Tuberculosis: The Epidemiology, Diagnosis and Prevention

Assisted Living Residence Advisory Committee Meeting
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April 28, 2011
Tuberculosis Epidemiology

~ 2 billion people are infected - A Third of the World!

10% will develop active TB in their lifetime

→ 10 million new active TB / yr
→ 2 million deaths / yr
WHO Global Surveillance Report, 2008

- 10.2 million new cases
- 14.4 million prevalent cases
- 1.5 million deaths
- 500,000 cases of MDR TB

www.who.int/tb
Reported TB Cases United States, 1982–2009

Number of TB Cases in U.S. vs Foreign-born Persons United States, 1996–2009
TB in Colorado: 2001-2010

Cases of Active TB by Year of Report

<table>
<thead>
<tr>
<th>Year</th>
<th># of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>138</td>
</tr>
<tr>
<td>2002</td>
<td>104</td>
</tr>
<tr>
<td>2003</td>
<td>111</td>
</tr>
<tr>
<td>2004</td>
<td>127</td>
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<td>2005</td>
<td>101</td>
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<tr>
<td>2006</td>
<td>124</td>
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<tr>
<td>2007</td>
<td>111</td>
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<tr>
<td>2008</td>
<td>103</td>
</tr>
<tr>
<td>2009</td>
<td>85</td>
</tr>
<tr>
<td>2010</td>
<td>71</td>
</tr>
</tbody>
</table>
State of Colorado
2010 Tuberculosis Cases by County

Explanation:
Shaded areas indicate counties reporting Tuberculosis cases in 2010.
The total number of cases is indicated as a red number.

Map prepared by CHEIS/GIS 3/11
TB history

- Leading cause of death in the U.S. during the nineteenth and early twentieth centuries
- Until Robert Koch's discovery of the TB bacteria in 1882, many scientists believed that TB was hereditary and could not be prevented
- Koch’s discovery brought hopes for a cure but also bred fear of contagion
- A person with TB was frequently labeled an outcast
What is TB?

- TB is a communicable disease caused by the bacteria Mycobacterium tuberculosis (MTB)
- It is spread person to person by breathing in infectious particles
- These particles are produced when a person with infectious TB coughs, sneezes, speaks, or sings
Transmission & pathogenesis

- Spread by droplet nuclei
- Close contacts at highest risk of becoming infected
- Once infected, 5% will develop TB disease within a year or two and another 5% will develop disease later in life
Risk Factors for Infection

1. Persons born or lived where TB is common
   Central and South America, Africa, Eastern Europe, Asia and the Pacific Islands

2. Close Contacts to persons with active TB

3. Elderly U.S. born (>70)
LTBI vs. pulmonary TB disease

- **Latent TB Infection**
  - Tuberculin skin test (TST) positive
  - Negative chest radiograph
  - No symptoms or physical findings suggestive of TB disease

- **Pulmonary TB Disease**
  - TST usually positive
  - Chest radiograph may be abnormal
  - Symptomatic
  - Respiratory specimens may be smear or culture positive
Inactive (Latent) TB Infection

- LTBI- asymptomatic state in people infected with *MTB*

- Live, inactive TB organisms are “walled off” inside the body by the immune system

- Person with LTBI doesn’t feel sick & is not contagious, but they *may* have abnormal CXR

- TB can reactivate & begin to multiply at anytime after the initial infection (this may occur decades later)
Latent TB Infection (LTBI)

- For adults with untreated LTBI & intact immunity the estimated risk of developing active TB is 5% - 10% over a lifetime (50% of those in 1st 2 yrs after infection)

- With HIV co-infection risk is 5%-10% per year

- Infants under a year have a 25% - 40% likelihood

- Adolescents & elderly also at higher risk
Latent TB Infection

- Evaluate persons for risk factors
- Test those with a risk factor using the TST or Interferon-gamma release assay (IGRA)
- Evaluate those with a (+) TST or IGRA by doing a symptom history and chest X-ray
- Refer to PCP or local public health for treatment recommendations and medication administration
Diagnosing LTBI

- The Mantoux tuberculin skin test (TST) is the most common method
- A TST reaction can take 3-12 weeks after TB infection to become positive
- A negative TST in a symptomatic patient does NOT rule out TB
Administering the Tuberculin Skin Test (TST)

- Inject 0.1 ml of tuberculin intradermally
- Produce a wheal 6-10 mm in diameter
Tuberculin Skin Test Reading

- The test is read after 48-72 hours by a trained health care worker.
- Diameter of the induration (firmness) is measured in millimeters (mm).
- Erythema (redness) is not measured.
TST for LTBI Diagnosis

Criteria for a Positive Reaction

<table>
<thead>
<tr>
<th>≥5 mm</th>
<th>≥10 mm</th>
<th>≥15 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV infection</td>
<td>Recent immigrants</td>
<td>No risk</td>
</tr>
<tr>
<td>Contact to active TB case</td>
<td>Injection drug users</td>
<td></td>
</tr>
<tr>
<td>Abnormal CXR</td>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>Immunosuppression</td>
<td>High-risk medical conditions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residents and employees of jails/nursing homes, hospitals</td>
<td></td>
</tr>
</tbody>
</table>

Note: Skin test conversion is an increase of ≥10 mm within a 2-year period
2 Commercially Available IGRAs

T-SPOT. TB

Oxford Immunotec
Harnessing the power of T cell measurement

QFT
QuantiFERON®-TB Gold In-Tube
Changing the way the world looks at TB
Interferon-gamma Release Assays

- Blood test for detecting TB infection
- Requires 1 visit (TST requires 2 visits)
- Results less subject to reader bias and error
- More specific with less cross-reaction with non-tuberculosis mycobacterium and BCG than the TST
Thoughts

- IGRAs are the preferred test in:
  - BCG vaccinated
  - Persons unlikely to get a TST completed

- Implementing IGRAs requires careful thought about logistical hurdles but can be done

- IGRAs may be less accurate (i.e. specific) in low risk populations than previously reported

- Additional longitudinal data is needed in all populations to understand the true implications of a positive test
TB Prevention

- Diagnosis and treatment of latent TB infection (LTBI) has been an important component of TB control in the U.S. for more than 40 years.
- 1965: American Thoracic Society recommended treatment of LTBI for those with previously untreated TB, tuberculin skin test (TST) converters, and young children.
- 1967: Recommendations expanded to include all TST positive reactors.
Recommended Treatment for Latent TB Infection

- INH daily for 9 months
- Rifampin daily for 4 months
Risk Factors for Progression

- HIV
- **Fibrotic CXR c/w prior TB**
- Immunosuppression (transplants, TNF-alpha inhibitors)
- Recent close contact to active TB

- **Diabetes**
- **Chronic renal failure**
- Silicosis
- Leukemia / lymphoma
- Head/neck cancer
- Wt loss > 10%
- gastric bypass surgery
Common sites of TB disease

- Lungs
- Pleura
- Central nervous system
- Lymphatic system
- Genitourinary systems
- Bones and joints
- Disseminated (miliary TB)
Systemic symptoms of TB

- Fever
- Chills
- Night sweats
- Appetite loss
- Weight loss
- Fatigue
Symptoms of pulmonary TB

- Productive, prolonged cough (duration of >3 weeks)
- Chest pain
- Hemoptysis
Treatment of Active TB Disease
Usually patients with active TB are no longer considered infectious if:

- They are on effective treatment (as demonstrated by M. tuberculosis susceptibility results) for >2 weeks
- Their symptoms have diminished **and**
- There is a mycobacteriologic response (e.g., decrease in grade of sputum smear positivity detected on sputum-smear microscopy)
Licensed facilities must be in compliance with state licensure standards

- **P0114, 104(3)(a)(i)(B)**
  TB test before direct contact with residents

- **P1144, 8.495.6.F.5.a.iii (ACF)**
  Documentation of annual TB testing
CDC recommendations for screening in Assisted Living Facilities

- If less than 3 TB patients per year, consider facility low risk and conduct baseline two-step TST or IGRA
- Repeat TST or IGRA only if unprotected exposure to TB occurs
TB resources

- CDC Division of TB Elimination web site
  - [http://www.cdc.gov/nchstp/tb/default.htm](http://www.cdc.gov/nchstp/tb/default.htm)
  - Interactive Core Curriculum on Tuberculosis: What the Clinician Should Know
  - Self Study Modules on Tuberculosis

- CDPHE TB Program web site
  - [http://www.cdphe.state.co.us/dc/TB/tbhome.html](http://www.cdphe.state.co.us/dc/TB/tbhome.html)

- CDPHE TB Program – 303.692.2638
Questions?