Tuberculosis (TB) Epidemiology Update

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April 8, 2015
Disclaimer

- I have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials being discussed during this presentation.
Objectives

- Provide global, national and state epidemiological overview of TB
- Discuss and review the impact of TB response activities
- Review fundamental TB surveillance principles.
What’s beneath the surface?
TB AROUND THE WORLD
Global Response and Impact

- Lives saved between 2000-2013: 37 million
- Mortality Rate 1990-2013: 45% decrease
- Annual funding gap: $2 billion

Data Source: Global Tuberculosis Report 2014.WHO.2014
## The Global TB situation

<table>
<thead>
<tr>
<th></th>
<th>Estimated incidence, 2013</th>
<th>Estimated number of deaths, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>All forms of TB</td>
<td>9 million</td>
<td>1.5 million</td>
</tr>
<tr>
<td>HIV-associated TB</td>
<td>1.1 million</td>
<td>360,000</td>
</tr>
<tr>
<td>Multidrug-resistant TB</td>
<td>480,000</td>
<td>210,000</td>
</tr>
</tbody>
</table>

Data Source: Global Tuberculosis Report 2014.WHO.2014
WHO: Global trends in estimated rates of TB incidence, prevalence and mortality (1990-2013)

Source: Global Tuberculosis Report 2014, WHO

Data Source: Global Tuberculosis Report 2014.WHO.2014
Estimated TB Incidence Rates by WHO Region, 1990-2013

Data Source: Global Tuberculosis Report 2014.WHO.2014
Estimated TB Incidence Rates, 2013

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.


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Estimated TB Mortality Rates Excluding HIV-Positive People, 2013
Countries Using Measurements From Vital Registration Systems to Measure Mortality}

Countries for which TB mortality is estimated using measurements from vital registration systems (n=124) and/or mortality surveys (n=2, India and Viet Nam)

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Availability of National Electronic Case Bases Databases of TB Patients

Availability of national electronic case-based databases of TB patients, 2013

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Number of MDR-TB Cases Estimated to Occur Among Notified Pulmonary TB Cases, 2013
Funding for MDR-TB (1)

Available funding for TB care and control in 125 countries reporting 96% of global cases by intervention area and WHO region, 2013

Data Source: Global Tuberculosis Report 2013.WHO.2013
Number of Patients With Laboratory-Confirmed XDR-TB Started on Treatment in 2013
WHO 2013 Top 10 HBC’s\(^1\) Estimated Incidence/Rates; Rank by 2013 Incidence

Global Rate 126

- **India**: 1.24 million Total Cases, Rate per 100,000 pop.
- **China**: 860 Total Cases, Rate per 100,000 pop.
- **Indonesia**, **South Africa**, **Pakistan**, **Philippines**, **Bangladesh**, **Ethiopia**, **Myanmar**

\(^1\)High Burden Countries, by Case Incidence, Plus US and Mexico;
Source: Global Tuberculosis Report 2014. WHO. 2014
TB IN THE U.S.
Case Definition

• CSTE Position Statement
  – 09-ID-65
    • Clinical Criteria
      – A positive tuberculin skin test or positive interferon gamma release assay for *M. tuberculosis*
      – Other signs and symptoms compatible with TB
      – Treatment with two or more anti-TB medications
      – A completed diagnostic evaluation
    • Laboratory Criteria
      – Isolation of *M. tuberculosis* from a clinical specimen
      – Demonstration of *M. tuberculosis* complex from a clinical specimen by nucleic acid amplification test, OR,
      – Demonstration of acid-fast bacilli in a clinical specimen when a culture has not been or cannot be obtained or is falsely negative or contaminated.
Reported TB Cases*
United States, 1982–2013

*Provisional data for 2014.
Source: CDC
### TB Morbidity
#### United States, 2007–2014

<table>
<thead>
<tr>
<th>Year</th>
<th>No.</th>
<th>Incidence Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>13,282</td>
<td>4.4</td>
</tr>
<tr>
<td>2008</td>
<td>12,895</td>
<td>4.2</td>
</tr>
<tr>
<td>2009</td>
<td>11,520</td>
<td>3.8</td>
</tr>
<tr>
<td>2010</td>
<td>11,163</td>
<td>3.6</td>
</tr>
<tr>
<td>2011</td>
<td>10,517</td>
<td>3.4</td>
</tr>
<tr>
<td>2012</td>
<td>9,945</td>
<td>3.2</td>
</tr>
<tr>
<td>2013</td>
<td>9,588</td>
<td>3.0</td>
</tr>
<tr>
<td>2014</td>
<td>9,412</td>
<td>3.0</td>
</tr>
</tbody>
</table>
TB Case Rate Map, * United States, 2014

*Cases per 100,000.

< 3.0 (2013 national average)

> 3.0

D.C.
Number and rate* of newly diagnosed tuberculosis (TB) cases among U.S.-born and foreign-born persons, by year reported — United States, 2000–2014†
Trends in TB Cases in Foreign-born Persons, United States, 1993 – 2013*

No. of Cases

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>7000</td>
</tr>
<tr>
<td>1994</td>
<td>7100</td>
</tr>
<tr>
<td>1995</td>
<td>7500</td>
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<td>7400</td>
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<td>1998</td>
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<td>2010</td>
<td>6000</td>
</tr>
<tr>
<td>2011</td>
<td>5900</td>
</tr>
<tr>
<td>2012</td>
<td>5800</td>
</tr>
<tr>
<td>2013</td>
<td>5700</td>
</tr>
</tbody>
</table>

Percentage

- 1993: 0%
- 1994: 10%
- 1995: 20%
- 1996: 30%
- 1997: 40%
- 1998: 50%
- 1999: 60%
- 2000: 70%

*Updated as of June 11, 2014.
### U.S. Number and rate of TB Cases and Percentage Change by Race/Ethnicity

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>2013</th>
<th>2014</th>
<th>(%) change from 2013 to 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Rate</td>
<td>No.</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2,697</td>
<td>5.0</td>
<td>2,760</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>2,089</td>
<td>5.3</td>
<td>1,996</td>
</tr>
<tr>
<td>Asian</td>
<td>2,989</td>
<td>18.6</td>
<td>2,961</td>
</tr>
<tr>
<td>White</td>
<td>1,424</td>
<td>0.7</td>
<td>1,247</td>
</tr>
<tr>
<td>Other§</td>
<td>341</td>
<td>3.8</td>
<td>401</td>
</tr>
<tr>
<td>Unknown</td>
<td>27</td>
<td>—</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>9,567</td>
<td>3.0</td>
<td>9,412</td>
</tr>
</tbody>
</table>

* Per 100,000 population.
† Data for 2014 are provisional.
‡ Includes persons reported as American Indian/Alaska Native (2014: 115 cases, rate = 4.9; 2013: 127 cases, rate = 5.5); Native Hawaiian or other Pacific Islander (2014: 94 cases, rate = 17.4; 2013: 60 cases, rate = 11.3); and of multiple races (2014: 192 cases, rate = 3.0; 2013: 154 cases, rate = 2.5).
TB Case Rates,* U.S.-Affiliated Pacific Islands, 2013

- United States overall: 3.0 cases per 100,000
- Hawaii: 8.2 cases per 100,000
- American Samoa: 3.7 cases per 100,000
- Palau: 28.4 cases per 100,000
- Guam: 29.9 cases per 100,000
- Northern Mariana Islands: 31.3 cases per 100,000
- Federated States of Micronesia: 122.5 cases per 100,000
- Marshall Islands: 219.4 cases per 100,000

*Cases per 100,000
TB Case Rates* by Age Group
United States, 1993–2013

Cases per 100,000

Age Group (years)

* Updated as of June 11, 2014.
TB Case Rates by Age Group and Sex, United States, 2013

Cases per 100,000

Under 5  5 - 14  15 - 24  25 - 44  45 - 64  ≥65

Male  Female
TB Case Rates by Age Group and Race/Ethnicity,*
United States, 2013

*All races are non-Hispanic. Persons reporting two or more races accounted for less than 1% of all cases.
Reported TB Cases by Race/Ethnicity,*
United States, 2013

- Black or African American: 22%
- Asian: 32%
- Hispanic or Latino: 29%
- Native Hawaiian or Other Pacific Islander: 1%
- White: 15%
- American Indian or Alaska Native: 1%

*All races are non-Hispanic. Persons reporting two or more races accounted for less than 1% of all cases.
Reported TB Cases by Origin and Race/Ethnicity,* United States, 2013

*All races are non-Hispanic. Persons reporting two or more races accounted for less than 1% of all cases.

** American Indian or Alaska Native and Native Hawaiian or Other Pacific Islander accounted for less than 1% of foreign-born cases and are not shown.
TB Case Rates in U.S.-born vs. Foreign-born Persons, United States, 1993 – 2013*

*Updated as of June 11, 2014.
Countries of Birth of Foreign-born Persons Reported with TB, United States, 2013

- **Mexico** (20%)
- **Philippines** (13%)
- **India** (8%)
- **Vietnam** (7%)
- **China** (6%)
- **Guatemala** (3%)
- **Haiti** (3%)
- **Other Countries** (40%)
Percent of Foreign-born with TB by Time of Residence in U.S. Prior to Diagnosis, 2013

*Foreign-born TB patients for whom information on length of residence in the U.S. prior to diagnosis is unknown or missing.
Primary Anti-TB Drug Resistance, United States, 1993 – 2013*

*Updated as of June 11, 2014.

Note: Based on initial isolates from persons with no prior history of TB. Multidrug resistant TB (MDR TB) is defined as resistance to at least isoniazid and rifampin.
Primary MDR TB, United States, 1993 – 2013*

*Updated as of June 11, 2014.

Note: Based on initial isolates from persons with no prior history of TB. MDR TB defined as resistance to at least isoniazid and rifampin.
Primary Isoniazid Resistance in U.S.-born vs. Foreign-born Persons, United States, 1993 – 2013*

*Updated as of June 11, 2014.
Note: Based on initial isolates from persons with no prior history of TB.
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.
Estimated HIV Coinfection in Persons Reported with TB, United States, 1993 – 2013*

*Updated as of June 11, 2014.
Note: Minimum estimates based on reported HIV-positive status among all TB cases in the age group.
Number of County-based Tuberculosis Genotype Clusters* by Cluster Size, United States, 2011–2013

* Genotype cluster is defined as two or more cases with matching spoligotype and 24-locus MIRU-VNTR (GENType) within a county during the specified 3-year time period.
TB IN ILLINOIS
## National Ranking 2014

<table>
<thead>
<tr>
<th>State</th>
<th>Cases</th>
<th>% Change from 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>2145</td>
<td>-1.0</td>
</tr>
<tr>
<td>Texas</td>
<td>1269</td>
<td>3.8</td>
</tr>
<tr>
<td>New York</td>
<td>786</td>
<td>-9.1</td>
</tr>
<tr>
<td>Florida</td>
<td>595</td>
<td>-8.7</td>
</tr>
<tr>
<td>Georgia</td>
<td>334</td>
<td>-1.2</td>
</tr>
<tr>
<td>*Illinois</td>
<td>320</td>
<td>-2.1</td>
</tr>
<tr>
<td>New Jersey</td>
<td>308</td>
<td>-3.8</td>
</tr>
</tbody>
</table>
Illinois Reported TB Cases 2008-2014

No. of Cases

<table>
<thead>
<tr>
<th>Year</th>
<th>City of Chicago</th>
<th>Illinois Outside of Cook</th>
<th>Suburban Cook County</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>215</td>
<td>130</td>
<td>37</td>
</tr>
<tr>
<td>2009</td>
<td>210</td>
<td>135</td>
<td>38</td>
</tr>
<tr>
<td>2010</td>
<td>155</td>
<td>120</td>
<td>40</td>
</tr>
<tr>
<td>2011</td>
<td>140</td>
<td>125</td>
<td>42</td>
</tr>
<tr>
<td>2012</td>
<td>130</td>
<td>120</td>
<td>43</td>
</tr>
<tr>
<td>2013</td>
<td>120</td>
<td>115</td>
<td>44</td>
</tr>
<tr>
<td>2014</td>
<td>125</td>
<td>110</td>
<td>45</td>
</tr>
</tbody>
</table>
US and IL TB Rates per 100,000
2008-2014

Rate per 100,000 Population

United States Case Rate

Illinois Case Rate

IDPH
ILLINOIS DEPARTMENT OF PUBLIC HEALTH
TB Cases by Age Group
Illinois, 2008-2014
TB Rates by Age Group
Illinois, 2008-2014

TB Cases by Hispanic Ethnicity\(^1\) and Non-Hispanic Race Illinois, 2008-2014

\(^1\)Persons of Hispanic origin may be of any race or multiple race
TB by Ethnicity/Race
Illinois, 2014

- Hispanic 29% (93)
- White 16% (51)
- Black 24% (78)
- Asian 31% (98)
Percentage, Foreign-born vs. U.S.-born
Illinois, 2003-2014

- 2003: 46%
- 2004: 46%
- 2005: 46%
- 2006: 46%
- 2007: 46%
- 2008: 46%
- 2009: 46%
- 2010: 46%
- 2011: 46%
- 2012: 46%
- 2013: 46%
- 2014: 46%

- 2003: 67%
- 2004: 67%
- 2005: 67%
- 2006: 67%
- 2007: 67%
- 2008: 67%
- 2009: 67%
- 2010: 67%
- 2011: 67%
- 2012: 67%
- 2013: 67%
- 2014: 67%

- Foreign-born
- U.S.-born
Foreign TB Cases by Country of Birth
Illinois, 2014

- Mexico, 30.00%
- India, 12.50%
- Philippines, 10.00%
- China, 6.50%
- Poland, 2%
- Nigeria, 3.20%
- Other, 38%
Estimated % HIV Co-infection in Persons Reported with TB

Percentage of Reported Cases

<table>
<thead>
<tr>
<th>Year</th>
<th>All Ages</th>
<th>Aged 25–44</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>1995</td>
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<td>1997</td>
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<td>1</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>0</td>
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<td>2001</td>
<td></td>
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<td>2002</td>
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<td>0</td>
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<tr>
<td>2014</td>
<td></td>
<td>0</td>
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</tbody>
</table>
Primary Anti-TB Drug Resistance\textsuperscript{1} Illinois, 1993-2014

\textsuperscript{1}Resistance based on initial susceptibility testing.
* Isolates may be resistant to other drugs, except rifampin.
** MDR, or multi-drug resistant, TB is defined as resistance to at least isoniazid.
Directly Observed Therapy (DOT)
Mode of Treatment Administration
Reported Cases, Illinois, 1994-2013

DOT = Directly observed therapy; SA = Self-administered therapy
*2012 Preliminary Data – Missing 4 (1.2%) of reports.
**Changes in data reporting system in 2008 affects distribution of reporting of DOT and DOT+SA.
2011 completeness of DOT reporting: 15 cases (4.2%) not reporting DOT/DOT+SA/SA Only.
2009-2013 TB Outbreak Cases/Suspects by Treatment Start Date, N=45
Challenges in the Control of Tuberculosis

• HIV epidemic
• Increasing drug desistance
  – MDR and XDR TB
• Health system weaknesses and lack of political will
  – Poor infrastructure
  – Lack of political support and awareness
  – Organization of primary health care services
Strategies for Control of TB: Limitations

• Detection and treatment of cases
  – Compliance
  – Drug resistance
  – HIV epidemic

• Treatment of Latent infection

• Limited treatment options

• Continuing education for medical providers
Critical Strategies for Controlling TB

- Increase case finding
- Evaluate and treat contacts of cases
- Treat latent TB cases
- Increase case finding for HIV patients
- Provide effective treatment for HIV
- Increase funding for research and development
Cost of Doing Nothing

> $10,000,000

TB Outbreak in Homeless Shelter

$50,000 - $100,000

Multi-drug Resistant TB Case

$5,000 - $10,000

Uncomplicated TB

$532

LTBI treatment using 3HP, 12 doses/12 weeks with DOT
Quiz Question #1

• Which of the following is not included in the CSTE case definition as a clinical criteria for TB?

A. A positive tuberculin skin test or positive interferon gamma release assay for M. tuberculosis
B. Treatment with INH
C. A completed diagnostic work up
D. A chest x-ray showing cavitary lesions
Quiz Question #2

• Between 2000 and 2013, how many lives are estimated to have been saved through effective TB diagnosis and treatment?

A. 2000
B. 40 million
C. 1.3 billion
D. 37 million
Question #3

• Which of the high burden TB countries had the highest incidence and case count of TB in 2013?

A. Myanmar and China
B. Indonesia and Pakistan
C. India and South Africa
D. Bangladesh and Ethiopia
Quiz Question #4

- In 2014 TB cases in foreign born persons account for what percentage of total IL cases?
  A. 30%
  B. 67%
  C. 76%
  D. 55%
Questions
Acknowledgements

Thanks to
Illinois Department of Public Health TB Control Program
THANK YOU

FREDRICK L. ECHOLS, M.D.

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