Appendix C
PowerPoint Slide Set

PowerPoint Slide Set

The Core Curriculum is accompanied by a PowerPoint slide set for use in presentations and training programs. Images of the slides are included in this appendix. The slide set may be downloaded from the CDC DTBE website at www.cdc.gov/tb.

Core Curriculum on Tuberculosis:
What the Clinician Should Know

Sixth Edition 2013

National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention
Division of Tuberculosis Elimination

CDC

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Core Curriculum Contents

Chapters	Content
1	Overview of Tuberculosis (TB) Epidemiology in the United States
2	Transmission and Pathogenesis of TB
3	Testing for TB Infection and Disease
4	Diagnosis of TB Disease
5	Treatment for Latent TB Infection
6	Treatment for TB Disease
7	TB Infection Control
8	Community TB Control

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Chapter 1. Overview of TB Epidemiology in the United States

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Progress Toward TB Elimination in the U.S.

- 1989: Release of A Strategic Plan for the Elimination of Tuberculosis in the United States, *MMWR* 1989; 38 (Suppl. No. S-3), with goal of TB elimination in 2010
- 1985–1992: Resurgence of TB in the United States, fueled by several factors
- In response to resurgence, U.S. renewed commitment and support for TB control
- In 1993, upward trend was reversed; that decline has continued

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Factors Contributing to the Increase in TB Morbidity: 1985-1992

- Emerging HIV/AIDS epidemic
- Immigration from countries where TB was common
- Transmission of TB in congregate settings
- Development of multidrug-resistant (MDR) TB

Decades of funding cuts had impaired effectiveness of TB control programs

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Factors Contributing to the Decrease in TB Morbidity Since 1993

- Success attributed to increased efforts to
  - Promptly identify persons with TB
  - Initiate appropriate treatment
  - Ensure completion of therapy
- But TB elimination faces barriers

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Areas of Concern Remain

- U.S. TB cases occur largely in high-risk populations
- In these populations, TB is difficult to detect, diagnose, and treat
- Global TB epidemic persists
- Current TB control measures are limited; new tests, vaccines, drugs needed

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TB Disease Trends in the United States

- During resurgence, 1985–1992, reported TB cases increased every year
- 1993–2011: cases decreased
  - 1993–2002: cases decreased 5%-7% annually
  - 2003–2008: decreased at a more moderate 3%-5%
  - 2009: declined 10.6% from 2008
  - 2010–2011: cases resumed moderate decreases (average 4.5% from 2009)
- 10,528 cases reported in 2011

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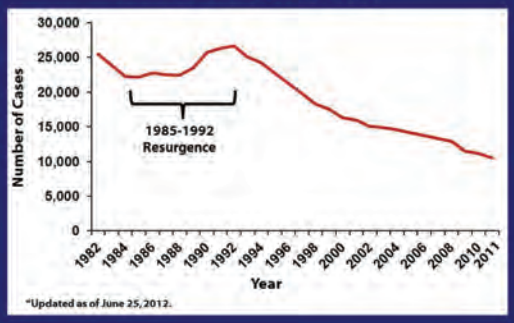
Reported TB Cases United States, 1982–2011*



*Updated as of June 25, 2012.

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TB Trends, United States

- While TB is declining overall, high rates persist among some groups
- Local epidemiology affects trends in individual areas
- 2011: total of 37 states reported a rate <3.4/100,000 (national average for the year)
- 12 states + D.C. reported a rate >3.4/100,000
  - These areas = 67% of the 2011 national total
  - Also had substantial decreases in TB, 1992–2011

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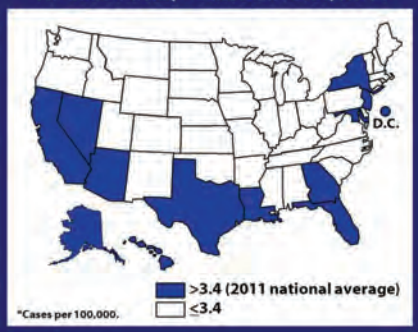
TB Case Rates,* United States, 2011



*Cases per 100,000.

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Reported Cases of TB by Country of Origin, United States

- Cases among U.S.-born and foreign-born persons declining, but much less so in foreign born
- 2002: First year foreign-born persons accounted for majority of U.S. TB cases (51%)
  - 2011, accounted for 62%
- In foreign-born persons, TB cases roughly level:
  - 1993–2008: TB cases averaged 7,700/year
  - 2009-2011: TB cases averaged 6,700/year
- In U.S.-born persons: 1993–2011, TB cases decreased from 17,438 to 3,981

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Percentage of TB Cases among Foreign-Born Persons in the U.S., 2001 and 2011

- Number of states with <25% of cases in foreign-born: down from 13 to 6
- Number of states with 25% -49% of cases in foreign-born: down from 14 to 11
- Number of states with ≥50% of cases in foreign-born: *up* from 23 to 34

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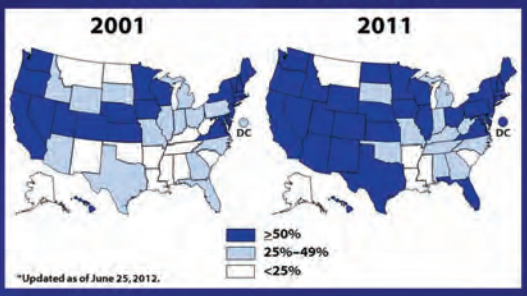
Percentage of TB Cases Among Foreign-Born Persons, United States*



*Updated as of June 25, 2012.

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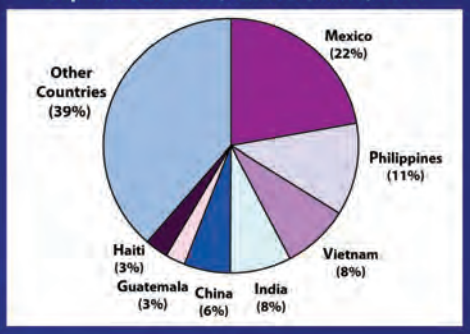
Countries of Birth of Foreign-Born Persons Reported with TB, United States, 2011



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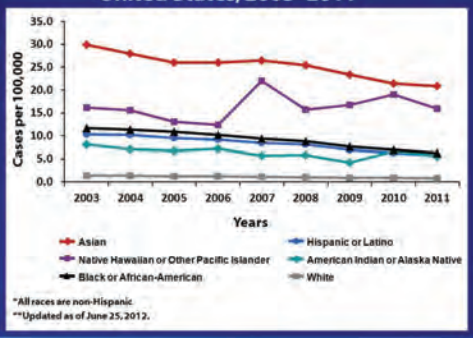
TB Case Rates by Race/Ethnicity* United States, 2003–2011**



*All races are non-Hispanic
**Updated as of June 25, 2012.

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Factors Likely Contributing to Burden of TB in Minorities

- In foreign-born minorities, TB may result from infection in country of origin
- Some minority groups have unequal distribution of TB risk factors (e.g., HIV infection), contributing to increased exposure to TB or increased risk of developing disease once infected with *M. tuberculosis*
- Lower socioeconomic status and crowded housing are linked to increased TB risk

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HIV-Infected Persons, United States, 1993–2011*

- Persons coinfected with HIV and *M. tuberculosis* are at high risk of developing TB disease
- In persons with TB, all ages, percentage of HIV coinfection decreased from 15% to 6%
  - In age group 25–44, decreased from 29% to 10%

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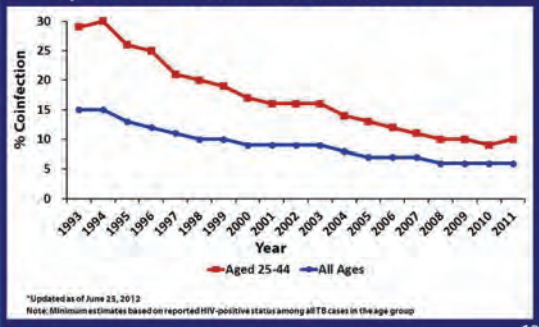
Estimated HIV Coinfection in Persons Reported with TB, United States, 1993–2011*



*Updated as of June 25, 2012
Note: Minimum estimates based on reported HIV-positive status among all TB cases in the age group

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Multidrug-Resistant (MDR) TB Remains a Serious Public Health Concern in the United States

- MDR TB has decreased in foreign born and U.S. born, but decline greater in U.S. born
- 1993–2011, proportion of primary MDR TB in foreign born increased from 25% to 83%

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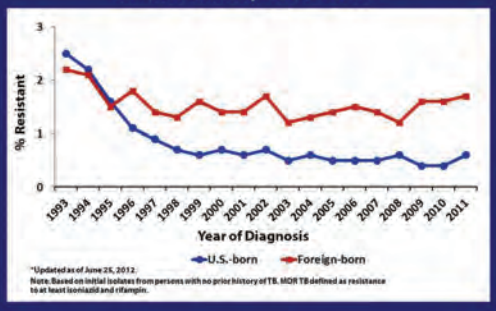
Primary MDR TB in U.S.-Born vs. Foreign-Born Persons United States, 1993–2011*



*Updated as of June 25, 2012.
Note: Based on initial isolates from persons with no prior history of TB. MDR TB defined as resistance to at least isoniazid and rifampin.

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Extensively Drug-Resistant (XDR) TB in the United States

- XDR TB is a rare type of MDR TB
  - Resistant to INH, RIF, fluoroquinolones, and ≥1 of 3 injectable 2nd-line drugs
- No apparent trend for XDR TB in the U.S.

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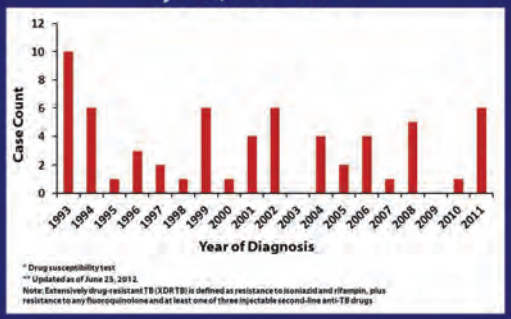
XDR TB Case Count Defined on Initial DST* by Year, 1993–2011**



* Drug susceptibility test
** Updated as of June 25, 2012.
Note: Extensively drug-resistant TB (XDR TB) is defined as resistance to isoniazid and rifampin, plus resistance to any fluoroquinolone and at least one of three injectable second-line anti-TB drugs

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Persons at Higher Risk for Exposure to or Infection with TB

- Close contacts of person known or suspected to have active TB
- Foreign-born persons from areas where TB is common
- Persons who visit TB-prevalent countries
- Residents and employees of high-risk congregate settings

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Persons at Higher Risk for Exposure to or Infection with TB (cont.)

- Health care workers (HCWs) who serve high-risk clients
- Populations defined locally as having increased incidence of latent *M. tuberculosis* infection or TB disease, such as medically underserved, low-income persons who abuse drugs or alcohol
- Children and adolescents exposed to adults at increased risk for infection or disease

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Chapter 2. Transmission and Pathogenesis of TB

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Introduction

- Airborne disease caused by the bacterium *Mycobacterium tuberculosis (M. tb)*
- *M. tb* complex (*M. tb, M. bovis, M. africanum, M. microti, M. canetti, M. caprae, M. pinnipedii, and M. mungi*) can cause TB disease
- Majority of TB cases caused by *M. tb*
- *M. tb* organisms also called tubercle bacilli

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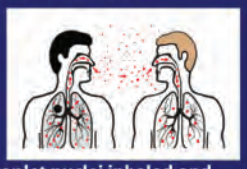
Transmission of *M. tuberculosis*

- *M. tb* spread via airborne particles called droplet nuclei
- Expelled when person with infectious TB coughs, sneezes, shouts, or sings



- Transmission occurs when droplet nuclei inhaled and reach the alveoli of the lungs, via nasal passages, respiratory tract, and bronchi

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Probability TB Will Be Transmitted

- Susceptibility of the exposed person
- Infectiousness of person with TB (i.e., number of bacilli TB patient expels into the air)
- Environmental factors that affect the concentration of *M. tb* organisms
- Proximity, frequency, and duration of exposure (e.g., close contacts)
- Can be transmitted from children, though less likely

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Pathogenesis

	Droplet nuclei containing tubercle bacilli are inhaled, enter the lungs, and travel to the alveoli.
	Tubercle bacilli multiply in the alveoli.

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Pathogenesis

A small number of tubercle bacilli enter the bloodstream and spread throughout the body. The tubercle bacilli may reach any part of the body, including areas where TB disease is more likely to develop (such as the brain, larynx, lymph node, lung, spine, bone, or kidney).

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Pathogenesis

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

If the immune system cannot keep the tubercle bacilli under control, the bacilli begin to multiply rapidly (TB disease). This process can occur in different areas in the body, such as the lungs, kidneys, brain, or bone.

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Latent TB Infection (LTBI)

- Granulomas may persist (LTBI), or may break down to produce TB disease
- 2 to 8 weeks after infection, LTBI can be detected via TST or interferon-gamma release assay (IGRA)
- The immune system is usually able to stop the multiplication of bacilli
- Persons with LTBI are not infectious and do not spread organisms to others

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TB Disease

- In some, the granulomas break down, bacilli escape and multiply, resulting in TB disease
- Can occur soon after infection, or years later
- Persons with TB disease are usually infectious and can spread bacteria to others
- Positive *M. tb* culture confirms TB diagnosis

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Sites of Disease

- Lungs (pulmonary): most common site; usually infectious
- Miliary: occurs when bacilli spread to all parts of the body; rare, but fatal if untreated
- Central nervous system: usually occurs as meningitis, but can occur in brain or spine

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Sites of Disease (cont.)

Outside the lungs (extrapulmonary): usually not infectious, unless person has

- Concomitant pulmonary disease,
- Extrapulmonary disease in the oral cavity or larynx, or
- Extrapulmonary disease with open site, especially with aerosolized fluid.

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Risk of Developing Disease
Normal Immune System

- **Untreated, 5% of infected persons with normal immunity develop TB in first 1–2 years post infection, another 5% later in life**
- **Thus, about 10% of infected persons with normal immunity will develop TB at some point in life if not treated**

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Risk of Developing Disease (cont.)
Weak Immune System

- **Persons with weak immunity at increased risk of progressing to TB disease**
  - Untreated HIV infection highest risk factor: risk of developing TB disease is 7%–10% *each year*;
  - Children <5 years of age also at increased risk

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LTBI vs. TB Disease

Person with LTBI (Infected)	Person with TB Disease (Infectious)
Has a small amount of TB bacteria in his/her body that are alive, but inactive	Has a large amount of active TB bacteria in his/her body
Cannot spread TB bacteria to others	May spread TB bacteria to others
Does **not** feel sick, but may become sick if the bacteria become active in his/her body	May feel sick and may have symptoms such as a cough, fever, and/or weight loss
Usually has a TB skin test or TB blood test reaction indicating TB infection	Usually has a TB skin test or TB blood test reaction indicating TB infection
Radiograph is typically normal	Radiograph may be abnormal
Sputum smears and cultures are negative	Sputum smears and cultures may be positive
Should consider treatment for LTBI to prevent TB disease	Needs treatment for TB disease
Does **not** require respiratory isolation	May require respiratory isolation
Not a TB case	A TB case

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Drug-Resistant TB

- **Caused by organisms resistant to one or more TB drugs**
- **Transmitted same way as drug-susceptible TB, and no more infectious**
- **Delay in detecting drug resistance may prolong period of infectiousness because of delay in starting correct treatment**

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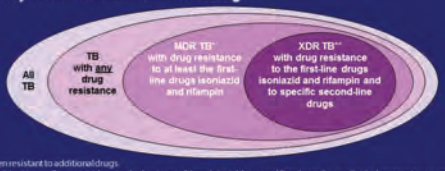
Multidrug-Resistant (MDR) and Extensively Drug-Resistant (XDR) TB

- **MDR TB caused by bacteria resistant to best TB drugs, isoniazid and rifampin**
- **XDR TB caused by organisms resistant to isoniazid and rifampin, plus fluoroquinolones and ≥1 of the 3 injectable second-line drugs**



*Often resistant to additional drugs
**Resistant to any fluoroquinolone and at least one of three injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin

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Types of Drug Resistance

Drug resistance develops in two ways:

- **Primary resistance develops in persons initially infected with resistant organisms**
- **Secondary (acquired) resistance develops during TB therapy**

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Circumstances Increasing the Risk of Drug-Resistant TB

Risk of drug-resistant TB is increased with exposure to a person who

- Has confirmed drug-resistant TB
- Had prior unsuccessful treatment for TB, and drug susceptibility results not known
- Originated in a drug-resistant TB prevalent country
- Has positive smear and culture 2 months after treatment start

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Classification System for TB

- Based on TB pathogenesis (stage of disease)
- Helps clinician track the development of TB in patients
- Persons with class 3 or 5 TB should be reported to health department
- Patients should not have class 5 classification for more than 3 months

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TB Classification System

Class	Stage of Disease
0	No exposure, no infection
1	Exposure, no evidence of infection
2	TB infection, no disease
3	TB, clinically active
4	TB, not clinically active
5	TB suspect

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Chapter 3. Testing for TB Infection and Disease

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Identifying High-Risk Groups for *M. tb* Testing

- Health-care providers should find and test
  - Uninfected persons at high risk for LTBI, and/or
  - Persons at high risk for progression to TB disease
- Flexibility needed in defining high-risk groups
- Risk for TB or LTBI in current high-risk groups may decrease over time, and groups currently *not* at risk may subsequently become high risk

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Evaluation of Persons with Positive TB Tests

- Facilities should consult with local health department before starting testing program to ensure evaluation and treatment resources are available
- Persons with positive TST or IGRA should be evaluated for disease
- If disease is ruled out, consider for LTBI treatment
- If patient not willing or able to take treatment, educate on TB signs and symptoms

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Methods for Detecting *M. tb* Infection in U.S.

- Mantoux tuberculin skin test (TST)
- IGRAs:
  - QuantiFERON-TB Gold In-Tube (QFT-GIT)®, and
  - T-Spot.*TB*®
- These tests do not exclude LTBI or TB disease
- Decisions about medical/public health management should include other info/data, and not rely only on TST/IGRA results

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Mantoux Tuberculin Skin Test (TST)

- Purified protein derivative (PPD), derived from tuberculin, is injected between skin layers using the Mantoux technique
- Infected person's immune cells recognize TB proteins in PPD, respond to site, causing wheal to rise
- Takes 2-8 weeks after exposure and infection for the immune system to react to PPD
- Reading and interpretation of TST reaction must be done within 48–72 hours

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Administering the TST

- Inject 0.1 ml of PPD (5 tuberculin units) into forearm between skin layers
- Produce wheal (raised area) 6–10 mm in diameter
- Follow universal precautions for infection control

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Reading the TST

- Trained health care worker assesses reaction 48–72 hours after injection
- Palpate (feel) injection site to find raised area
- Measure diameter of induration across forearm; only measure induration, not redness
- Record size of induration in millimeters; record "0" if no induration found

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Interpreting the TST Reaction

≥5 mm induration is classified as positive in

- HIV-infected persons
- Recent contacts of infectious TB
- Persons with fibrotic changes on chest radiograph consistent with prior TB
- Patients with organ transplants and other immunosuppressed patients

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Interpreting the TST Reaction (cont.)

≥10 mm induration is classified as positive in

- Recent arrivals from high-prevalence countries
- Injection drug users
- Residents and employees of high-risk congregate settings

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Interpreting the TST Reaction (cont.)

≥10 mm induration is classified as positive in

- Mycobacteriology laboratory personnel
- Persons with conditions that increase risk for progressing to TB
- Children <5 years of age, or children and youth exposed to adults at high risk

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Interpreting the TST Reaction (cont.)

≥15 mm is classified as positive in

- Persons with no known risk factors for TB

Targeted skin testing should only be conducted among high-risk groups

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Factors that May Affect the Skin Test Reaction

False-positive	• Nontuberculous mycobacteria • BCG vaccination • Problems with TST administration
False-negative	• Anergy • Viral, bacterial, fungal coinfection • Recent TB infection • Very young age; advanced age • Live-virus vaccination • Overwhelming TB disease • Renal failure/disease • Lymphoid disease • Low protein states • Immunosuppressive drugs • Problems with TST administration

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Special Considerations When Using TST

Boosting

- Some may have negative (waned) TST reaction when tested years after infection (e.g., older adults)
- Initial skin test may stimulate (boost) ability to react to PPD
- Subsequent positive boosted reaction may be misinterpreted as a new infection
- May still be considered for treatment if currently at high risk for TB disease

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Special Considerations When Using TST (cont.)

Two-Step Testing

- Used for initial skin testing of adults to be retested periodically, to reduce likelihood that boosted reaction will be misinterpreted as recent infection
- If 1st test positive, consider infected; if negative, give 2nd test 1–3 weeks later
- If 2nd test positive, consider infected; if negative, consider uninfected

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Special Considerations When Using TST (cont.)

Pregnant women

- TST is safe and reliable for mother and fetus throughout pregnancy
- Give TST to pregnant women who have risk factors for infection or disease

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Special Considerations When Using TST (cont)

Occupational Exposure to TB

- **Cutoff for defining a positive TST reaction depends on**
  - Individual risk factors for TB
  - Prevalence of TB in the facility
- **High-risk sites should test residents and staff at entry and hire and at intervals determined by annual risk assessment**

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Interferon Gamma Release Assays (IGRAs)

- **IGRAs detect *M. tb* infection by measuring immune response in blood**
- **Cannot differentiate between TB and LTBI; other tests needed**
- **May be used for surveillance/screening, or to find those who will benefit from treatment**
- **FDA-approved IGRAs are QFT Gold In-Tube and T-Spot.*TB* test**

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General Recommendations for Using IGRAs

- **May be used in place of, but not in addition to, TST**
- **Preferred when testing persons**
  - Who might not return for TST reading
  - Who have received BCG vaccination
- **Generally should not be used to test children <5 years of age, unless used in conjunction with TST**

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General Recommendations for Using IGRAs (cont.)

May be used in place of TST to test recent contacts of infectious TB

- **Detect *M. tb* infection with greater specificity than TST**
- **Data are limited on ability to predict subsequent TB**
- **In contact investigations, confirm negative via retest 8–10 weeks postexposure**
- **Use same test for repeat testing to reduce misclassification errors**

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General Recommendations for Using IGRAs (cont.)

- **May be used for periodic screening, e.g., for health-care workers**
- **IGRAs do not boost subsequent test results; administered with one patient visit**
- **Results from both IGRA and TST may be useful when initial test is**
  - Negative, and patient has high risk of TB infection or disease
  - Positive, and additional evidence is required/desired
  - Unclear or indeterminate

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BCG Vaccination

- **Vaccine made from live, attenuated (weakened) strain of *M. bovis***
- **Early version first given to humans in 1921**
- **Many TB-prevalent countries vaccinate infants to prevent severe TB disease**

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Recommendations for BCG Vaccination

- BCG not generally recommended in the U.S.
- However, its use may be considered in very limited circumstances
- Use BCG only after consultation with local health department and TB experts

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Recommendations for BCG Vaccination (cont.)

Infants and Children

- Can be considered for infant or child with negative skin-test result who
  - Is continually exposed to untreated or ineffectively treated adult
  - Will be continually exposed to adult with MDR TB
- BCG vaccination *not* recommended for HIV-infected children

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Recommendations for BCG Vaccination (cont.)

Health-Care Workers

Should be considered on individual basis for health-care workers in settings in which

- High percentage of MDR TB patients has been found,
- Transmission of drug-resistant TB strains and subsequent infection are likely, and
- Comprehensive TB infection-control precautions implemented but not successful.

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BCG Contraindications

- Contraindicated in persons with impaired immune response from
  - HIV infection, congenital immunodeficiency
  - Leukemia, lymphoma, generalized malignancy
  - High-dose steroid therapy
  - Alkylating agents
  - Antimetabolites
  - Radiation therapy
- BCG vaccination should *not* be given to pregnant women

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Interpretation of TB Test Results in BCG-Vaccinated Persons

- TST or IGRA not contraindicated for BCG-vaccinated persons
- Results used to support or exclude diagnosis of infection
- In BCG-vaccinated, interpret TST with same criteria used for non–BCG-vaccinated
- Booster phenomenon may occur in BCG-vaccinated persons

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Chapter 4. Diagnosis of TB Disease

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Medical Evaluation for TB

- Medical history
- Physical examination
- Test for TB infection
- Chest radiograph
- Bacteriologic examination

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Medical Evaluation for TB
1. Medical History

- Symptoms of disease; how long
- History of TB exposure, infection, or disease
- Past TB treatment
- Demographic risk factors for TB
- Medical conditions that increase risk for TB disease

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Medical Evaluation for TB (cont.)
1. Medical History (cont.)

Symptoms of pulmonary TB:

- Prolonged cough (3 weeks or longer), hemoptysis
- Chest pain
- Loss of appetite, unexplained weight loss
- Night sweats, fever
- Fatigue

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Medical Evaluation for TB (cont.)
1. Medical History (cont.)

Symptoms of possible extrapulmonary TB:

- Blood in the urine (TB of the kidney)
- Headache/confusion (TB meningitis)
- Back pain (TB of the spine)
- Hoarseness (TB of the larynx)
- Loss of appetite, unexplained weight loss
- Night sweats, fever
- Fatigue

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Medical Evaluation for TB (cont.)
2. Physical Examination

- Provides valuable information about the patient's overall condition
- Cannot be used to confirm or rule out TB disease

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Medical Evaluation for TB (cont.)
3. Test for *M. tuberculosis* Infection

- Two methods for detecting *M. tb* infection: TST and IGRAs
- TST and IGRAs help differentiate persons with *M. tb* infection from those not infected
- Negative reaction to either does not exclude diagnosis of TB or LTBI

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Medical Evaluation for TB (cont.)
4. Chest Radiograph

- Chest abnormalities suggest, but do not confirm, TB disease
- Posterior-anterior view is standard
- Apical/posterior areas of upper lobe or superior areas of lower lobe often show abnormalities
- In immunosuppressed (e.g., HIV infected), lesions may have atypical appearance

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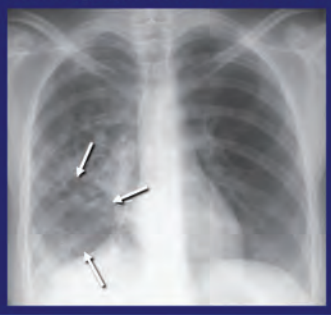
Chest Radiograph with Lower Lobe Cavity



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Medical Evaluation for TB (cont.)
4. Chest Radiograph (cont.)

- Old TB can produce dense, hard nodules or lesions containing live bacilli
- Fibrotic nodules/lesions from old TB + positive TB test = high-priority candidate for LTBI treatment
- Calcified lesions pose low risk for progressing to TB
- Active versus inactive disease cannot be determined from chest radiograph alone

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Medical Evaluation for TB (cont.)
4. Chest Radiograph (cont.)

- In HIV infected, pulmonary TB may present atypical radiograph
  - Less common: cavitary disease (with higher CD4 counts)
  - More common: infiltrates, adenopathy, or normal radiograph (with lower CD4 counts)
- With signs/symptoms, negative radiograph does not rule out disease
- With no signs/symptoms and positive TB test, negative radiograph may rule out TB in HIV-negative person

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Medical Evaluation for TB (cont.)
5. Bacteriologic Examination of Specimens

- Specimen collection
- AFB smear classification
- NAA testing
- Culture and identification
- Drug-susceptibility testing

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Medical Evaluation for TB (cont.)
5. Bacteriologic Examination of Specimens (cont.)

Specimen collection, processing, and review

- All persons suspected of TB disease should have sputum cultured
- Collect at least 3 sputum specimens at 8- to 24-hour intervals, at least 1 in the morning
- Follow infection control precautions during specimen collection
- Collection methods include coughing, sputum induction, bronchoscopy, gastric aspiration

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Medical Evaluation for TB (cont.)
5. Bacteriologic Examination of Specimens (cont.)

Specimen collection methods for extrapulmonary TB

- **TB disease can occur in almost any site**
- **Variety of clinical specimens other than sputum can be submitted**
- **Before collection, ensure transport and processing procedures are in place**

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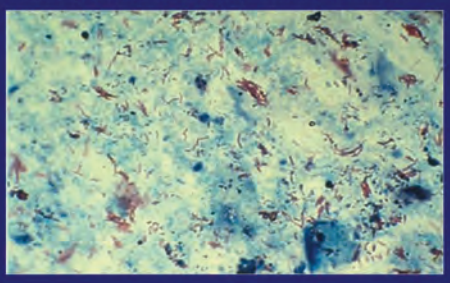
Medical Evaluation for TB (cont.)
5. Bacteriologic Examination of Specimens (cont.)

Smear examination

- **Detecting AFB in smears may be first evidence of mycobacteria**
  - Quickest (results within 24 hours) and easiest procedure
  - Provides a preliminary presumptive diagnosis of TB
  - AFB in a smear are counted and classified as 4+, 3+, 2+, or 1+

86

AFB Smear
AFB (shown in red) are tubercle bacilli



87

Direct Detection Using Nucleic Acid Amplification (NAA)

- **NAA tests rapidly identify a specimen via DNA and RNA amplification**
- **Benefits may include**
  - Earlier lab confirmation of TB disease
  - Earlier respiratory isolation and treatment initiation
  - Improved patient outcomes; interruption of transmission
- **Perform at least 1 NAA test on each pulmonary TB suspect**
- **A single negative NAA test does not exclude TB**

88

Nucleic Acid Amplification (NAA) Test

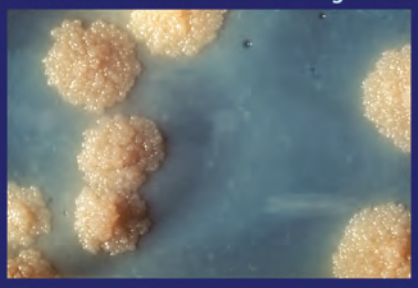
89

Culture

- **Remains gold standard for confirming diagnosis of TB**
- **Culture all specimens, even if smear or NAA negative**
- **Results in 4–14 days when liquid medium systems used**
- **Culture monthly until conversion, i.e., 2 consecutive negative cultures**

90

Colonies of *M. tuberculosis* Growing on Media



91

Drug-Susceptibility Testing

- Conduct drug-susceptibility testing on initial *M. tb* isolate
- Promptly forward results to the health department
- Repeat for patients who
  - Do not respond to therapy or
  - Have positive cultures despite 3months of therapy

92

Drug-Susceptibility Testing

93

Second-line Drug-Susceptibility Testing

Limit to persons at increased risk for drug resistance:

- Have history of treatment with TB drugs
- Had contact with a person with drug-resistant TB
- Demonstrated resistance to first-line drugs
- Has positive smears or cultures despite 3 months of TB treatment

94

Molecular Detection of Drug Resistance

- Drug resistance is caused by mutations in specific *M. tb* genes
- Several molecular assays and tests can detect mutations
- Molecular detection should be used for patients with high risk for rifampin resistance (MDR TB)
- Conventional drug susceptibility testing should be done in conjunction with molecular tests

95

Genotyping

- Laboratory-based approach that analyzes the genetic material of patient isolates
- Different strains of *M. tb* have different genotype patterns
- *M. tb* isolates with identical genotypes often indicates recent transmission
- Main purpose of genotyping: add to TB controllers' understanding of TB transmission in their community

96

Genotyping (cont.)

Used with traditional epi investigations, genotyping has

- Confirmed/detected transmission
- Identified risk factors for recent infection
- Demonstrated re-infection with different strains
- Identified weaknesses in conventional contact investigations
- Documented lab cross-contamination
- Identified outbreaks not previously recognized

97

Chapter 5. Treatment for Latent Tuberculosis Infection

98

Treatment for Latent TB Infection (LTBI)

- Over 11 million persons in U.S. estimated to have LTBI (4% of population)
  - 5%-10% will develop TB disease if untreated
- Treatment of LTBI essential to controlling and eliminating TB disease
- Reduces risk of LTBI to TB disease progression
- Use targeted testing to find persons at high risk for TB who would benefit from LTBI treatment
- Several treatment regimens available

99

Candidates for Treatment of LTBI

High-risk persons with positive IGRA test or TST reaction of ≥5 mm:

- HIV-infected persons
- Recent contacts of persons with infectious TB
- Persons with fibrotic changes on chest radiograph consistent with prior TB
- Patients with organ transplants and other immunosuppressed patients

100

Candidates for Treatment of LTBI (cont.)

High-risk persons with positive IGRA test or TST reaction of ≥10 mm:

- Recent arrivals (<5 yrs) from high-prevalence areas (e.g., Asia, Africa, Eastern Europe, Latin America, and Russia)
- Injection drug users
- Residents and employees of high-risk congregate settings (e.g., correctional facilities, homeless shelters, hospitals, and long term care facilities)
- Mycobacteriology laboratory personnel

101

Candidates for Treatment of LTBI (cont.)

High-risk persons with positive IGRA test or TST reaction of ≥10 mm (cont.):

- Persons with conditions that increase risk for TB:
  - Silicosis
  - Diabetes mellitus
  - Chronic renal failure
  - Certain cancers (e.g., leukemia and lymphomas, or cancer of the head, neck, or lung)
  - Gastrectomy or jejunoileal bypass
  - Weight loss of at least 10% below ideal body weight
  - Young children <5 years of age; children/adolescents exposed to adults in high-risk categories

102

Candidates for Treatment of LTBI (cont.)

- **Low-risk persons with positive IGRA test or TST reaction ≥15 mm:**
  - Persons with no known risk factors for TB generally should not be tested
- **Targeted testing programs should only be conducted among high-risk groups**
- **If low-risk persons are tested and have positive IGRA test or TST reaction ≥15 mm, evaluate for LTBI treatment**

103

Close Contacts with Negative IGRA or TST Result

- **Some contacts should be evaluated and treated for LTBI even with negative TB test results:**
  - Young children <5 years of age
  - Immunosuppressed persons
  - Others at risk for rapid progression to TB disease once infected
- **Always rule out TB disease with chest radiograph and medical evaluation before treating for LTBI**
- **Give LTBI treatment (window prophylaxis) regardless of test result**
- **Retest 8–10 weeks after last exposure to allow for delayed immune response**

104

LTBI Treatment Regimens

Isoniazid (INH)

- **9-month daily regimen is preferred: 270 doses within 12 months**
  - Effective for HIV-infected as well as HIV-uninfected persons
  - Can be given twice weekly via DOT: 76 doses within 12 months
  - Preferred for children 2–11 years of age

105

LTBI Treatment Regimens

INH (cont.)

- **6-month regimen also generally acceptable: 180 doses within 9 months**
  - Can be given twice weekly via DOT: 52 doses within 9 months
  - Shorter regimen not recommended for children, immunosuppressed persons, persons whose x-rays suggest previous TB

106

LTBI Treatment Regimens

INH-rifapentine (RPT) regimen (12-dose regimen)

- **INH and RPT given in 12 once-weekly doses under DOT**
- **Offers equal option to 9 months daily INH, but does not replace other treatment options for LTBI (Table 5.3)**
- **Recommended for treating LTBI in otherwise healthy people ≥12 years of age who had recent contact with infectious TB, or who had a tuberculin skin test conversion or a positive blood test for TB infection**

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LTBI Treatment Regimens

INH-RPT regimen (12-dose regimen) (cont.)

- **Can be considered for specific groups that would benefit (e.g., need to complete treatment in short time)**
- **12-dose regimen is *not* recommended for children <2 years, HIV-infected persons on ART drugs, patients with presumed INH or RIF resistance, women who are or might become pregnant during treatment**
- **Patients should be monitored monthly; ask about side effects and assess for signs of adverse effects**

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LTBI Treatment Regimens

Dosage for 12-dose INH and RPT:

- **Isoniazid: 15 mg/kg rounded up to the nearest 50 or 100 mg, with a 900 mg maximum**
- **Rifapentine:**
  - 10.0-14.0 kg: 300 mg
  - 14.1-25.0 kg: 450 mg
  - 25.1-32.0 kg: 600 mg
  - 32.1-49.9 kg: 750 mg
  - ≥ 50.0 kg: 900 mg maximum
- **Keep RPT sealed until it is used**

109

Adverse Reactions to INH

Use of INH is associated with some adverse reactions:

- **Peripheral neuropathy – give vitamin B_6 if patient has risk factors, or if signs/symptoms develop**
- **Fatal hepatitis – pregnant/postpartum women at increased risk; monitor closely**
- **Elevated liver enzymes – discontinue INH if liver enzyme levels exceed 3X normal with symptoms, or 5X upper limit of normal with no symptoms**
  - Closely monitor if signs/symptoms of liver injury, or liver enzyme levels are elevated but less than above

110

Rifampin (RIF)

- **Alternative to INH is 4 months daily RIF: 120 doses within 6 months**
- **Should not be used in HIV-infected persons being treated with some antiretroviral therapy(ART)**
- **In some instances where RIF cannot be used, rifabutin can be substituted**

111

Recommendation Against the RIF/PZA Regimen

- **LTBI regimen of 2 months of RIF/PZA is no longer recommended owing to associated severe liver injury.**
- **PZA should *not* be offered to persons with LTBI, but should continue to be included in multidrug regimens for treatment of TB disease.**

112

LTBI Treatment Regimens for Specific Situations

HIV-Infected Persons

- **Consult an expert in managing HIV and TB**
- **INH daily for 9 mos, rather than 6 mos, is optimal: 270 doses within 12 months**
- **HIV-infected persons on ART drugs should not take the 12-dose regimen; drug interactions not known**
- **HIV-infected persons on some ART drugs, such as protease inhibitors or delavirdine, should not take RIF**
- **Rifabutin with dose adjustments can sometimes be substituted for RIF**

113

LTBI Treatment Regimens for Specific Situations (cont.)

Persons with Fibrotic Lesions Suggesting Previous TB

- **Should be treated for LTBI if they have**
  - A positive TST reaction (at least 5 mm) or IGRA result
  - No symptoms of infectious TB disease
  - No history of treatment for TB disease
- **Evaluate with sputum smear and culture, and treat only after TB disease excluded by negative culture**
- **Acceptable regimens include**
  - 9 months of INH
  - 4 months of RIF (with or without INH)
- **Persons with evidence of primary, healed TB not at increased risk for TB**

114

LTBI Treatment Regimens for Specific Situations (cont.)

Contacts of Persons with Multidrug-Resistant (MDR) TB

- Consider risk for progressing to MDR disease before recommending LTBI treatment
- When prescribing treatment for these contacts, consult an MDR TB expert

115

LTBI Treatment Regimens for Specific Situations (cont.)

Pregnancy and Breast-Feeding

- 9 months of INH daily or twice weekly; give with vitamin B_6
- If cannot take INH, consult with TB expert
- 12-dose INH-RPT regimen not recommended for pregnant women; its safety in pregnancy is not known
- Women at high risk for progression to TB disease, especially HIV infected or diabetic, should not delay LTBI treatment; monitor carefully
- Breast-feeding not contraindicated

116

Patient Monitoring

Before starting treatment for LTBI, clinicians should

- Exclude possibility of disease (symptoms, chest radiograph)
- Determine if patient has history of prior treatment for LTBI or disease
- Determine if any contraindications to treatment
- Obtain information about current and previous drug therapy, including adverse reactions
- Recommend HIV testing, unless the patient declines (opt-out screening)

117

Patient Monitoring (cont.)

Establish rapport with patient and emphasize

- Benefits of treatment
- Importance of adherence to treatment regimen
- Possible adverse side effects of regimen
- Establishment of optimal follow-up plan

118

Patient Monitoring (cont.)

- **Baseline laboratory testing not routinely indicated for all patients**
- **Baseline hepatic measurements are indicated for**
  - Patients with a liver disorder or liver disease
  - Patients with HIV infection
  - Pregnant women and those in immediate postpartum period
- **Patients with abnormal baseline tests should be monitored regularly**

119

Patient Monitoring (cont.)

At least monthly, evaluate for

- Adherence to prescribed regimen
- Signs and symptoms of TB disease
- Signs and symptoms of adverse effects, especially hepatitis
  - Jaundice, loss of appetite, fatigue, and/or muscle and joint aches

120

Chapter 6.
Treatment of TB Disease

121

Major Goals of TB Treatment

- Cure patient, minimize risk of death/disability, prevent transmission to others
- Provide safest, most effective therapy in shortest time
- Prescribe multiple drugs to which the organisms are susceptible
- Never treat with a single drug or add single drug to failing regimen
- Ensure adherence and completion of therapy

122

Develop Treatment and Monitoring Plan

Plan should include

- Description of treatment regimen
- Methods for assessing/ensuring adherence
- Monitoring methods for treatment response and adverse events

123

Adherence

- Nonadherence results in inadequate treatment
- Can lead to treatment failure, relapse, ongoing transmission, and drug resistance
- Clinician responsible for completion of therapy
- To ensure adherence, provide education, case management, DOT, incentives and enablers, and combination pills
- If these fail, take more restrictive action

124

Case Management

Strategy to ensure patients complete treatment. Three elements:

- Assigning responsibility
- Conducting regular systematic review
- Developing plans to address barriers to adherence

Case managers must ensure patients are educated about TB, therapy is continuous, and contacts are evaluated properly

125

Directly Observed Therapy (DOT)

- Health-care worker watches patient swallow each dose
- DOT is preferred management strategy for all patients
- Can reduce acquired drug resistance, treatment failure, and relapse
- Nearly all regimens can be intermittent if given as DOT
- DOT reduces total number of doses and encounters
- For drug-resistant TB, use daily regimen and DOT

126

Current Anti-TB Drugs

10 drugs FDA-approved for treatment of TB

- Isoniazid (INH)
- Rifampin (RIF)
- Pyrazinamide (PZA)
- Ethambutol (EMB)
- Rifapentine (RPT)
- Streptomycin (SM)
- Cycloserine
- Capreomycin
- *p*-Aminosalicylic acid
- Ethionamide

127

Current Anti-TB Drugs (cont.)

- **Four first-line drugs considered standard treatment:**
  - Isoniazid (INH)
  - Rifampin (RIF)
  - Pyrazinamide (PZA)
  - Ethambutol (EMB)

- **Rifabutin and rifapentine also considered first-line drugs in some circumstances**
- **Streptomycin (SM) formerly first-line drug, but now less useful owing to increased SM resistance**

128

TB Disease Treatment Regimens

- **Four regimens recommended for treatment of drug-susceptible TB, with different options for number of doses and for length of continuation phase**
- **Initial phase: standard four drugs (INH, RIF, PZA, EMB) for 2 months (one excludes PZA)**
- **Continuation phase: additional 4 months; 7 months for some patients**

129

TB Disease Treatment Regimens (cont.)

- **When to use 7-month continuation phase:**
  - Disease is cavitary and sputum culture is positive at end of initial phase;
  - Initial phase excluded PZA; or
  - Once-weekly INH and RPT used in continuation phase, and culture is positive at end of initial phase.

130

Regimen 1 for Treatment of Pulmonary, Drug-Susceptible TB 6-Month Standard Regimen for Most Patients

Initial phase

INH, RIF, PZA, EMB daily (7 or 5 days/week) for 8 weeks

4-month continuation phase options

1) INH, RIF daily (7 or 5 days/week) for 18 weeks

2) INH, RIF intermittently (2 days/week or 1 day/week for INH, rifapentine) for 18 weeks

131

Regimen 2 for Treatment of Pulmonary, Drug-Susceptible TB 6-Month Daily + Intermittent Dosing Options

Initial phase

INH, RIF, PZA, EMB daily (7 or 5 days/week) for 2 weeks, *then* 2 days/week for 6 weeks

4-month continuation phase options

1) INH, RIF intermittently (2 days/week) for 18 weeks

2) INH, RPT intermittently (1 day/week) for 18 weeks

132

Regimen 3 for Treatment of Pulmonary, Drug-Susceptible TB 6-Month Intermittent Dosing Options

Initial phase

INH, RIF, PZA, EMB intermittently (3 days/week) for 8 weeks

4-month continuation phase

INH, RIF intermittently (3 days/week) for 18 weeks

133

Regimen 4 for Treatment of Pulmonary, Drug-Susceptible TB 7-Month Regimen without Pyrazinamide

Initial phase

INH, RIF, EMB daily (7 or 5 days/week) for 8 weeks

7-month continuation phase options

1) INH, RIF daily (7 or 5 days/week) for 31 weeks
2) INH, RIF intermittently (2 days/week) for 31 weeks

134

Treatment Completion

- Defined as ingesting prescribed number of doses within specified time
- Duration depends on drugs used, isolate's susceptibility, and patient's response to drugs
- Most patients can be treated with 6-mo or 9-mo therapy; 6 mo is used for most patients

135

Follow-up After Treatment

- Not necessary for patients with satisfactory response
- Patients with susceptible TB should report symptoms
- Patients with resistant organisms must have individualized follow-up evaluation

136

Treatment Interruptions

- Treatment interruption is common
- Restart or continue therapy based on when interruption occurred and duration of interruption

137

Treatment Interruption During Initial Phase

- If lapse ≥14 days, restart treatment
- If lapse <14 days, continue treatment to completion as long as all doses completed within 3 months

138

Treatment Interruption During Continuation Phase

- **If patient received ≥80% of doses and**
  - Sputum smear was negative on initial testing, further therapy may not be needed
  - Sputum smear was positive on initial test, continue therapy
- **If patient received <80% of doses, and lapse is**
  - <3 months long, continue therapy
  - >3 months long, restart therapy from beginning of initial phase

139

Treating Culture-Negative Disease

- **Some patients may have culture-negative pulmonary TB disease**
- **Start culture-negative patient on four-drug therapy if high clinical suspicion for TB**

140

Treatment Regimens for Specific Situations

Pregnant Women

- **Initial regimen should consist of INH, RIF, and EMB**
  - SM is contraindicated; PZA not contraindicated, but detailed data on teratogenicity not available
  - If PZA not used, duration of therapy is 9 months
  - If treating MDR TB in pregnancy, consult MDR TB expert
- **Breast-feeding not contraindicated for women being treated for TB disease**
- **Vitamin B_6 supplementation recommended if taking INH**

141

Treatment Regimens for Specific Situations (cont.)

Infants and Children

- **Treat with same regimens recommended for adults, with exception that EMB not used routinely in children**
- **Treat as soon as diagnosis suspected**
- **For disseminated TB or TB meningitis in children, treat for 9–12 months**

142

Treatment Regimens for Specific Situations (cont.)

HIV-Infected Persons

- **Management of HIV-related TB is complex**
- **Should be provided in consultation with experts in treatment of both HIV and TB**
- **Can be treated with standard regimens except:**
  - Do not use once-weekly continuation-phase INH and RPT
  - In patients with advanced HIV, use daily or 3x weekly therapy

143

Treatment Regimens for Specific Situations (cont.)

HIV-Infected Persons (cont.)

- **If possible, use a rifamycin for the entire course of therapy, along with ART**
- **A major concern: RIF interacts with some PIs and NNRTIs**
- **Rifabutin has fewer drug interactions and may be used instead of RIF**
- **Drug dosages may need adjusting; consult expert**

144

Treatment Regimens for Specific Situations (cont.)

HIV-Infected Persons (cont.)

- These guidelines are likely to change over time
- For more information, see Managing Drug Interactions in the Treatment of HIV-Related Tuberculosis at: http://www.cdc.gov/tb/publications/guidelines/TB_HIV_Drugs/default.htm

145

Pregnancy in HIV-Infected Women

- Treatment is complicated in HIV-infected pregnant women with TB
- Pregnancy alters distribution/metabolism of some drugs, including ART
- Protease inhibitor concentrations reduced in pregnancy

146

HIV-Infected Children

HIV-infected children with TB at greater risk for severe forms of disease

- For more information, see Managing Drug Interactions in the Treatment of HIV-Related Tuberculosis at: http://www.cdc.gov/tb/publications/guidelines/TB_HIV_Drugs/default.htm

147

Conditions Requiring Additional Considerations

- Renal insufficiency/end-stage renal disease
  - Some TB drugs are cleared by the kidneys; thus the dosing must be altered with renal disease
  - Rather than decrease dosage size, increase dosing interval
- Hepatic disease - consider regimens with fewer hepatotoxic agents
- Extrapulmonary TB - In most cases, treat with same regimens used for pulmonary TB

148

Conditions Requiring Additional Considerations (cont.)

Drug-resistant TB: can develop as primary or secondary resistance

- Primary resistance is caused by initial infection with resistant organisms
- Secondary or acquired resistance develops during therapy owing to
  - Patient being treated with inadequate regimen,
  - Patient not taking drugs as prescribed, or
  - Other conditions such as drug malabsorption or drug-drug interactions.

149

Conditions Requiring Additional Considerations (cont.)

Multidrug-resistant TB (MDR TB)

- Presents high risk for treatment failure, relapse, further acquired resistance, and/or death
- Clinicians unfamiliar with its treatment should seek expert consultation
- Always use DOT to ensure adherence

150

Conditions Requiring Additional Considerations (cont.)

Culture-negative TB

- **Failure to isolate TB bacilli from person with clinical evidence does not exclude TB**
- **At minimum, TB suspects should have 3 specimens for smear and culture**
- **If high likelihood of TB, initiate therapy with INH, RIF, PZA, and EMB**

151

Patient Monitoring

Recommended Examinations for Baseline Monitoring

Patient	Recommended Test
All patients	Measure aminotransferases (i.e., AST, ALT), bilirubin, alkaline phosphatase, and serum creatinine and a platelet count
Patients at risk for hepatitis B or C (e.g., injection drug user, born in Asia or , or HIV infected)	Conduct serologic tests
Patients who are taking EMB	Test visual acuity (Snellen chart) and color vision (Ishihara)
HIV-infected patients	Obtain CD4+ lymphocyte count

152

Patient Monitoring (cont.)

Monitoring During Treatment

Patient	Recommendations
All patients	Repeat at least monthly clinical evaluations to • Identify possible adverse reactions to medications • Assess adherence
Patients who are taking EMB	• Question monthly regarding visual disturbances • Repeat monthly testing for visual acuity (Snellen chart) and color vision (Ishihara) for patients whose dose exceeds 15-20 mg/kg and those who have been receiving EMB for >2 months
Patients who have extrapulmonary TB disease	Evaluation depends on • Sites involved • Ease with which specimens can be obtained

153

Evaluating Response to Treatment

- **Assess patient's response to treatment using three methods:**
  - Clinical evaluation, bacteriological examination, chest radiograph
- **Conduct clinical evaluations at least monthly; after 2 months of therapy, if symptoms do not resolve, reevaluate for**
  - Potential drug-resistant disease
  - Nonadherence to drug regimen

154

Evaluating Response to Treatment (cont.)

- **Bacteriological examination**

If cultures do not convert to negative after 3 months of therapy, evaluate patient for drug resistance or adherence issues; after 4 months, consider treatment failed

- **Chest radiograph**

Patients with initially negative cultures should have chest radiograph after 2 months of treatment and at completion of therapy

155

Evaluating Response to Treatment (cont.)

- **Monitor for adverse reactions**
- **Common adverse reactions include**
  - Gastrointestinal problems
  - Hepatitis
  - Rash
  - Fever

156

Chapter 7.
TB Infection Control

157

Introduction

- *M. tb* can be transmitted in any setting
- Transmission has been documented in health-care settings where there is exposure to persons with infectious TB who
  - Have unsuspected TB disease,
  - Have not received adequate treatment, or
  - Have not been isolated from others.

158

Infectiousness

- Directly related to number of bacilli-laden droplets expelled into the air
- Infection occurs when person inhales droplets, which travel to alveoli
- Young children with TB less likely to be infectious, but can transmit *M. tb*
- Infectiousness usually declines rapidly with treatment
  - However, some remain infectious for weeks or months

159

Infectiousness (cont.)

Patient factors associated with infectiousness:

- Coughing
- Cavity in the lung
- Sputum smears positive for acid-fast bacilli (AFB)
- TB disease of the lungs, airway, or larynx
- Undergoing cough-inducing or aerosol-generating procedures
- Not receiving adequate therapy
- Culture positive

160

Criteria to Be Considered Noninfectious

Patients no longer considered infectious if:

- They have 3 consecutive negative sputum smears,
- Their symptoms have improved, and
- They are adhering to an adequate treatment regimen for at least 2 weeks

161

Environmental Factors that Enhance Risk of Transmission

- High concentration of droplet nuclei in the air
- Exposure in small, enclosed spaces
- Poor ventilation that inadequately dilutes or removes droplet nuclei
- Recirculation of air containing droplets
- Improper specimen handling procedures
- Positive air pressure in patient's room causing flow to other areas

162

TB Infection Control Measures

- **TB infection control (IC) measures should be based on TB risk assessment for the setting**
- **The goals of IC programs are**
  - Detect TB disease early and promptly
  - Isolate persons with known/suspected TB
  - Start treatment in persons with known/suspected TB

163

Detection of TB Disease

- **Primary risk in health-care settings: unsuspected persons with TB disease**
- **Protocols for detecting, isolating, and managing TB suspects should be implemented**
- **Staff admitting patients should be trained to know signs/symptoms of TB**

164

Airborne Precautions

- **Separate and isolate persons with TB signs/symptoms**
  - Preferably use airborne infection isolation (AII) room
  - Single-patient room with controlled environment to minimize transmission of infection
  - Continue precautions until 3 negative smears, 2 weeks therapy, and improved symptoms
- **Start TB patients/suspects on standard TB therapy**

165

Hierarchy of Controls

TB IC program should be based on three levels of controls:

- **Administrative controls to reduce risk of exposure**
- **Engineering controls to prevent spread and reduce concentration of droplet nuclei**
- **Personal respiratory protection to further reduce risk of exposure**

166

Administrative Controls

To reduce risk of exposing uninfected persons to infectious disease:

- **Assign responsibility for IC in the facility**
- **Conduct annual facility risk assessment by examining**
  - Number of TB patients in the setting
  - Promptness of detecting, isolating, and evaluating TB suspects
  - Evidence of transmission in the setting
  - Community TB rate

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Administrative Controls (cont.)

- **As part of risk assessment, do risk classification to determine need for testing**
  - Low risk: Settings where persons with TB not likely to be seen
  - Medium risk: Settings where HCWs will possibly be exposed to TB
  - Potential ongoing transmission: Settings with evidence of transmission in past year

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Administrative Controls (cont.)

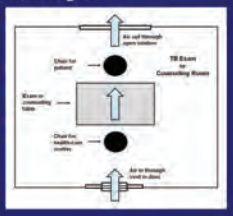
- Institute IC plan to ensure TB suspects found, isolated, evaluated, treated
- Ensure recommended laboratory services are available
- For HCWs, implement effective work practices and test as classification indicates
- Ensure equipment is properly cleaned, disinfected, and sterilized
- Educate, train, and counsel HCWs, patients, visitors about TB

169

Environmental Controls

Prevent spread and reduce concentration of infectious droplet nuclei through

- Primary controls: ventilation technologies
  - Natural ventilation: relies on open doors, windows
  - Mechanical ventilation (local exhaust and general): equipment, use of AII room
- Secondary controls: HEPA filters and ultraviolet germicidal irradiation (UVGI)

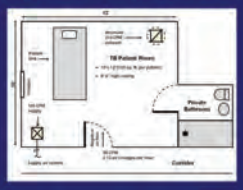


170

Environmental Controls (cont.)

AII rooms designed to prevent spread of droplet nuclei

- TB suspect/patient should be put in AII room immediately
- Facilities that see TB patients should have at least one AII room



171

Environmental Controls (cont.)

Characteristics of AII room:

- Single-patient room with private bathroom
- Negative pressure relative to hallway
- Air sent outdoors or through HEPA filter
- Six or more air changes per hour (in some settings 12 or more air changes per hour are recommended)
- Visitors should use N95 respirator

172

Respiratory Protection Controls

Consists of using personal protective equipment in areas with increased risk of exposure:

- TB AII rooms
- Rooms where cough- or aerosol-producing procedures are done
- Vehicles transporting infectious patients
- Homes of infectious TB patients

173

Respiratory Protection Controls (cont.)

- Settings that use respiratory protection controls should develop, implement, and maintain a respiratory protection program
- Train HCWs on respiratory protection
- Educate patients on respiratory hygiene
- Test HCWs for mask fit and functionality

174

Respirator for Health-Care Workers

Health-care worker wearing a respirator

Respirators

- Designed to filter out droplet nuclei from being inhaled by the health-care worker and other individuals.
- Should properly fit different face sizes and features.
- Should NOT be worn by the patient.

175

Surgical Mask for Persons with Infectious TB Disease

Infectious TB patient wearing a surgical mask

Surgical masks

- Designed to stop droplet nuclei from being spread (exhaled) by the patient.
- Should NOT be worn by the health-care worker.

176

Infection Control Programs in Nontraditional Settings

Nontraditional settings seeing TB patients must have an IC program. These include

- Correctional facilities
- Homeless shelters
- Long-term care facilities
- Home-based health-care and outreach settings
- Emergency medical services

177

TB Infection Control in the Home

Patients can be sent home while still infectious if

- A follow-up plan has been made
- Patient is on standard treatment and DOT arranged
- No very young (under 5 years) or immunocompromised persons in household
- Patient willing to refrain from travel outside the home except for health-care visits

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TB Infection Control in the Home (cont.)

HCWs visiting patients at home should:

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

HCWs whose responsibilities include visiting patients at home should participate in an annual TB testing program

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Chapter 8. Community TB Control

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Responsibility for TB Control

- Health departments maintain primary responsibility for TB prevention and control
- Complexity of TB control requires public health sector to collaborate with others

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Roles and Responsibilities of Public Health Sector

Public health sector plans, coordinates, and evaluates TB control efforts

Requires state and local health departments to focus on

- Planning and policy development
- Contact investigation
- Clinical/diagnostic services for TB patients and their contacts
- Training and education
- Surveillance and information management
- Monitoring and evaluation

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Roles and Responsibilities of Public Health Sector (cont.)

Planning and Policy Development

- TB control programs should collaborate with community stakeholders to develop plan
- Written plan should be based on the following:
  - Local epidemiologic data
  - Availability of clinical and support services
  - Availability of fiscal resources
  - Current legal statutes and standards of care

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Roles and Responsibilities of Public Health Sector (cont.)

Planning and Policy Development (cont.)

Plan should

- Assign specific roles and responsibilities
- Define pathways of communication
- Assign sufficient human and financial resources
- Provide for expert consultation and oversight
- Provide guidance to TB laboratories

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Roles and Responsibilities of Public Health Sector (cont.)

Planning and Policy Development (cont.)

Plan should

- Ensure complete/timely contact investigations (CIs) are done; assist local providers in CIs and providing DOT
- Provide culturally appropriate info to patients
- Minimize financial and cultural barriers to TB control
- Ensure clinicians promptly report all suspected and confirmed TB cases

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Roles and Responsibilities of Public Health Sector (cont.)

Clinical and Diagnostic Services

Health department must ensure

- TB patients can access diagnostic/treatment services
- Completeness of TB-related services and continuity of care, regardless of where patient seeks care
- Standards of care are met

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Roles and Responsibilities of Public Health Sector (cont.)

Clinical and Diagnostic Services (cont.)

Health department must ensure

- Radiology and lab services readily accessible
- Radiograph and AFB results available within 24 hours
- All TB smear, culture, and drug-susceptibility results reported promptly by laboratories

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Roles and Responsibilities of Public Health Sector (cont.)

Training and Education

TB control programs should

- Provide training for TB control program staff
- Educate other HCWs, community members, public health officials, and policy makers
- Create and implement educational activities using resources from CDC, RTMCCs, NIH-supported TB curriculum centers, NTCA, and others

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Roles and Responsibilities of Public Health Sector (cont.)

Surveillance and Information Management

- Surveillance and information management systems should be priorities of all TB control programs
- Patient care can be improved through standardized data collection and test result tracking
- Other benefits include ready access to details of treatment regimens, DOT administration, drug-drug interactions

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Roles and Responsibilities of Public Health Sector (cont.)

Monitoring and Evaluation

- Evaluation provides programs evidence-based means of improving TB control strategies
- Develop evaluation priorities based on local TB challenges and how services are organized
- First priority for evaluation should be on key TB control strategies:
  - Identify and treat all persons with infectious TB disease
  - Find contacts and others at high risk; offer therapy
  - Interrupt transmission in high-risk settings

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Roles and Responsibilities of Specific Private Sector Providers

Private sector includes

- Clinicians
- Community health centers
- Hospitals
- Academic institutions
- Medical professional organizations
- Community-based organizations
- Correctional facilities
- Civil surgeons
- Pharmaceutical and biotechnology industries

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Clinicians

- Understand prevalent medical conditions of their patient populations
- Be aware of local TB reporting laws
- Know procedures for suspected TB: diagnose, hospitalize, report case, plan treatment
- Follow current guidance for screening, diagnosis, treatment of TB and LTBI
- Be able to administer TB tests, rule out TB disease, administer treatment

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Community Health Centers

- Ensure staff ability to assess, diagnose, and start treatment for TB and LTBI
- Work closely with local physicians, hospitals, labs, and public health agencies
- Arrange for reporting of TB suspects; refer patients to necessary services

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Community Health Centers (cont.)

- Be aware of local programs providing TB services for high-risk patients
- Educate and motivate patients about implications of TB
- Establish recommended infection control practices

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Hospitals

- Develop infection control policies and plans to prevent transmission
- Promptly report suspected/confirmed TB cases
- Provide training to staff
- Ensure TB patients are discharged on a standard regimen and with follow-up plan

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Academic Institutions

- Incorporate TB into their curricula
- Serve as a community resource in TB management issues
- Partner with local public health agencies in TB control activities
- Provide leadership in conducting TB-related research

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Medical Professional Organizations

- Train/educate members regarding TB
- Provide professional leadership on clinical practice and control of TB
- Advocate for adequate TB control funding
- Promote global TB control; link U.S. health professionals with those outside the U.S.

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Roles and Responsibilities of Specific Private Sector Providers (cont.)

Role of Community Based Organizations

- Partner with local public health sector to facilitate access to services for target population
- Participate in advocacy/support activities
- Coordinate with public health sector to develop education materials tailored to their populations

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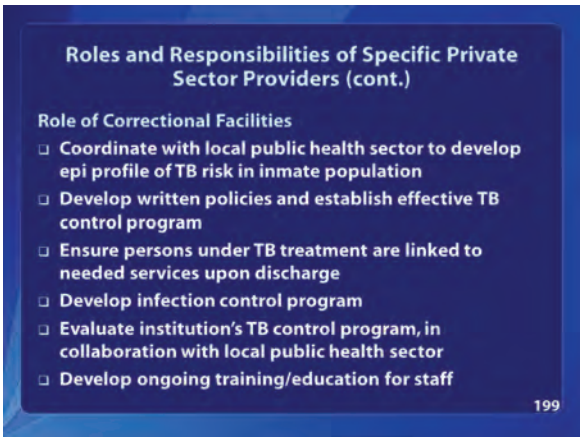
Roles and Responsibilities of Specific Private Sector Providers (cont.)
Role of Correctional Facilities
Coordinate with local public health sector to develop epi profile of TB risk in inmate population
Develop written policies and establish effective TB control program
Ensure persons under TB treatment are linked to needed services upon discharge
Develop infection control program
Evaluate institution's TB control program, in collaboration with local public health sector
Develop ongoing training/education for staff
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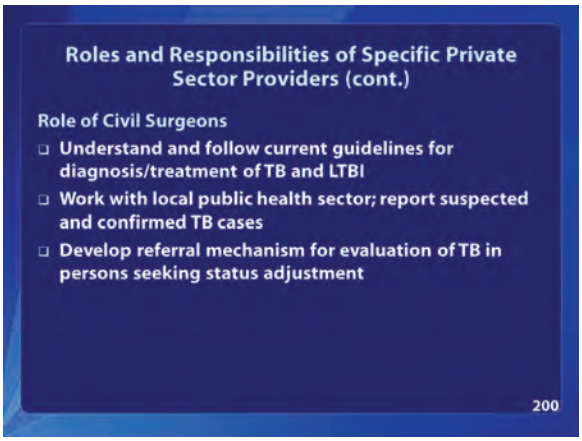
Roles and Responsibilities of Specific Private Sector Providers (cont.)
Role of Civil Surgeons
Understand and follow current guidelines for diagnosis/treatment of TB and LTBI
Work with local public health sector; report suspected and confirmed TB cases
Develop referral mechanism for evaluation of TB in persons seeking status adjustment
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Roles and Responsibilities of Specific Private Sector Providers (cont.)
Role of Pharmaceutical and Biotechnology Industries
Understand their role in developing tools for diagnosing, treating, preventing TB
Review costs/markets for new product development and potential funding sources
Join coalitions such as Global Partnership to Stop TB, Global Alliance for TB Drug Development, FIND
Work with other stakeholders to ensure access to products for patients
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Notes

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