Overview of Tuberculosis
Epidemiology, Transmission, Clinical Presentation, and Treatment
Tuberculosis

- Airborne disease caused by the bacterium *Mycobacterium tuberculosis* (*M. tb*)
- *M. tb* complex (MTBC) includes other mycobacteria that can cause TB: *M. bovis*, *M. africanum*, *M. canettii*, *M. microti*
- Expelled when a person with infectious TB coughs, sneezes, shouts, or sings
- Transmission occurs when droplet nuclei (airborne particle about 1-5 microns) are inhaled and reach the alveoli of the lungs, via nasal passages, respiratory tract, and bronchi
- 2 billion people infected worldwide (1/3 of the world’s population)
- Estimated 8.7 million new cases in 2011
- 13% of new cases co-infected with HIV
- 1.4 million deaths in 2011

TB is a Global Disease

Estimated tuberculosis (TB) incidence rates, 2011

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TB Case Rates,* United States, 2011

*Cases per 100,000.

Reported TB Cases
United States, 1982–2011

No. of Cases

Year


Number of TB Cases in U.S.-born vs. Foreign-born Persons, United States, 1993–2011

No. of Cases

# TB Infection versus TB Disease

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

• Sharing air space with someone sick with TB disease (e.g., live, work, or play together)
• Crowded living conditions
• Residency or travel in a country with a high-incidence of TB disease
• High risk occupations including laboratory and health care jobs
Risk of Progression to TB Disease

• 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
Risk Factors for TB Disease

• Low socioeconomic status
• Homelessness
• Diseases, conditions or drugs that weaken the immune system
  – Cancer
  – Transplantation
  – Malnutrition
  – Diabetes
  – Alcoholism
  – HIV infection
    • TB is the leading cause of death worldwide in HIV infected individuals
    • 10% lifetime risk for developing active TB among HIV uninfected
    • 10% annual risk for developing active TB among HIV infected
• Major surgical procedures may occasionally trigger dissemination
Signs and Symptoms of TB Disease

• Extrapulmonary TB
  – *M. tuberculosis* can infect any organ of the body
  – Symptoms vary by site of disease

• Pulmonary TB
  – Cough >2 weeks
    • often productive (sputum), can be bloody
  – Fever
  – Night sweats
  – Weight loss
  – Chest pain
Diagnosis of TB Disease

• Signs and Symptoms consistent with TB
• Chest X-ray
• Clinical Judgment
• Bacteriology
  – AFB smear microscopy
  – Nucleic Acid Amplification Testing (NAAT)
  – Culture and Identification
  – Drug susceptibility testing (DST)
TB treatment Regimens

• TB Infection – LTBI treatment options
  – 9 months isoniazid
  – 4 months rifampin
  – 3 months isoniazid plus rifapentine

• TB Disease – pulmonary, drug susceptible TB, 6-month standard regimen
  – Intensive phase: 2 months isoniazid, rifampin, ethambutol, and pyrazinamide
  – Continuation phase: 4 months of isoniazid and rifampin
Drug Resistant TB

- Multidrug resistant TB (MDR TB)—resistant to at least rifampin (RIF) and isoniazid (INH)
- 3.7% of new cases worldwide are estimated to have MDR TB (20% among previously treated TB cases)
- 50% of all MDR cases are estimated to occur in India and China
- Globally, outcome data for MDR TB is limited. Highest death rates among MDR TB patients seen in African region (19%)
- Extensively drug resistant TB (XDR TB)—MDR TB plus resistance to at least 1 fluoroquinolone and 1 second-line injectable drug

Global MDR TB New Cases

Percentage of new tuberculosis cases with MDR-TB*

* MDR-TB: multidrug-resistant tuberculosis (resistance to, at least, isoniazid and rifampicin)

Note: Figures are based on the most recent year for which data have been reported, which varies among countries.


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Global MDR TB Previously Treated Cases

Percentage of previously treated tuberculosis cases with MDR-TB*

* MDR-TB: multidrug-resistant tuberculosis (resistance to, at least, isoniazid and rifampicin)
Note: Figures are based on the most recent year for which data have been reported, which varies among countries.

MDR TB Treatment

- 2 years of therapy with second-line drugs
- Expensive and drugs may not be readily available
- Second-line drugs often cause severe adverse effects and are very difficult for patients to tolerate
- Increasing resistance to second-line drugs due to frequent changes in regimens (often due to toxicity), poor adherence, too few effective drugs available for regimen

WHO; Guidelines for the programmatic management of drug-resistant tuberculosis: Emergency Update 2008
TB Testing Algorithm

- Process Specimen
- AFB Smear Microscopy (TAT* 24 hours)
- Inoculate Media
- Species Identification (TAT 2–6 weeks)
- Drug Susceptibilities (TAT 2-3 weeks)
- Molecular Detection of Resistance (TAT 48–72 hours)

Rapid Detection
- NAAT (TAT 48 hours)

*Turnaround time (TAT)
The Laboratory is Essential

- Laboratory is a critical partner in the diagnosis of TB
- Rapid, reliable results are essential for early detection of MTBC to prevent ongoing transmission
- Drug susceptibility test results identify drug resistance and help guide the clinician in providing appropriate treatment
- Laboratory results important for monitoring patient response to therapy