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

Facilitation Tips

Background
In this module, participants will learn about the diagnosis of tuberculosis (TB) disease and latent TB infection (LTBI), including targeted testing. Targeted testing is a TB control strategy that is used to identify people at high risk for developing TB disease who would benefit by treatment of LTBI, if detected. LTBI is diagnosed with the Mantoux tuberculin skin test (TST) or an interferon-gamma release assay (IGRA). In most cases, TB disease is diagnosed with certain laboratory tests (bacteriologic examination); for patients who may have pulmonary TB disease, a chest x-ray is also useful for diagnosis. It is important to evaluate people who have symptoms of TB disease; if they are found to have TB disease, they need treatment to be cured and to avoid spreading TB to others. For this reason, the diagnosis of TB disease is crucial to controlling the spread of TB in homes and communities.

Learning Objectives
After this presentation, participants will be able to
1. Identify high-risk groups for targeted testing
2. Describe how to give and interpret a TST and an IGRA
3. Discuss considerations for using either the TST or IGRA for diagnosing infection with Mycobacterium tuberculosis
4. Describe the components of a medical evaluation for diagnosing TB disease

Module Overview

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<td><img src="image1.png" alt="Image" /></td>
<td>- Introduce Module 3</td>
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**Self-Study Modules on Tuberculosis**

### 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 give and interpret a Mantoux tuberculin skin test (TST) and an interferon-gamma release assay (IGRA)
3. Discuss considerations for using either the TST or IGRA for diagnosing infection with *M. tuberculosis*
4. Describe the components of a medical evaluation for diagnosing TB disease

**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
Targeted Testing

Targeted Testing (1)
• Targeted testing is a TB control strategy used to identify and treat persons:
  – At high risk for infection with *M. tuberculosis*
  – 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 spread of TB

- Introduce section
- Ask participants if they know what targeted testing is
- Review slide content
- Review slide content
- 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 population 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 – Module 3, p. 6

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- 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 – Module 3, pp. 6-7

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- Review slide content
- Tell participants that TB is more common in parts of Asia, Africa, Russia, Eastern Europe, and Latin America

Groups at High Risk for TB Infection – Module 3, p. 7
- Review slide content
- Ask participants what settings they think could be considered “high-risk” (examples include nursing homes, homeless shelters, and correctional facilities)

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

- Review slide content
- Tell participants that the medical conditions known to increase risk for TB include silicosis, diabetes, severe kidney disease, certain types of cancer, certain intestinal conditions, organ transplant, and immunosuppressive therapy

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

- Introduce section

Diagnosis of Latent TB Infection (LTBI) – Module 3, pp. 8-38
**Diagnosis of 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 test (QFT-G)
    - QuantiFERON®-TB Gold In-Tube (QFT-GIT)
    - T-SPOT

**Mantoux Tuberculin Skin Test**
- Review slide content

**Diagnosis of Latent TB Infection (LTBI)**
- Introduce section
- 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**
- 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.
**Mantoux Tuberculin Skin Test (2)**
0.1 ml of 5 tuberculin units of liquid tuberculin are injected between the layers of skin on forearm

- Explain that the TST is given by using a single dose disposable syringe
- Review slide content
- Explain that a tuberculin unit is a standard strength of tuberculin
- State that tuberculin is NOT a vaccine

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**Mantoux Tuberculin Skin Test (3)**
- Forearm should be examined within 48 - 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 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 the test must be repeated

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**Multiple-Puncture Test**
- In the past, multiple-puncture tests (tine tests) were a popular skin testing method for TB
- No longer recommended
  - Amount of tuberculin that enters skin cannot be measured
  - Mantoux TST is preferred TB skin test method because amount of tuberculin can always be measured

- Review slide content
- Explain that multiple puncture tests were done by puncturing skin of the forearm with a device that has a set of short prongs or tines coated with tuberculin

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Mantoux Tuberculin Skin Test – Module 3, p. 8
Mantoux Tuberculin Skin Test – Module 3, p. 9
Multiple-Puncture Test – Module 3, p. 9
**Mantoux Tuberculin Skin Test**

**Study Question 3.1**

What is the TST used for? (pg. 11)

The TST is used to determine whether a person has TB infection.

Answers – Module 3, p. 71

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**Mantoux Tuberculin Skin Test**

**Study Question 3.2**

How is the Mantoux TST given? (pg. 11)

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. 71

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**Mantoux Tuberculin Skin Test**

**Study Question 3.3**

With the TST, when is the patient’s arm examined? (pg. 12)

The patient’s arm is examined by a health care worker, 48 – 72 hours after tuberculin is injected.

Answers – Module 3, p. 71
Mantoux Tuberculin Skin Test

Study Question 3.4

How is the induration measured? (pg. 12)

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

- Read question
- Ask participants for answers

Mantoux Tuberculin Skin Test

Study Question 3.5

Why is the Mantoux TST preferable to multiple puncture tests? (pg. 12)

Mantoux TST is preferable because it is more accurate and the amount of tuberculin can always be measured.

- Read question
- Ask participants for answers

Diagnosis of Latent TB Infection (LTBI)

Mantoux Tuberculin Skin Test

Interpreting the Reaction

- Introduce section
Slide 25

- Review slide content

Interpreting the Reaction – Module 3, p. 13

Slide 26

- Review slide content

Interpreting the Reaction – Module 3, p. 13

Slide 27

- Review slide content

Interpreting the Reaction – Module 3, p. 13
Slide 28

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
  - Children younger than 4 years old
  - Infants, children, or adolescents exposed to adults in high-risk categories

Interpreting the Reaction – Module 3, p. 13

Slide 29

Mantoux Tuberculin Skin Test (8)
Interpreting the Reaction
- Induration of ≥ 15 mm is considered a positive reaction for people who have no known risk factors for TB

Interpreting the Reaction – Module 3, p. 15

Slide 30

Mantoux Tuberculin Skin Test
Study Question 3.6
What 2 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? (p. 16)
- Size of induration and risk factors for TB
- An additional factor is the risk of exposure to TB in the person's job

Answers – Module 3, p. 71

- Review slide content
- Reiterate that targeted testing should only be done in high-risk groups
- Introduce study questions
- Ask participants to turn to p. 16 (if participants have print-based modules)
- Read question
- Ask participants for answers
Read question
- Ask participants for answers

Mantoux Tuberculin Skin Test
Study Question 3.7
For which groups of people is \( \geq 5 \) mm of induration considered a positive reaction? (Name 4.) (pg. 16)
- People living with HIV
- Recent contacts of people with infectious TB
- People who have had TB disease before
- Patients with organ transplants and other immunosuppressed individuals

Answers – Module 3, p. 72

Read question
- Read question
- Ask participants for answers

Mantoux Tuberculin Skin Test
Study Question 3.8
For which groups of people is \( \geq 10 \) mm of induration considered a positive reaction? (pg. 17)
- Recent arrivals to the U.S. from areas where TB is common
- People who inject drugs
- Mycobacteriology lab workers
- People who live or work in high-risk congregate settings
- People with certain medical conditions
- Children younger than 4 years old
- Infants, children, and adolescents exposed to adults in high-risk categories

Answers – Module 3, p. 72

Read question
- Read question
- Ask participants for answers

Mantoux Tuberculin Skin Test
Study Question 3.9
For which group of people is \( \geq 15 \) mm of induration considered a positive reaction? (pg. 17)
People with no risk factors for TB.

Answers – Module 3, p. 72
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<tr>
<td><strong>Diagnosis of Latent TB Infection (LTBI)</strong>&lt;br&gt;Mantoux Tuberculin Skin Test&lt;br&gt;Factors that Affect the Reaction</td>
<td>- Introduce section</td>
<td>- Explain that the TST is a valuable tool, but it is not perfect&lt;br&gt;- Review slide content</td>
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<td><strong>Mantoux Tuberculin Skin Test (9)</strong>&lt;br&gt;<strong>False-Positive Reaction</strong>&lt;br&gt;• Factors that can cause people to have a positive reaction even if they do not have TB infection:&lt;br&gt;  – Infection with nontuberculous mycobacteria&lt;br&gt;  – BCG vaccination&lt;br&gt;  – Administration of incorrect antigen&lt;br&gt;  – Incorrect measuring or interpretation of TST reaction</td>
<td><strong>Mantoux Tuberculin Skin Test (10)</strong>&lt;br&gt;<strong>BCG Vaccine</strong>&lt;br&gt;• People who have been vaccinated with BCG may have a false-positive TST reaction&lt;br&gt;  – However, there is no reliable way to distinguish between reaction caused by TB infection or by BCG vaccine&lt;br&gt;• Individuals should always be further evaluated if they have a positive TST reaction</td>
<td><strong>BCG Vaccine</strong> – Module 3, p. 18&lt;br&gt;<strong>False-Positive Reaction</strong> – Module 3, p. 18</td>
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**False-Negative Reaction** – Module 3, p. 21

- Review slide content

**Mantoux Tuberculin Skin Test (12)**

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

**Mantoux Tuberculin Skin Test (13)**

Anergy

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

**Mantoux Tuberculin Skin Test** – Module 3, p. 22

- Review slide content

- Stress that people with symptoms of TB should be evaluated for TB disease right away

**Anergy** – Module 3, p. 2

- Review slide content
Slide 40

**Mantoux Tuberculin Skin Test Study Question 3.10**

Name 4 factors that can cause false-positive reactions to the TST. (pg 19)
- Infection with nontuberculous mycobacteria (NTM)
- BCG vaccination
- Administration of incorrect antigen
- Incorrect measuring or interpretation of TST reaction

*Answers – Module 3, p. 72*

- Introduce study questions
- Ask participants to turn to p. 19 (if participants have print-based modules)
- Read question
- Ask participants for answers

Slide 41

**Mantoux Tuberculin Skin Test Study Question 3.11**

Is there a reliable way to distinguish a positive TST reaction caused by vaccination with BCG from a reaction caused by true TB infection? (pg 19)

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

*Answers – Module 3, p. 73*

- Read question
- Ask participants for answers

Slide 42

**Mantoux Tuberculin Skin Test Study Question 3.12**

Name 6 factors that can cause false-negative reactions to the TST. (pg 24)
- Anergy
- Recent TB infection (within past 8-10 weeks)
- Very young age
- Recent live-virus (e.g., measles or smallpox) vaccination
- Incorrect method of giving the TST
- Incorrect measuring or interpretation of TST reaction

*Answers – Module 3, p. 73*

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

**Study Question 3.13**

What is anergy? *(pp. 24)*

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

Answers – Module 3, p. 73

**Study Question 3.14**

After TB has been transmitted to someone, how long does it take before TB infection can be detected by the TST? *(pp. 24)*

2 - 8 weeks

Answers – Module 3, p. 73

**Study Question 3.15**

What should be done if a patient has a negative TST result, but has symptoms of TB disease? *(pp. 25)*

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

Answers – Module 3, p. 73
Slide 46

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

Interferon-Gamma Release Assays – Module 3, pp. 33-38

Slide 47

Types of IGRAs

- QuantIFERON®-TB Gold (QFT-G)
  - CDC guidelines published in 2005
- QuantIFERON®-TB Gold In-Tube (QFT-GIT)
  - Approved 10/2007
- T-Spot®-TB test (T-SPOT)
  - Type of ELISPOT assay
  - Approved 7/2008
- CDC guidelines for IGRAs are under development

Types of IGRAs – Module 3, p. 33

Slide 48

QFT-G and QFT-GIT (1)

- Measures person’s immune reactivity to M. tuberculosis
- Used to help diagnose M. tuberculosis infection in persons suspected of having either LTBI or TB disease

Note: Information on the QFT-GIT is not presented in the print-based Self-Study Modules on Tuberculosis

QFT-G – Module 3, p. 33
- Review slide content

Note: Information on the QFT-GIT is not presented in the print-based Self-Study Modules on Tuberculosis

QFT-G – Module 3, p. 33

- Review slide content

Note: Information on the QFT-GIT is not presented in the print-based Self-Study Modules on Tuberculosis

QFT-G – Module 3, p. 34

- Review slide content

Note: Information on the QFT-GIT is not presented in the print-based Self-Study Modules on Tuberculosis

QFT-G – Module 3, pp. 34-35
- Explain that results are reported as either positive, negative, or indeterminate

- Review slide content

\[\text{Note: Information on the QFT-GIT is not presented in the print-based Self-Study Modules on Tuberculosis}\]

\[\text{QFT-G – Module 3, p. 35}\]

- Review slide content

\[\text{Note: Information on the T-SPOT is not presented in the print-based Self-Study Modules on Tuberculosis}\]

- Review slide content

- Explain that BCG vaccination does not affect IGRA results because the antigens used for IGRA are not found in BCG vaccine strains

\[\text{Note: Booster phenomenon is presented on slides 62-63}\]

\[\text{IGRA Advantages – Module 3, pp. 36-37}\]
IGRA Disadvantages and Limitations

- Blood samples must be processed within 12 hours for some IGRA.
- Errors in running and interpreting test can decrease accuracy.
- Limited data on its use in certain populations.
- Limited data on its use to determine who is at risk for developing TB disease.

IGRA Disadvantages and Limitations – Module 3, p. 38

QFT-G and QFT-GIT Study Question 3.20

What are the steps for conducting a QFT-G and QFT-GIT? (pg. 39)

Follow manufacturer’s instructions:

- Confirm arrangements for delivery and testing of blood in qualified laboratory within 12 hours of collection.
- Draw sample of whole blood from patient into tube with heparin.
- Schedule appointment for patient to receive test results and, if then needed, medical evaluation and possible treatment.

Answers – Module 3, p. 74

QFT-G and QFT-GIT Study Question 3.21

How are QFT-G and QFT-GIT results interpreted? (pg. 39)

- Interpretation is based on the IFN-γ concentrations in the test samples.
- Laboratories can use software to calculate results.
- Report of results are submitted to requesting clinician.

Answers – Module 3, p. 74
**Slide 58**

**QFT-G and QFT-GIT Study Question 3.22**

How should a negative QFT-G or QFT-GIT result be interpreted? (pg. 73)

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

**Answers – Module 3, p. 74**

**Slide 59**

**IGRAs Study Question 3.23**

What are 5 advantages for using an IGRA as compared to the TST? (pg. 75)

- Requires a single patient visit
- Results can be available in 24 hours
- Does not cause the booster phenomenon
- Less likely to have incorrect reading of results
- BCG vaccine does not affect IGRA results

**Answers – Module 3, p. 75**

**Slide 60**

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

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

**TB Testing Programs – Module 3, p. 26**
Slide 61
- Review slide content
- Ask participants what types of TB testing programs are used where they work

**TB Testing Programs (1)**
- Many health care facilities have TB testing programs
  - Employees and residents are periodically given TSTs or IGRA
- Testing programs:
  - Identify people who have LTBI or TB disease and give them treatment
  - Determine whether TB is being transmitted in facility

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**TB Testing Programs (2)**
**Baseline Test**
- Employees and/or residents are given TST or IGRA when they first enter facility
  - If person is negative, they may be retested at regular intervals thereafter

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**TB Testing Programs (3)**
**Conversion**
- Persons whose TST or IGRA result converts from negative to positive have probably been infected with *M. tuberculosis*
  - TST or IGRA conversions may indicate that TB is being transmitted in facility

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*TB Testing Programs – Module 3, p. 26*
*Baseline Test – Module 3, p. 26*
*Conversion – Module 3, p. 26*
Booster Phenomenon – Module 3, pp. 27-29

- Review slide content

Booster Phenomenon – Module 3, p. 28

- Explain the booster phenomenon using the flowchart

Two-Step Testing – Module 3, p. 29

- Review slide content
- Explain two-step testing using the flowchart

Two-Step Testing – Module 3, p. 30

- Introduce study questions
- Ask participants to turn to p. 31 (if participants have print-based modules)
- Read question
- Ask participants for answers

Answers – Module 3, p. 73

- Read question
- Ask participants for answers

Answer – Module 3, p. 74
Slide 70

**Two-Step Testing**

**Study Question 3.18**

In what type of situation is two-step testing used? (pg. 70)

- It is used in many programs for skin testing employees when they start their job.

**Answers** – Module 3, p. 74

Slide 71

**Two-Step Testing**

**Study Question 3.19**

How is two-step testing done? (pg. 70)

- If a person has a negative reaction to an initial skin test, he or she is given a second test 1-3 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

**Answers** – Module 3, p. 74

Slide 72

**Diagnosis of TB Disease**

- Introduce section

**Diagnosis of TB Disease** – Module 3, pp. 40-64
- 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

**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

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**Diagnosis of TB Disease**

**Medical Evaluation**

1. Medical History
2. Physical Examination
3. Test for TB Infection

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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

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

**Medical Evaluation – Module 3, p. 40**

**Medical History – Module 3, pp.40-41**
1. Medical History (2)
**General Symptoms of TB Disease**
- Fever
- Appetite loss
- Chills
- Fatigue
- Night sweats
- Malaise
- Weight loss

- 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. 41*

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Slide 77

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. 41*

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Slide 78

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

- Review slide content

*Symptoms of Extrapulmonary TB Disease – Module 3, p. 42*
- Review slide content

Physical Examination – Module 3, p. 43

- Review slide content

Testing for TB Infection – Module 3, p. 44

- Review slide content

Testing for TB Infection – Module 3, p. 44

- Explain that sometimes people with TB disease may have a negative test result

Testing for TB Infection – Module 3, p. 44
- Introduce study questions
- Ask participants to turn to p. 44 (if participants have print-based modules)
- Read question
- Ask participants for answers

*Answers – Module 3, p. 75*

- Ask participants to turn to p. 45 (if participants have print-based modules)
- Read question
- Ask participants for answers

*Answers – Module 3, p. 75*

- Read questions
- Ask participants for answers

*Answers – Module 3, p. 75*
Slide 85

**Diagnosis of TB Disease**

**Study Question 3.27**

For patients with symptoms of TB disease, should clinicians wait for TST or IGRA results before starting other diagnostic tests? (pg. 46)

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

Answers – Module 3, p. 76

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Slide 86

**Diagnosis of TB Disease**

**Medical Evaluation**

4. **Chest X-Ray**

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Slide 87

**4. Chest X-Ray (1)**

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

Review slide content

- Explain that the patient in the picture has a cavity in the right upper lobe. The left lung is normal.

Chest X-Ray – Module 3, p. 46
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

Chest X-Ray – Module 3, p. 46

4. Chest X-Ray (3)

- Chest x-rays cannot confirm TB disease
  - Other diseases can cause lung abnormalities
  - Only bacteriologic culture can prove 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. 46

Slide 90

Chest X-Ray
Study Question 3.28

Name 2 purposes of the chest x-ray. (pp. 47)

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

Answers – Module 3, p. 76
- Read question
- Ask participants for answers

*Answers – Module 3, p. 76*

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- Introduce section

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- Review slide content

*Bacteriological Examination – Module 3, p. 48*
- Review slide content

Bacteriological Examination – Module 3, p. 48

- Review slide content

Specimen Collection – Module 3, pp. 48-51

- Review slide content

Sputum Sample Specimen Collection – Module 3, pp. 48-49
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”  

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 nose or mouth into lung to obtain pulmonary secretions or lung tissue  

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  

- Review slide content  

Induced Sputum Collection – Module 3, p. 49  
Bronchoscopy – Module 3, p. 49  
Gastric Washing – Module 3, p. 49
Slide 100

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

Slide 101

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, p. 53

Slide 102

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

Examination of AFB Smears – Module 3, pp. 53-54
- Review slide content
- Explain that even though a smear is considered negative if no AFB are seen it **does not rule out** the possibility of TB disease because there can be AFB in the smear that were not seen

**Examination of AFB Smears – Module 3, p. 55**

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- Introduce study questions
- Ask participants to turn to p. 55 (if participants have print-based modules)
- Read question
- Ask participants for answers

*Answers – Module 3, p. 76*

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- Read question
- Ask participants for answers

*Answers – Module 3, p. 76*
Bacteriologic Examination

Study Question 3.32

What does a positive smear indicate about a patient's infectiousness? (pg. 59)

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

Answers – Module 3, p. 77

Diagnosis of TB Disease

Medical Evaluation
5. Bacteriologic Examination

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

Nucleic Acid Amplification Tests – Module 3, p. 58
- Review slide content

5. Bacteriologic Examination (13)
Nucleic Acid Amplification Tests (NAA)
- If NAA test and AFB smears are positive:
  - Patients are presumed to have TB and should begin treatment
- If NAA test is negative and AFB smears are positive:
  - Patients may have nontuberculous mycobacteria infection (NTM)

_Culturing and Identifying Specimen – Module 3, p. 58_

- Review slide content

5. Bacteriologic Examination (14)
Culturing and Identifying Specimen
- Culturing:
  - Determines if specimen contains _M. tuberculosis_
  - Confirms diagnosis of TB disease
- All specimens should be cultured

_Culturing and Identifying Specimen – Module 3, p. 58_

- Review slide content

5. Bacteriologic Examination (15)
Culturing and Identifying Specimen
- Step 1: Detect growth of mycobacteria
  - Solid media: 3 - 6 weeks
  - Liquid media: 4 - 14 days
- Step 2: Identify organism that has grown
  - Nucleic acid probes: 2 - 4 hours
  - Biochemical tests: 6 - 12 weeks

_Culturing and Identifying Specimen – Module 3, p. 60_
5. Bacteriologic Examination (16)  
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 (17)  
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 (18)  
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

- Review slide content

- Review slide content

- Explain that culture conversion is when the culture goes from positive growth to negative growth of *M. tuberculosis*
5. Bacteriologic Examination (19)
**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

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5. Bacteriologic Examination (20)
**Drug Susceptibility Testing**

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

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5. Bacteriologic Examination (21)
**Types of Drug-Resistant TB**

| Mono-resistant | Resistant to any one TB treatment drug |
| Poly-resistant | Resistant to at least any two TB drugs (but not both isoniazid and rifampin) |
| Multidrug-resistant (MDR TB) | Resistant to at least isoniazid and rifampin, the two best first-line TB treatment drugs |
| Extensively drug-resistant (XDR TB) | 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) |

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- 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, p. 63*

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- 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. 63-64*

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- Explain that these are four types of drug-resistant TB
- Review slide content

*Types of Drug-Resistant TB – Module 3, p. 63*
- Introduce study questions
- Ask participants to turn to p. 65 (if participants have print-based modules)
- Read question
- Ask participants for answers

Answers – Module 3, p. 77

- Read question
- Ask participants for answers

Answers – Module 3, p. 77

- Read question
- Ask participants for answers

Answers – Module 3, p. 77
**Drug Susceptibility Study Question 3.36**

**How often should drug susceptibility tests be done? (pg. 45)**

- 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. 77*

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**Slide 122**

**Reporting TB Cases**

*Reporting TB Cases – Module 3, p. 62*

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**Slide 123**

**Reporting TB Cases**

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

*Reporting TB Cases – Module 3, p. 62*
- Explain that each reported TB case is checked to make sure it meets certain criteria. All cases that meet the criteria, called *verified TB cases*, are counted each year.

- Review slide content

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**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

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**Criteria for Reporting TB Cases (2)**

3. Patient has positive AFB smear, but culture has not or cannot be done
4. In the absence of laboratory confirmation, patient has:
   - Positive TST reaction
   - Other signs and symptoms of TB disease
   - Been treated with 2 or more TB drugs
   - Been given a complete diagnostic evaluation

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**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 decided to treat the patient for TB disease

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*Reporting TB Cases – Module 3, p. 62*
- Introduce case studies

Slide 127

**Case Studies**

Slide 128

**Module 3: Case Study 3.1**

Which of the following patients have a positive TST reaction? Circle the best answer(s). (pg. 17)

- 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, 50 yrs. old, diabetic, 12 mm induration
- d. Mr. Sung, 73 yrs. old, nursing home resident, 11 mm induration
- e. Mr. Williams, 21 yrs. old, no known risk factors, 13 mm induration
- f. Mr. Marcus, 43 yrs. old, chest x-rays findings suggestive of previous TB, 6 mm induration
- g. Ms. Royce, 56 yrs. old, husband has pulmonary TB, 9 mm of induration

*Answers – Module 3, p. 78*

- Ask participants to turn to p. 17 (if participants have print-based modules)
- Read case study
- Ask participants which of the patients have a positive TST reaction

Slide 129

**Module 3: Case Study 3.2 (1)**

A 30 year-old man who recently immigrated from India is given a TST and found to have 14mm 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. (pg. 20)

*Case Study 3.2 – Module 3, p. 20*

- Ask participants to turn to p. 20 (if participants have print-based modules)
- Read case study
Module 3: Case Study 3.2 (2)
How should this man’s results be interpreted?

- Positive reaction 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. 78

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. (pg. 25)

Case Study 3.3 – Module 3, p. 25

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 8–10 weeks since he was exposed to TB

Answers – Module 3, p. 79
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. (pg. 32)

- Ask participants to turn to p. 32 (if participants have print-based modules)
- Read case study

Case Study 3.4 – Module 3, p. 32

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
- Booster phenomenon

- Read case study question
- Ask participants for answers

Answers – Module 3, p. 79

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. (pg 52)

- Ask participants to turn to p. 52 (if participants have print-based modules)
- Read case study

Case Study 3.5 – Module 3, p. 52
Module 3: Case Study 3.5 (2)

What should be done?

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. 80

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+. (pg. 54)

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
- Smears are positive, clinicians should suspect that she has TB disease and should consider her infectious
- It is possible that the AFB are mycobacteria other than tubercle bacilli
- Diagnosis cannot be proven until culture results are available

Answers – Module 3, p. 80
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. (pg. 57)

- Ask participants to turn to p. 57 (if participants have print-based modules)
- Read case study

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 does have pulmonary TB disease.

Answers – Module 3, p. 80

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. (pg. 66)

- Ask participants to turn to p. 66 (if participants have print-based modules)
- Read case study

Case Study 3.8 – Module 3, p. 66
Read case study questions
- Ask participants for answers
- Ask if there are any questions about Module 3 before moving on to Module 4

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

Answers – Module 3, p. 81