)

- Ventilation is the movement of air in a building and the replacement of air inside with air from outside
- Ventilation technologies include:
  - Natural ventilation
  - Mechanical ventilation

Ventilation Technologies (2)

Natural Ventilation

- Doors and windows should be open
- Fans can be used to distribute air
- HCW should sit near fresh air source
- Can be useful for nontraditional settings that do not have a central ventilation system

- Review slide content
- Explain that the specifics of environmental controls will differ for each health care setting

- Review slide content
- State that when fresh air enters a room, it dilutes the concentration of particles in room air, such as droplet nuclei containing *M. tuberculosis*

- Review slide content
- Explain that natural ventilation relies on open doors and windows to bring in air from the outside
- State that waiting rooms, shelter dormitories, or other rooms in which people congregate should have an operable door, window, or skylight kept open as often as possible
**Ventilation Technologies (3)**

**Mechanical Ventilation**
- Refers to the use of technological equipment to circulate and move air
- Consists of two types of technologies
  - Local exhaust ventilation
  - General ventilation
- Should be used by hospitals, TB clinics, and other settings where TB patients are expected

---

**Ventilation Technologies (4)**

**Mechanical Ventilation**
- Local exhaust ventilation
  - Stops airborne contaminants from spreading into general environment
  - Includes external hoods, booths, and tents
  - Should be used for cough-inducing procedures

---

**Ventilation Technologies (5)**

**Mechanical Ventilation**
- General ventilation systems:
  - Dilute contaminated air
  - Remove contaminated air
  - Control airflow patterns in patient and procedure rooms (e.g., negative pressure in AII room)
**Ventilation Technologies (6)**

**Mechanical Ventilation**

- AII rooms are designed to prevent spread of droplet nuclei expelled by patient
  - Negative pressure
  - Clean air flows from corridors into AII room
- Air cannot escape AII room
  - Exhausted outdoors or passed through filter

*Image credit: Curry International TB Center*

**Environmental Controls - Module 5, p. 21**

**HEPA Filters**

- HEPA filters are special filters used to remove droplet nuclei from air
- Must be used when releasing air from:
  - Local exhaust ventilation booths to surrounding area
  - AII room to general ventilation system

*Image credit: Curry International TB Center*

**Environmental Controls - Module 5, p. 21**

**UVGI**

- UVGI is air cleaning technology that consists of lamps that give off UV light, which can kill tubercle bacilli
- Should be used with other infection control measures
- UV light can be harmful to skin and eyes

*Image credit: Curry International TB Center*

**Environmental Controls - Module 5, p. 22**
TB Infection Control

TB Infection Control Measures
Respiratory-Protection Controls

- Introduce section
- Ask what types of respiratory protection controls should be used by the patient and the health care worker

Respiratory-Protection Controls - Module 5, pp. 22-24

Respiratory-Protection Controls (1)
- Third level of infection-control that includes:
  - Implementing a respiratory-protection program
  - Training health care workers on respiratory-protection
  - Educating patients on respiratory hygiene

- Review slide content
- Note that all health care settings that use respiratory-protection controls are required by the Occupational Safety and Health Administration (OSHA) to develop, implement, and maintain a respiratory-protection program
- Explain that respiratory-protection controls reduce the risk of TB transmission in settings where administrative and environmental controls may not fully protect persons against droplet nuclei

Respiratory-Protection Controls - Module 5, p. 22

Respiratory-Protection Controls (2)
Personal Respirators
- Respirators filter out droplet nuclei
- Should be used in:
  - TB AII rooms
  - Rooms where cough-inducing or aerosol generating procedures are done
  - Ambulances transporting infectious TB patients
  - Homes of infectious TB patients

- Review slide content

Respiratory-Protection Controls - Module 5, p. 22
Respiratory-Protection Controls (3)

Personal Respirators

• Important that respirator fits properly:
  – Fit test used to determine which respirator to wear
  – User seal check should be done each time a respirator is put on

Health care worker undergoing an FF test
Image credit: Paul Jensen

Respiratory-Protection Controls (4)

Personal Respirators

• Respirators that can be used to protect against M. tuberculosis:
  – Nonpowered respirators with N95, N99, N100, R95, R99, R100, P95, P99, and P100 filters
  – Powered air-purifying respirators (PAPRs) with high-efficiency filters
  – Supplied-air respirators

Image credit: Greg Knobloch

Respiratory-Protection Controls (5)

Respirators and Surgical Masks

• Important to understand the difference between respirators and surgical masks
  – Respirators protect individuals from inhaling droplet nuclei
  – Surgical masks stop droplet nuclei from being exhaled into air by infectious TB patients or suspects

Respiratory-Protection Controls - Module 5, p. 23
Slide 52

Health care worker wearing a personal respirator

Explain that this image is of a health care worker wearing a personal respirator

Respiratory-Protection Controls (6) Respirators

Module 5 – Infectiousness and Infection Control

Slide 53

Patient wearing a surgical mask

Explain that this image is of a patient wearing a surgical mask

Emphasize that patients should not wear respirators because respirators are designed to prevent persons from inhaling droplet nuclei

Respiratory-Protection Controls (7) Surgical Masks

Module 5 – Infectiousness and Infection Control

Slide 54

What are the three levels of control that form the basis of a TB infection-control program?

• Administrative controls
• Environmental controls
• Respiratory-protection controls

Introduce study questions

Ask participants to turn to p. 26 (if participants have print-based modules)

Read question

Ask participants for answers

TB Infection-Control Study Question 5.9

Module 5 – Infectiousness and Infection Control

Answers - Module 5, p. 38
Administrative Controls

Study Question 5.10
List 5 administrative control measures that should be taken in health care settings to reduce the risk of exposure to persons who may have TB disease.

- Assign responsibility for TB infection control
- Conduct TB risk assessment
- Develop and implement a written TB infection-control plan
- Ensure prompt availability of recommended laboratory processing, testing, and reporting of results
- Implement effective work practices for the management of patients
- Ensure proper cleaning, sterilization, or disinfection of equipment
- Train and educate health care workers
- Test and evaluate health care workers for TB
- Apply epidemiology-based prevention principles
- Use posters and signs educating and advising respiratory hygiene and cough etiquette
- Coordinate efforts with health department and high-risk health care and congregate settings

Module 5 - Infectiousness and Infection Control

Environmental Controls

Study Question 5.11
Where should sputum induction, bronchoscopy, or other cough-inducing procedures be done?

These medical procedures should be done in special AII rooms or sputum induction booths to prevent any droplet nuclei expelled during the procedure from reaching other parts of the facility.

Module 5 - Infectiousness and Infection Control

Environmental Controls

Study Question 5.12
What is a TB AII room? What are the important characteristics of an AII room?

Airborne infection isolation (AII) rooms have special characteristics to prevent spread of droplet nuclei expelled by a TB patient. They are at negative pressure relative to other parts of the facility, and air from the room is exhausted directly to the outdoors or passed through a filter.

Module 5 - Infectiousness and Infection Control
| Slide 58 | Ventilation Systems
Study Question 5.13
How do ventilation systems help prevent the spread of TB?
Ventilation systems maintain negative pressure and exhaust air properly. These systems can also be designed to minimize the spread of TB in other areas of the facility.

Answers - Module 5, p. 40
| Slide 59 | Ventilation Systems
Study Question 5.14
Give 4 examples of settings where personal respirators should be used.
• TB AII rooms
• Rooms where cough-inducing procedures are done
• Ambulances or other vehicles transporting infectious TB patients
• Homes of infectious TB patients

Answers - Module 5, p. 40
| Slide 60 | Respiratory Protection-Controls
Study Question 5.15
What is the difference in use between a respirator and a surgical mask?
• Respirators protect individuals from inhaling droplet nuclei
• Surgical masks stop droplet nuclei from being exhaled into the air by the person wearing them

Answers - Module 5, p. 40
• Introduce section

TB Infection Control

TB Risk Assessment

TB Risk Assessment (1)
- Administrative control measure
- Helps to inform infection control plan
- Determines types of controls needed for setting
- Serves as an initial and ongoing monitoring and evaluation tool for infection-control program
- Helps determine frequency of employee testing

Module 5 – Infectiousness and Infection Control

• Explain that every health care and congregate setting should conduct initial and ongoing evaluations of the risk for transmission of *M. tuberculosis*

• Review slide content

TB Risk Assessment (2)
- Risk assessment examines many factors, including:
  - Number of patients with TB disease in setting
  - Promptness of detection, isolation, and evaluation of patients with suspected or confirmed TB
  - Evidence of transmission of *M. tuberculosis* in setting
  - Community rate of TB disease

Module 5 – Infectiousness and Infection Control

• Review slide content
**TB Risk Classification**

- **Low risk**
  - Persons with TB disease are not expected to be encountered

- **Medium risk**
  - Possible exposure to persons with TB disease
  - Possible exposure to clinical TB specimens

- **Potential ongoing transmission**
  - Setting where there is evidence of person-to-person transmission of *M. tuberculosis* in past year

**TB Risk Assessment - Module 5, p. 28**

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**TB Testing Frequency**

<table>
<thead>
<tr>
<th>TB Risk Classification</th>
<th>Frequency for TB Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>- Conduct baseline test when health care worker is hired</td>
</tr>
<tr>
<td></td>
<td>- No further testing needed unless exposure occurs</td>
</tr>
<tr>
<td>Medium Risk</td>
<td>- Conduct baseline test when health care worker is hired</td>
</tr>
<tr>
<td></td>
<td>- Repeat test annually</td>
</tr>
<tr>
<td>Potential Ongoing Transmission</td>
<td>- Conduct baseline test when health care worker is hired</td>
</tr>
<tr>
<td></td>
<td>- Repeat test every 8 to 10 weeks until there is no evidence of <em>M. tuberculosis</em> transmission in setting</td>
</tr>
</tbody>
</table>

**TB Risk Assessment - Module 5, p. 30**

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**TB Infection Control**

**Infection Control in Nontraditional Facility–Based Settings**

**Infection Control in Nontraditional Facility-Based Settings** - Module 5, pp. 30-32
Slide 67

Special Considerations (1)

- Nontraditional facility-based settings where TB patients receive care should establish and follow an infection-control program
- Includes settings such as:
  - Nursing homes
  - Correctional facilities
  - Homeless shelters
  - Drug treatment centers
  - Emergency medical services
  - Home-based health care
  - Outreach settings

Slide 68

Special Considerations (2)

- Correctional Facilities
  - Medical settings within correctional facilities should:
    - Classify as medium risk or higher
    - Test all staff annually
    - Implement a respiratory-protection program with at least one AII room

Slide 69

Special Considerations (3)

- Correctional Facilities
  - Medical settings within correctional facilities should (cont.):
    - Have inmates with suspected or confirmed TB disease wear surgical mask when transported
    - Establish and maintain a tracking system for inmate testing and treatment

- Review slide content
- Explain that the main goal should be to detect TB disease early and arrange for isolation and treatment of patients suspected of having TB
- Local health departments and congregate settings should collaborate to provide training and education about TB as well as conducting contact investigations when necessary

*Infection Control in Nontraditional Facility-Based Settings* - Module 5, p. 30

- Review slide content

*Infection Control in Nontraditional Facility-Based Settings* - Module 5, pp. 30-31

- Review slide content
- State that confidentiality of inmate information should be ensured during testing for signs and symptoms of TB

*Infection Control in Nontraditional Facility-Based Settings* - Module 5, p. 31
Special Considerations (4)
Homeless Shelters
- Should observe the same TB infection-control measures as outpatient clinics
- Several factors in shelter environment can influence likelihood of TB transmission:
  - Crowdedness of shelter
  - Ventilation system of shelter

Special Considerations (5)
Emergency Medical Services (EMS)
- EMS workers should be included in TB testing program based on risk for the setting
- Persons with infectious TB who are transported in ambulance should wear surgical mask
- Drivers, health care workers, and other staff should consider wearing a respirator
- Ambulance should allow for maximum amount of outdoor air to be circulated in vehicle

Special Considerations (6)
Long-Term Care Facilities (LTCFs)
- LTCFs (e.g., hospices and nursing homes) should:
  - Symptom screen and possibly test new employees and residents
  - Have administrative and environmental controls if they accept patients with infectious TB
- Persons with TB disease who are non-infectious can stay in LTCFs and do not need AII room
TB Infection Control

TB Infection Control in the Home

- Introduce section
- Ask what type of TB infection control should be used in the home for the family and for the health care worker

TB Infection Control in the Home - Module 5, pp. 32-33

---

TB Infection Control in the Home (1)

Patient Returning Home

TB patients and TB suspects may be sent home after starting treatment, even though they may be infectious

- Review slide content

TB Infection Control in the Home - Module 5, p. 32

---

TB Infection Control in the Home (2)

Patient Returning Home

- Criteria for patient to return home:
  - Follow-up plan has been made with the local TB program
  - Patient on TB treatment and DOT arranged
  - No infants or children younger than 5 years of age or persons with immunocompromising conditions in home

- Explain that TB patients can return home even if they do not have three negative sputum smears, if certain criteria are met
- Explain that patients with TB disease are allowed to go back home if all of the criteria are met
- Review slide content

TB Infection Control in the Home - Module 5, p. 32
Slide 76

**TB Infection Control in the Home (3)**

**Patient Returning Home**

- Criteria for patient to return home (cont.):
  - All household members have already been exposed to TB patient
  - Patient is willing to not travel outside of home until sputum smear results are negative

Slide 77

**TB Infection Control in the Home (4)**

**Patient Returning Home**

- TB patients and members of household should take steps to prevent spread of TB
- Patients with TB should be instructed to:
  - Cover mouth and nose with tissue when coughing or sneezing
  - Sleep alone
  - Not have visitors until noninfectious

Slide 78

**TB Infection Control in the Home (5)**

**Health Care Workers (HCWs)**

- HCWs should:
  - Be trained in detecting TB signs and symptoms
  - Take precautions to protect themselves:
    - Instruct patient to cover mouth when coughing
    - Wear personal respirator
    - Collect sputum in well-ventilated areas
    - Participate in TB testing and prevention programs

---

**Review slide content**
**Slide 79**

**TB Risk Assessment**

**Study Question 5.16**

What are 3 different TB risk classifications that can be assigned to health care settings?

- Low risk
- Medium risk
- Potential ongoing transmission

---

**Answers - Module 5, p. 40**

**Slide 80**

**TB Risk Assessment**

**Study Question 5.17**

Depending on risk classification, how often should health care settings test workers for TB?

- **Low Risk Settings**
  - Conduct TB baseline test when HCW is hired
  - No further testing needed unless exposure occurs

- **Medium Risk Settings**
  - Conduct TB baseline test when HCW is hired
  - Repeat test annually

- **Potential Ongoing Transmission**
  - Conduct baseline test when HCW is hired
  - Repeat test 8-10 weeks until there is no longer evidence of *M. tuberculosis* transmission in the setting

---

**Answers - Module 5, p. 41**

**Slide 81**

**TB Infection Control in the Home**

**Study Question 5.18**

What precautions should a health care worker take when visiting the home of a TB patient who may be infectious?

- Instruct patients to cover mouth and nose with a tissue when coughing or sneezing
- Wear a personal respirator
- Collect sputum specimen in a well-ventilated area
- Participate in a TB testing and prevention program

---

**Answers - Module 5, p. 41**
Module 5: Case Study 5.1

For each of the following situations, decide whether the patient should be considered infectious or non-infectious, and explain why.

Two weeks ago, Mr. Lopez had a sputum smear that was positive; since then no sputum specimens have been tested. Mr. Lopez started self-administered TB treatment 7 days ago. He still has a cough.

Case Study 5.1 – Module 5, p. 7
Module 5: Case Study 5.1
Question 5A: Answer
• Mr. Lopez should be considered infectious
• Should be given his treatment by DOT to ensure he receives adequate treatment
• Does not meet the criteria for noninfectiousness because:
  – He has been receiving treatment for only 7 days, not 2 weeks
  – His symptoms have not improved
  – He does not have 3 consecutive negative sputum smears

Module 5: Case Study 5.1
Question 5B
Ms. Nguyen, a patient with pulmonary TB, has been receiving DOT treatment for 6 weeks and no longer has symptoms of TB. She has had three sputum smears. The first one was positive, but the last two were negative.

Module 5: Case Study 5.1
Question 5B: Answer
• Ms. Nguyen should be considered infectious until she has 3 consecutive negative sputum smears
• She meets the first 2 criteria for noninfectiousness:
  – Has been receiving treatment for at least 2 weeks
  – Her symptoms have improved
### Module 5: Case Study 5.1

**Question 5C**

Mr. Martin started DOT treatment for pulmonary TB in April. His symptoms went away and his sputum smears were negative in May. However, the outreach worker was unable to locate him on June 5th and has not been able to contact him since that time. Mr. Martin returned to the TB clinic on August 2nd, and was still coughing.

---

**Module 5: Case Study 5.1 Question 5C: Answer**

- Mr. Martin, at this point, should be considered infectious
- He might have been noninfectious in May, but it appears that he may be infectious again
  - Has been coughing and has not received adequate treatment since June 4th
- Should be evaluated for infectiousness and nonadherence to treatment

---

### Module 5: Case Study 5.2 (1)

You are checking patients into the TB clinic. An elderly man comes to the desk and says he was told to come and get checked because one of his friends has TB. You notice that he looks sick and is coughing frequently. The waiting room is full of patients, and you know it will probably be more than an hour before the physician can see him.

---

**Case Study 5.2 – Module 5, p. 15**

**Module 5 – Infectiousness and Infection Control 88**

**Module 5: Case Study 5.1**

**Question 5C**

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---

**Answers - Module 5, p. 42**

**Module 5 – Infectiousness and Infection Control 89**

**Module 5: Case Study 5.1 Question 5C: Answer**

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---

**Module 5 – Infectiousness and Infection Control 90**

**Module 5: Case Study 5.2 (1)**

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---

**Case Study 5.2 – Module 5, p. 15**

**Module 5 – Infectiousness and Infection Control 90**

**Module 5: Case Study 5.2 (1)**

You are checking patients into the TB clinic. An elderly man comes to the desk and says he was told to come and get checked because one of his friends has TB. You notice that he looks sick and is coughing frequently. The waiting room is full of patients, and you know it will probably be more than an hour before the physician can see him.
Module 5: Case Study 5.2 (2)

• What should you do?
  – Suspect that this man has infectious TB and work with clinical staff to ensure he is evaluated for TB quickly
  – Give him a surgical mask, instruct him to keep it on, and ask him to cover his mouth and nose when coughing or sneezing.
  – Move the man to an area away from other patients right away

Module 5: Case Study 5.3 (1)

You are sent to deliver directly observed therapy (DOT) to a woman who started treatment last week for suspected pulmonary TB. Her sputum smear results are not back yet. You are asked to collect another sputum specimen while you are at the woman’s home.

Module 5: Case Study 5.3 (2)

• What precautions should you take?
  • Instruct patient to cover her mouth and nose when she coughs or sneezes.
  • Wear a personal respirator when visiting her home.
  • Collect sputum in well-ventilated area, away from other household members.
  • Participate in a TB testing and prevention program

Answers - Module 5, p. 43

Case Study 5.3 – Module 5, p. 35

Answers - Module 5, p. 43
Self-Study Modules on Tuberculosis, 1-5 Slide Sets
Sample Course Evaluation
Self-Study Modules on Tuberculosis, 1-5 Course Evaluation

Thank you for participating in this training. Please complete this evaluation form to the best of your ability. In this evaluation form, there are no wrong or right answers. You do not need to put your name on this form – your responses will be anonymous.

For each item below, please circle one response.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The training was well organized</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. The training sessions were relevant to my needs</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. The presenters were well prepared</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. The presenters were receptive to participant comments</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. The study questions helped me learn the material</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. The case studies helped me learn the material</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>7. There was enough time to cover all the material</td>
<td>1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
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<td>8. The training enhanced my knowledge in TB</td>
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<td>9. The learning environment was conducive to learning</td>
<td>1</td>
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<tr>
<td>10. The course was consistent with the stated objectives</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

OVER
11. What did you like best about this course?

12. What did you like least about this course?

13. What topics would you like MORE emphasis on?

14. What topics would you like LESS emphasis on?

15. Additional Comments:

Thank you for completing this form!