Slide Set — Core Curriculum on Tuberculosis: What the Clinician Should Know

Text Only Version

Slide 1 (title slide). Core Curriculum on Tuberculosis: What the Clinician Should Know. Fifth edition 2011

Slide 2. Core Curriculum Contents

Overview of Tuberculosis (TB) Epidemiology in the United States

Transmission and Pathogenesis of TB

Testing for TB Infection and Disease

Diagnosis of TB Disease

Treatment for Latent TB Infection

Treatment for TB disease

TB Infection Control

Community TB Control

Slide 3 (title slide). Chapter 1. Overview of TB Epidemiology in the United States

Slide 4. 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

Slide 5. 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

Slide 6. 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

Slide 7. 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

Slide 8. TB Disease Trends in the United States

During resurgence, 1985–1992, reported TB cases increased every year

1993–2009: cases decreased

1993–2002: cases decreased 5%-7% annually

2003–2008 decline continued but at a more moderate 3%-5%

11,545 cases reported in 2009

Slide 9. Reported TB Cases, United States, 1982–2009

[Image: A graph illustrating U.S. TB trends, 1982–2009. It shows U.S. TB cases declining at a steady rate from 1982 until 1985, then shows several years of increasing case counts, reaching a peak in 1992. A bracket superimposed on the graph marks the start and end points (1985–1992) of the resurgence. Case counts began decreasing again in 1993, and 2009 marked the seventeenth year of decline in the total number of TB cases reported in the United States since the peak of the resurgence.]

Slide 10. TB Trends, United States

While TB is declining overall, high rates persist among some groups

Local epidemiology affects trends in individual areas

34 states have achieved annual rate ≤3.5/100,000 (elimination interim target for year 2000)

Slide 11. TB Case Rates, United States, 2009.

[Image: A map depicting U.S. TB case rates for 2009. For the decade leading up to 2009, a group of 34 states had a rate ≤3.5/100,000; 11 states and the District of Columbia had a rate above 3.8/100,000, the 2009 national

average; and a small group of states reported rates of 3.6–3.8, less than the national average but not meeting the year 2000 interim goal.]

Slide 12. 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 persons

2002: Foreign-born persons first accounted for majority of U.S. TB cases (51%); in 2009, accounted for 59%

1993–2009: TB in foreign-born persons was roughly level (7,000–8,000/year); in U.S.-born, dropped from >17,000 to 4,571

Slide 13. Percentage of TB Cases among Foreign-Born Persons in the U.S., 1999 and 2009.

States with ≥50% of cases in foreign born: from 13 states in 1999 to 31 states

States with ≥70% of cases in foreign born: from 2 states to 14 states (not shown on slide).

[Image: Side-by-side maps of the United States showing the percentage range of the total number of TB cases that occurred in foreign-born persons in each state for 1999 and 2009.]

Slide 14. Countries of Origin of Foreign-Born Persons Reported with TB, United States, 2009.

[Image: Pie chart showing the overall distribution of the countries of origin of foreign-born persons reported with TB in 2009, with the top seven highlighted. The seven top countries accounted for 62% of the total, with Mexico accounting for 23%; the Philippines, 12%; India, 8%; Vietnam; 8%; China, 5%; Guatemala, 3%; and Haiti, 3%. Persons from more than 135 other countries accounted for 2% or less of the total, but altogether accounted for 38% of foreign-born persons reported with TB.]

Slide 15. TB Rates in Racial and Ethnic Minorities Groups, 1993–2009.

[Image: Graph showing the trend in TB rates by race/ethnicity in the United States, 1993–2009. Asians and Pacific Islanders had the highest TB rates, with a rate of 41.2 per 100,000 beginning in 1993 and declining to 23.1 in 2009. Asians and Pacific Islanders also had the smallest percentage decline over the same time period (43%). Rates declined by at least 65% over the same time period in the other racial/ethnic groups, including non-Hispanic blacks or African Americans, Hispanics, American Indians and Alaska Natives, and non-Hispanic whites.]

Slide 16. Factors Contributing to Burden of Disease in Minorities

In foreign born, disease may result from infection in country of origin

Some minority groups have higher proportion of risk factors for exposure and for progression from infection to disease

Lower socioeconomic status and crowded housing linked to increased TB risk

Slide 17. HIV-Infected Persons, 1993-2009.

Persons coinfected with TB and HIV are at high risk of developing TB disease

Percentage of HIV coinfection (all ages) decreased, from 15% to 6%

Age group 25–44 decreased, from 29% to 10%

[Image: Graph illustrating estimated HIV coinfection in persons reported with TB, 1993–2009. These are minimum estimates because of incomplete reporting of HIV status. Two lines on the graph illustrate 1) a decrease in the percentage coinfection for all age groups, and 2) a more substantial decrease in percentage of coinfection among persons in the 25-44 age group.]

Slide 18. Multidrug-Resistant (MDR) TB Remains a Serious Public Health Concern.

MDR TB has decreased in foreign born and U.S. born, but much more in U.S. born

1993–2009, proportion of primary MDR TB in foreign born increased from 25% to 88%

[Image: Graph showing primary MDR TB in U.S.-born versus foreign-born persons. The percentage with primary MDR TB has declined among both groups, although the decline in the U.S.-born has been greater; as a result, the proportion of primary MDR TB cases reported in foreign-born persons has increased. Among U.S.-born, the percentage with primary MDR TB remained between 0.4% and 0.7% from 1998 through 2008 and was 0.3% in 2009. The percentage among foreign-born persons has fluctuated year by year, averaging approximately 1.5% from 1999 through 2009.]

Slide 19. Extensively Drug-Resistant (XDR) TB.

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.

[Image: A bar chart showing the annual number of XDR TB cases for 1993 to 2009. The most reported in a single year was 10 in 1993, while there were no cases reported in 2003 and 2009. There is no apparent trend in the number of XDR TB cases in the United States.]

Slide 20. 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

Slide 21. 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 high risk for infection or 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

Slide 22. (title slide). Chapter 2. Transmission and Pathogenesis of TB

Slide 23. 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

Slide 24. 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

[Image: Drawing of two facing figures, with their airway passages and lungs shown. Dots in the air between them represent droplet nuclei containing tubercle bacilli organisms. The organisms are spreading, via the droplet nuclei, from person to person.]

Slide 25. 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

Slide 26. Pathogenesis

Droplet nuclei containing tubercle bacilli are inhaled, enter the lungs, and travel to the alveoli

[Image: Drawing of a left-facing figure, with airway passages and lungs visible. Dots in the air in front of figure, in airways, and in lungs represent tubercle bacilli being inhaled, entering the lungs, and traveling to the alveoli.]

Tubercle bacilli multiply in the alveoli

[Image: A drawing showing the tiny air sacs, alveoli, at the end of the airway branches in the lungs. A cutaway view of one air sac shows that it contains bacilli.]

Slide 27. 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).

[Image: Drawing of the upper part of a human torso showing areas where TB can develop: brain, larynx, lymph nodes, lung, spine, bone, kidney.]

Slide 28. Pathogenesis (cont.)

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).

[Image: Drawing of an air sac in which special immune cells (macrophages) have formed a barrier shell / granuloma and surrounded the bacilli]

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.

[Image: Drawing of air sac with shell breaking down and bacilli escaping and multiplying]

Slide 29. 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

Slide 30. 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

Slide 31. 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

Slide 32. 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.

Slide 33. 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

Slide 34. 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

Slide 35. LTBI vs. TB Disease

Person with LTBI (Infected):

Has a small amount of TB bacteria in his/her body that are alive, but inactive

Cannot spread TB bacteria to others

Does not feel sick, but may become sick if the bacteria become active in his/her body

Usually has a TB skin test or TB blood test reaction indicating TB infection

Radiograph is typically normal

Sputum smears and cultures are negative

Should consider treatment for LTBI to prevent TB disease

Does not require respiratory isolation

Not a TB case

Person with TB Disease (Infectious):

Has a large amount of active TB bacteria in his/her body

May spread TB bacteria to others

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

Radiograph may be abnormal

Sputum smears and cultures may be positive

Needs treatment for TB disease

May require respiratory isolation

A TB case

Slide 36. 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

Slide 37. 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

[Image: Four nested/concentric ovals. The largest oval represents "All TB." The next largest is labeled "TB with any drug resistance." The third largest is "MDR TB* with drug resistance to at least the first-line drugs isoniazid and rifampin." The smallest oval is "XDR TB** with resistance to the first-line drugs isoniazid and rifampin and to specific second-line drugs."

*Often resistant to additional drugs

**Resistant to any fluoroquinolone and at least one of three injectable drugs, i.e., amikacin, kanamycin, or capreomycin)]

Slide 38. 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

Slide 39. 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

Slide 40. 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

Slide 41. TB Classification System

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

Slide 42. (title slide). Chapter 3. Testing for TB Infection and Disease

Slide 43. 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

Slide 44. 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

Slide 45. 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

Slide 46. Mantoux Tuberculin Skin Test

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

Slide 47. 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

[Image: Drawing of gloved hands holding a tuberculin syringe and injecting PPD into an arm. The drawing shows a discrete, pale elevation of the skin (wheal) has been formed.]

Slide 48. 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

[Image: Drawing of a hand holding a TST ruler and measuring the diameter of an induration. Only the induration is being measured; this is the correct way to read the TST reaction.]

Slide 49. 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

Slide 50. 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

Slide 51. 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 <4 years of age, or children and youth exposed to adults at high risk

Slide 52. 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

Slide 53. Factors that May Affect the Skin Test Reaction

Type of reaction: False positive
Possible cause:

Nontuberculous mycobacteria

BCG vaccination

Problems with TST administration

Type of reaction: False negative
Possible cause:

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

Slide 54. 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

Slide 55. 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

Slide 56. 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

Slide 57. 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

Slide 58. 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

Slide 59. 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

Slide 60. 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

Slide 61. 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

Slide 62. 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

Slide 63. 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

Slide 64. 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

Slide 65. 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.

Slide 66. 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

Slide 67. 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

Slide 68. (title slide). Chapter 4. Diagnosis of TB Disease

Slide 69. Medical Evaluation for TB

Medical history

Physical examination

Test for TB infection

Chest radiograph

Bacteriologic examination

Slide 70. 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

Slide 71. 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

Slide 72. 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

Slide 73. 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

Slide 74. 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

[Image: photo of Mantoux tuberculin skin test materials]
[Image: photo of QuantiFERON-TB Gold In-Tube test kit]
[Image: photo of T-Spot.TB test kit]

Slide 75. 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

Slide 76. Chest Radiograph with Lower Lobe Cavity

[Image: Chest radiograph with arrows pointing to cavity in lower lobe]

Slide 77. 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

Slide 78. 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

Slide 79. Medical Evaluation for TB (cont.)

5. Bacteriologic Examination of Specimens

Specimen collection

AFB smear classification

NAA testing

Culture and identification

Drug-susceptibility testing

[Image: Patient coughing up sputum into a tube; supervising health care worker is wearing respirator.]
[Image: Photo of Lowenstein-Jensen agar plate and tube (slant). Either can be used to culture clinical specimens for examination when extrapulmonary TB is suspected. The green substance in each is agar, on which the bacteria are grown.] Kit Whitworth helped with this one.
[Image: Patient undergoing bronchoscopy; the two health care workers performing the procedure are wearing respirators]

Slide 80. 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

[Image: A TB patient has coughed up sputum and is spitting it into a sterile container. The patient is sitting in a special sputum collection booth that, if properly ventilated, prevents the spread of tubercle bacilli.]

Slide 81. 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

Slide 82. 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+

Slide 83. AFB Smear

AFB (shown in red) are tubercle bacilli
[Image: Photo of acid-fast bacilli (AFB) smear. Detection of AFB in stained and acid-washed smears examined microscopically may provide the initial bacteriologic evidence of the presence of mycobacteria in a clinical specimen.]

Slide 84. 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

Slide 85. Nucleic Acid Amplification (NAA) Test

[Image: Photo of contents of NAA test kit]

Slide 86. 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

Slide 87. Colonies of M. tuberculosis Growing on Media
[Image: Photo showing several light-colored, granular clusters or colonies of M. tuberculosis]

Slide 88. 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

Slide 89. Drug-Susceptibility Testing

[Image: Photo of one of the liquid broth-based methods available for performing rapid drug-susceptibility testing for primary drugs (Becton Dickinson MGIT 960 tubes).]

Slide 90. 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

Slide 91. 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

Slide 92. 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

Slide 93. 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

Slide 9. (title slide). Chapter 5. Treatment for Latent Tuberculosis Infection

Slide 95. Treatment for Latent TB Infection (LTBI)

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

Slide 96. 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

Slide 97. 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 countries or regions (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

Slide 98. 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

Children <4 yrs of age; children/adolescents exposed to adults in high-risk categories

Slide 99. Candidates for Treatment of LTBI (cont.)

Low-risk persons with positive IGRA test or TST reaction of ≥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

Slide 100. Close Contacts with Negative IGRA or TST Results

Some contacts should be evaluated and treated for LTBI even with negative TB test results:

Children under 4 yrs of age

Immunosuppressed persons

Others at high risk for progressing to 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

Slide 101. 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

Children should always receive 9 months of therapy

Slide 102. LTBI Treatment Regimens

Isoniazid (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

Not recommended for children, HIV infected, persons whose x-rays suggest previous TB

Slide 103. Adverse Reactions to INH

Use of INH is associated with some adverse reactions

Peripheral neuropathy – give vitamin B6 if patient has risk factors, or if signs/symptoms develop

Elevation of liver enzymes – discontinue INH if adverse reactions develop, or if liver enzyme levels exceed 3X normal with symptoms, or 5X upper limit of normal with no symptoms

Fatal hepatitis – pregnant/postpartum women at increased risk; monitor closely

Slide 104. Rifampin (RIF)

Alternative to INH is 4 months daily RIF:120 doses within 6 months

Use of RIF contraindicated with some combinations of antiretroviral therapy

In some instances where RIF cannot be used, rifabutin can be substituted

Slide 105. Recommendations 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 be included in multidrug regimens for treatment of TB as described in TB disease treatment section

Slide 106. LTBI Treatment Regimens for Specific Situations

HIV-Infected Persons

Consult an expert in managing HIV and TB

INH daily for 9-mo, rather than 6-mo, is optimal: 270 doses within 12 months

RIF is generally contraindicated for persons taking protease inhibitors or delavirdine

Rifabutin with dose adjustments can sometimes be substituted for RIF

Slide 107. 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

Treat only after active disease excluded with sputum testing

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

Slide 108. LTBI Treatment Regimens for Specific Situations (cont.)

Contacts of Persons with Multidrug-Resistant TB

Consider risk for progressing to MDR disease before recommending LTBI treatment

When prescribing treatment for these contacts, consult an MDR TB expert

Slide 109. LTBI Treatment Regimens for Specific Situations (cont.)

Pregnancy and Breast-Feeding

9 months of INH daily or twice weekly; give with vitamin B6

If cannot take INH, consult with TB expert

Women at high risk for progression to TB disease should not delay LTBI treatment; monitor carefully

Breast-feeding not contraindicated

Slide 110. Patient Monitoring

Before starting treatment for LTBI, clinicians should

Exclude possibility of disease (symptoms, chest radiograph)

Determine if patient has history of treatment for LTBI or disease

Determine contraindications to treatment

Obtain information about current and previous drug therapy, including adverse reactions

Recommend HIV testing, unless the patient declines (opt-out screening)

Slide 111. 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

Slide 112. 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

Slide 113. 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

Slide 11. (title slide). Chapter 6. Treatment of TB Disease

Slide 115. 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

Slide 116. 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

Slide 117. 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

Slide 118. Case Management

Strategy to ensure patients complete treatment; includes

Assigning responsibility to case manager

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

Slide 119. 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

[Image: Health care worker and patient meeting outdoors; patient holds pills and drink.]
[Image: Display of examples of incentives and enablers.]
[Image: Health care worker and patient meeting in clinic; both wear respirators; pill bottles are on desk.]

Slide 120. 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

ρ-Aminosalicylic acid

Ethionamide

Slide 121. 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

[Image: photo of 1 white INH pill, 2 red RIF capsules, 3 white PZA pills, 3 white EMB pills]

Slide 122. 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

Slide 123. 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.

Slide 124. 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

Slide 125. 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

Slide 126. 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

Slide 127. 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

Slide 128. 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- or 9-mo therapy; 6 mo is used for most patients

Slide 129. 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

Slide 130. Treatment Interruptions

Treatment interruption is common

Restart or continue therapy based on when interruption occurred and duration of interruption

Slide 131. 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

Slide 132. 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

Slide 133. 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

Slide 134. 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 B6 supplementation recommended if taking INH

Slide 135. 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

Slide 136. 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

Slide 137. Treatment Regimens for Specific Situations (cont.)

HIV-Infected Persons (cont.)

If possible, use a rifamycin for the entire course of therapy, along with ARV therapy

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

Slide 138. 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

Slide 139. Pregnancy in HIV-Infected Women

Treatment is complicated in HIV-infected pregnant women with TB

Pregnancy alters distribution/metabolism of some drugs, including ARV drugs

Protease inhibitor concentrations reduced in pregnancy

Slide 140. 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

Slide 141. 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

Slide 142. 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.

Slide 143. 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

Slide 144. 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

Slide 145. Patient Monitoring

Recommended Examinations for Baseline Monitoring

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 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

Slide 146. Patient Monitoring (cont.)

Monitoring During Treatment
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 disease:
Evaluation depends on

Sites involved

Ease with which specimens can be obtained

Slide 147. 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

Slide 148. 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

Slide 149. Evaluating Response to Treatment (cont.)

Monitor for adverse reactions

Common adverse reactions include

Gastrointestinal problems

Hepatitis

Rash

Fever

Slide 15. (title slide). Chapter 7. TB Infection Control

Slide 151. 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.

Slide 152. 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 month

Slide 153. 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

Slide 154. 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

Slide 155. 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

Slide 156. 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

Slide 157. 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

[Image: doctor and patient seated at a desk in a clinic setting, facing each other; doctor is speaking; both wear personal respiratory protection]

Slide 158. 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

[Image: Patient seated alone in clinic setting, wearing personal respiratory protection and reading patient literature]

Slide 159. 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

Slide 160. 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

Slide 161. 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

Slide 162. 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

Slide 163. 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)

[Image: Diagram of TB exam or counseling room, with furniture arranged so that health care worker sits near source of fresh air supplied to room (vented door) and infectious patient sits near open window]

Slide 164. 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

[Image: Diagram of AII room, showing bed, private bathroom, window, door, and sources of air supply and air exhaust]

Slide 165. 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

Slide 166. 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

Slide 167. 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

Slide 168. Respirator for Health Care Workers

[Image: Health care worker wearing a respirator]
[Image: Display of several types of respirators]
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.

Slide 169. Surgical Mask for Persons with Infectious TB disease

[Image: TB patient wearing a surgical mask]
[Image: Display of several surgical masks]
Surgical masks

Designed to stop droplet nuclei from being spread (exhaled) by the patient.

Should NOT be worn by the health-care worker.

Slide 170. 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

Slide 171. 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 4 years) or immunocompromised persons in household

Patient willing to refrain from travel outside the home except for health-care visits

Slide 172. 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

Slide 173. (title slide). Chapter 8. Community TB Control

Slide 174. 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

Slide 175. 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

Slide 176. 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

Slide 177. 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

Slide 178. 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

Slide 179. 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

Slide 180. 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

Slide 181. 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

Slide 182. 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 interactions

Slide 183. 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

Slide 184. 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

Slide 185. 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

Slide 186. 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

Slide 187. 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

Slide 188. 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

Slide 189. 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

Slide 190. 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.

Slide 191. 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

Slide 192. 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

Slide 193. 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

Slide 194. 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