Epidemiology of Tuberculosis

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Disclosures

• Relevant Financial Relationships: None

• Off-Label/Investigational Uses: None
Learning Objectives

☑ Describe the tuberculosis (TB) epidemic in terms of susceptible groups

☑ Describe major factors that will affect future trends in TB
Latent TB Infection vs. Active TB Disease

**Latent TB Infection (LTBI):**
- Infected with TB bacteria that are not active
- No symptoms of TB
- Not infectious
- Not reported to MDH

**Active TB Disease (TB Case):**
- Infected with actively replicating TB bacteria
- Has signs/symptoms of TB
- Potentially infectious
- Requires multidrug treatment
- Reported to MDH
Persons at Risk for TB Infection

- Close contacts of infectious TB cases
- Foreign-born persons from TB endemic areas
- Visitors to TB endemic areas
- Residents/employees of congregate settings
- Healthcare workers
- Certain subpopulations with high TB transmission rates

Adapted from CDC
Persons at Higher Risk for Progression from Latent TB Infection (LTBI) to Active TB

- HIV-infected
- Recently infected with TB
- Fibrotic changes on CXR
- Immunosuppressed
- Substance abusers
- Cigarette smokers

Adapted from CDC
Persons at Higher Risk for Progression from Latent TB Infection (LTBI) to Active TB (cont’d)

• Children under age 5
• Persons with certain medical conditions:
  • Diabetes
  • Silicosis
  • Chronic renal failure
  • Certain types of cancers
  • Gastrectomy/intestinal bypass
  • Underweight

Adapted from CDC
**TB TRIVIA #1:**

How much of the world’s population is estimated to have latent TB infection?

a. $\frac{1}{2}$

b. $\frac{1}{4}$

c. $\frac{1}{3}$

d. $\frac{1}{5}$

e. $\frac{2}{3}$
TB in the World, 2014

- 1/3 of the world’s population has LTBI
- 9.6 million people diagnosed with TB disease
- 1.5 million died from TB
  - 27% (400,000) were HIV+
- 80% of reported TB cases occurred in 22 countries
  - Largest number in SE Asia/W. Pacific
  - Highest TB case rates in sub-Saharan Africa
- 480,000 people developed MDR-TB
- XDR-TB now found in 105 countries
- TB incidence and death rates are ↓

Source: WHO, 2015
Number of MDR-TB cases estimated to occur among notified pulmonary TB cases, 2014

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Epidemiology of TB in the United States, 2014
Reported TB Cases
United States, 1982–2014*

*Updated as of June 5, 2015.
TB Case Rates by Race/Ethnicity,*
United States, 2003–2014**

*All races are non-Hispanic.
**Updated as of June 5, 2015.
**TB TRIVIA #2:**

Among new foreign-born cases in the U.S. in 2014, what was the top country of birth?

A. China  
B. India  
C. Philippines  
D. Mexico  
E. Vietnam
Countries of Birth of Foreign-born Persons Reported with TB, United States, 2014

- Mexico (21%)
- Philippines (12%)
- India (8%)
- Vietnam (8%)
- China (7%)
- Guatemala (3%)
- Haiti (3%)
- Other Countries 39%

Total: 100%
TB Cases by Residence in Correctional Facilities, Age ≥15, United States, 1993-2014*

No. of Cases

Percentage

*Updated as of June 5, 2015.
Note: Resident of correctional facility at time of TB diagnosis.
TB Cases Reported as Homeless in the 12 Months Prior to Diagnosis, Age ≥15, United States, 1993-2014*

*Updated as of June 5, 2015.
Note: Homeless within past 12 months of TB diagnosis.
Primary MDR TB in U.S.-born vs. Foreign-born Persons United States, 1993 – 2014*

*Updated as of June 5, 2015.
Note: Based on initial isolates from persons with no prior history of TB. MDR TB defined as resistance to at least isoniazid and rifampin.
Extensively Drug-Resistant (XDR) TB

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

![Bar chart showing XDR TB case count defined on initial DST by year, 1993–2014.]

* Drug susceptibility test.
** Updated as of June 5, 2015.

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.
Epidemiology of TB in Minnesota
## Tuberculosis Morbidity and Mortality, Minnesota, 2010-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>No. Cases (Rate)*</th>
<th>No. Deaths**(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>135 (2.5)</td>
<td>3 (2%)</td>
</tr>
<tr>
<td>2011</td>
<td>137 (2.6)</td>
<td>9 (7%)</td>
</tr>
<tr>
<td>2012</td>
<td>162 (3.0)</td>
<td>4 (2%)</td>
</tr>
<tr>
<td>2013</td>
<td>151 (2.8)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>2014</td>
<td>147 (2.7)</td>
<td>3 (2%)</td>
</tr>
</tbody>
</table>

* Avg: 146 (2.7)  
** Avg: 2.9%

* Cases per 100,000 population. Rates calculated using state population estimates from the U.S. Census Bureau.  
**Represents only deaths due to TB disease or TB drug-induced toxicity
## Tuberculosis Morbidity

**States Covered by Mayo RTMCC, 2014**

<table>
<thead>
<tr>
<th>State</th>
<th>No. Cases</th>
<th>TB Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>54</td>
<td>1.7</td>
</tr>
<tr>
<td>IL</td>
<td>320</td>
<td>2.5</td>
</tr>
<tr>
<td>IN</td>
<td>108</td>
<td>1.6</td>
</tr>
<tr>
<td>MI</td>
<td>105</td>
<td>1.1</td>
</tr>
<tr>
<td>MN</td>
<td>147</td>
<td>2.7</td>
</tr>
<tr>
<td>MT</td>
<td>6</td>
<td>0.6</td>
</tr>
<tr>
<td>ND</td>
<td>15</td>
<td>2.0</td>
</tr>
<tr>
<td>OH</td>
<td>156</td>
<td>1.3</td>
</tr>
<tr>
<td>SD</td>
<td>8</td>
<td>0.9</td>
</tr>
<tr>
<td>WI</td>
<td>47</td>
<td>0.8</td>
</tr>
<tr>
<td>WY</td>
<td>2</td>
<td>0.3</td>
</tr>
</tbody>
</table>

* No. TB cases per 100,000 population

Source: CDC
Tuberculosis Incidence Rates per 100,000 Population, U.S. and Minnesota, 2000-2014

Cases per 100,000

Year of Diagnosis

Healthy People 2010 and 2020 objectives
TB TRIVIA #3:
What MN county reported the 3rd highest number of cases from 2010-2014?

A. Dakota
B. Olmsted
C. Scott
D. Stearns
E. Anoka

Dakota  Olmsted  Scott  Stearns  Anoka
20%  20%  20%  20%  20%
Tuberculosis Disease: Minnesota, 2010 – 2014

Hennepin: 299
Ramsey: 169
Suburban metro: 99
Greater MN: 165
Total: 732

Anishinaabe reservation or Dakota community
Number of Cases and Incidence of TB by Race/Ethnicity, Minnesota, 2010-2014

* Race categories do not include persons of Hispanic/Latino origin.
† Rate per 100,000 population. Calculated using population estimates from the U.S. Census Bureau.
Tuberculosis Cases by Age Group and Place of Birth, Minnesota, 2010-2014

Place of Birth

Percentage of Cases

- Foreign-Born
  - < 5 yrs
  - 5 - 14 yrs
  - 15 - 24 yrs
  - 25 - 44 yrs
  - 45 - 64 yrs
  - >= 65 yrs

- U.S.-Born
  - < 5 yrs
  - 5 - 14 yrs
  - 15 - 24 yrs
  - 25 - 44 yrs
  - 45 - 64 yrs
  - >= 65 yrs
Percentage of Foreign-Born Tuberculosis Cases, U.S. and Minnesota, 2005-2014

- MN: Ave: 81%
- US: Ave: 61%

Percentage of Cases: 0, 20, 40, 60, 80, 100
## Tuberculosis Cases by Race/Ethnicity and Place of Birth, Minnesota, 2010-2014

<table>
<thead>
<tr>
<th>Race / Ethnicity*</th>
<th>Foreign-Born Cases No. (%)</th>
<th>U.S.-Born Cases† No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>15 (2)</td>
<td>59 (42)</td>
</tr>
<tr>
<td>Black</td>
<td>308 (52)</td>
<td>35 (25)</td>
</tr>
<tr>
<td>Asian</td>
<td>211 (36)</td>
<td>14 (10)</td>
</tr>
<tr>
<td>Native American / Alaska Native</td>
<td>0</td>
<td>17 (12)</td>
</tr>
<tr>
<td>Multi-racial</td>
<td>0</td>
<td>1 (&lt;1)</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>59 (10)</td>
<td>13 (9)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>593 (100)</strong></td>
<td><strong>139 (100)</strong></td>
</tr>
</tbody>
</table>

*Race categories do not include persons of Hispanic/Latino origin.

†Includes U.S.-born children of foreign-born parents
TB TRIVIA #4:

Among foreign-born cases in MN from 2010-2014, most common country of birth?

A. India
B. Vietnam
C. Laos
D. Mexico
E. Somalia
Foreign-Born Tuberculosis Cases by Country of Birth, Minnesota, 2010-2014

- Somalia: 29%
- Ethiopia: 12%
- Laos: 9%
- Mexico: 6%
- India: 6%
- Vietnam: 5%
- Kenya: 4%
- Other: 29%

N = 593
### Foreign-Born Tuberculosis Cases by Region of Birth and Year of Diagnosis, Minnesota, 2010-2014

<table>
<thead>
<tr>
<th>Region of Birth</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>South/Southeast Asia</td>
<td>30</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>50</td>
<td>45</td>
<td>40</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>East Asia/Pacific</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Latin America/Caribbean</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Other*</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*“Other” includes: Eastern Europe, North Africa/Middle East, and Western Europe.*
What % of MN cases from 2010-2014 were pulmonary?

A. 30%
B. 41%
C. 50%
D. 63%
E. 70%
Tuberculosis Cases by Site of Disease, Minnesota, 2010-2014

- Pulmonary: 51%
- Extrapulmonary: 37%
- Both: 12%

63% Pulmonary

Most common extrapulmonary sites:
- Lymphatic (54%)
- Musculoskeletal (14%)
- Pleural (11%)

*A person can have more than one extrapulmonary site

N = 732
Tuberculosis Cases by Site of Disease and Place of Birth, Minnesota, 2010-2014

- Foreign-Born:
  - Pulmonary only: 47%
  - Extrapulmonary*: 53%

- U.S.-Born:
  - Pulmonary only: 72%
  - Extrapulmonary*: 28%

* Includes cases with or without concurrent pulmonary disease
Tuberculosis Cases by Risk Category* and Place of Birth, Minnesota, 2010-2014

- Recent contact: 22%
- Other medical condition**: 18%
- Substance abuse†: 19%
- Healthcare worker: 7%
- HIV-infected: 3.5%
- Homeless: 7%
- Long-term care resident: 3%
- Incarcerated: 2%
- USB
- FB

* Risk categories are not mutually exclusive
** Conditions or therapies † risk for progression to active TB disease, not HIV
† Alcohol abuse and/or illicit drug use

* Immunosupp.: 14%
* Diabetes: 11%
* Diabetes: 11%
* Immunosupp.: 6%

No. of eligible TB cases*  Percent of eligible TB cases with HIV result

2005: 89.8%  150
2006: 84.5%  100
2007: 88.5%  200
2008: 84.4%  250
2009: 90.9%  96.2
2010: 91%  97.5
2011: 98%  98
2012: 94.6%  90
2013: 95.2%  85
2014: 90.1%  80

* Alive at diagnosis

National objective on HIV testing changed
## Tuberculosis Cases by Drug Susceptibility Patterns and Place of Birth, MN, 2010-2014

<table>
<thead>
<tr>
<th>Place of birth</th>
<th>Cases With Susceptibility Results*</th>
<th>Any Drug Resistance† No. (%)</th>
<th>INH-Resistant** No. (%)</th>
<th>MDR-TB‡ No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign-Born Cases</td>
<td>456</td>
<td>94 (21)</td>
<td>53 (12)</td>
<td>4 (1)</td>
</tr>
<tr>
<td>U.S.-Born Cases</td>
<td>96</td>
<td>13 (14)</td>
<td>8 (8)</td>
<td>1 (1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>552</td>
<td>107 (19)</td>
<td>61 (11)</td>
<td>5 (1)</td>
</tr>
</tbody>
</table>

Only 1 XDR case in MN (2006)

* Culture-confirmed cases with drug susceptibility results available
† Resistance to at least one first-line anti-TB drug
** INH-resistant cases may also be resistant to other drugs
Trends: where is TB headed?

- **Worldwide:** drug-resistant TB more widespread

- **U.S.:**
  - ↓ in TB rates is slowing down
  - More drug resistant TB in foreign-born

- **MN:**
  - Affected by immigration trends
  - ↑ in cases in rural areas
  - ↑ cases with medical risk factors for TB disease
References

• CDC. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC and the Infectious Diseases Society of America. MMWR 2005;54(No. RR-12)

• World Health Organization http://www.who.int/tb/en/

• CDC http://www.cdc.gov/tb/

• MDH www.health.state.mn.us/tb
Resources

- **State (MDH):**
  - Web resources
  - TB Medications Program
  - Consultation on guidelines
  - Case management

- **Regional:**
  - Mayo Clinic RTMCC
  - resources and services

- **National (CDC):**
  - Lab services
  - Web resources
  - Medical consultation
MDH TB Prevention & Control Program

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Mayo Clinic Center for Tuberculosis
Which of the following individuals have a higher risk of developing TB disease if infected with TB?

A. Persons with diabetes
B. HIV-infected persons
C. Young children
D. Persons on immunosuppressive medications
E. All of the above
The percentage of foreign-born TB cases in MN is consistently lower than the foreign-born percentage among all TB cases in the U.S.

A. True  
B. False
Extrapulmonary TB is more common in foreign-born TB cases in Minnesota.

A. True
B. False