Mayo Clinic Center for Tuberculosis

Tri-State TB Clinical Intensive: Epidemiology of Tuberculosis

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Ivy Quarshie, MPH
Disclosure

• We have no actual or potential conflicts of interest in relation to this presentation
• We have no financial relationships to disclose
Learning Objectives

• Understand basic TB epidemiology in Indiana, Michigan, and Ohio and apply this knowledge in recommendations for TB control measures

• Identify high-risk populations for TB disease in each state

• Assess needs for improvement in TB control and prevention
Table of Contents

• Global TB Burden
• National TB Burden
• Indiana TB Burden
• Michigan TB Burden
• Ohio TB Burden
• Q & A
Global Burden of TB, 2013

- Estimated 9.0 million cases of TB disease
  - >50% in South-East Asia & Western Pacific Regions
  - 1.1 million (13%) were HIV-positive
    - Africa accounts for 4/5 of HIV-positive TB cases & TB deaths
  - 3.5% of cases are MDR-TB
- Estimated 1.5 million deaths from TB
Estimated TB incidence rates, 2013

24% of cases
Global Progress in TB

• TB mortality rate fell by 45% between 1990 & 2013
  • TB prevalence rate fell by 41%
• TB incidence falling at ~1.5% per year
• Increase in number of direct measurements of TB prevalence from nationwide population-based surveys
TB in the United States

- 2013
  - 9,582 cases of TB
    - 3.6% decline from 2012
    - 3.0 per 100,000 persons
    - 4.3% decline from 2012
- 2014 (Provisional)
  - 9,412 cases of TB
    - 3.0 per 100,000 persons
TB in Indiana
TB in Indiana, 2014

- 108 cases
  - 1.6 per 100,000 population
- 4 deaths
- 67.6% pulmonary
- 80% of cases were lab-confirmed
- Marion County had highest burden
Figure 1.

Number of Tuberculosis Cases
Indiana, 2005 - 2014

Source: Indiana 2014 TB Annual Report
Source: Indiana 2014 TB Annual Report
Source: Indiana 2014 TB Annual Report
Figure 8.

Tuberculosis Cases by Age Group
Indiana, 2014

N = 108

Source: Indiana 2014 TB Annual Report
Figure 11.

Tuberculosis Cases by Race
Indiana, 2014

White
43.5%

Asian
30.6%

Black or African American
23.1%

Native Hawaiian or Other Pacific Islander
2.8%

N = 108

Source: Indiana 2014 TB Annual Report
Figure 12. Tuberculosis Cases by Ethnicity Indiana, 2014

Source: Indiana 2014 TB Annual Report
TB in Foreign-Born Hoosiers

• 54.6% (59 cases) of 2014 cases were among foreign-born

• Burma, Mexico, India, & the Philippines were top countries of origin

• 39.0% had resided in the U.S. >5 years
Percentage of Tuberculosis Cases ≥ 15 Years of Age by HIV Testing Status
Indiana, 2014

- Test Results Known: 87%
- Testing Not Offered: 7%
- Refused Testing: 6%

N = 103
Figure 5. TB Cases with Known HIV Status (positive or negative), United States, 2013

Source: NTIP 2013
State Comparison

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October 2015

1DC, DE, IA, ID, KS, ME, MT, ND, NE, NH, NM, RI, SD, UT, VT, WV, and WY reported 50 or fewer TB cases in 2013. Due to the small denominators, data should be interpreted with caution. 2The fraction in each parenthesis reports the number of TB cases with known HIV status (either positive or negative HIV test results) out of the total number of TB cases. 3WY reported zero cases of TB in 2013.
## Number & Percentage of TB Cases by Risk Factor

**Indiana, 2014**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Number of Cases</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident of Correctional Facility</td>
<td>5</td>
<td>4.6%</td>
</tr>
<tr>
<td>Homelessness</td>
<td>10</td>
<td>9.3%</td>
</tr>
<tr>
<td>Resident of Long-Term Care Facility</td>
<td>2</td>
<td>1.9%</td>
</tr>
<tr>
<td>Injecting Drug Use</td>
<td>4</td>
<td>3.7%</td>
</tr>
<tr>
<td>Non-Injecting Drug Use</td>
<td>7</td>
<td>6.5%</td>
</tr>
<tr>
<td>Excess Alcohol Use</td>
<td>13</td>
<td>12.0%</td>
</tr>
</tbody>
</table>

Source: Indiana 2014 TB Annual Report
Figure 21. Percentage of Tuberculosis Cases by Drug Resistance, Indiana, 2010 - 2014

Source: Indiana 2014 TB Annual Report
Cases and Rates of Tuberculosis per 100,000 People – Michigan, 2010-2014

- **Cases and Rates of Tuberculosis**
  - **Number of Cases**
    - Values: 180, 160, 140, 120, 100
  - **Case Rate**
    - Values: 1.8, 1.6, 1.4, 1.2, 1.0

- **Graph**
  - Case Rate per 100,000 people

Mayo Clinic Center for Tuberculosis
Overview of TB in Michigan, 2014

- 105 cases
- 1.1 per 100,000
- 12 died before or during treatment

Site:
- 65% Pulmonary
- 31% Extra-pulmonary
- 4% Concurrent

- 71% lab confirmed by positive culture
- 21% clinical cases

- 97% of positive cultures with at least one genotyped isolate
  - 22% of isolates in MI clustered by County-GENType*

*two or more cases with matching spoligotype and 24-locus MIRU-VNTR (GENType) within a county during the specified 3-year time period
Incidence Rates of Tuberculosis by County – Michigan 2014

# of Cases/100,000 People (Census 2013)

- 0.0
- 0.1 - 1.0
- 1.1 - 2.0
- 2.1 - 4.7
- 4.8 - 9.0
Distribution of TB cases per year by Gender and Age – Michigan, 2010-2014

Proportion of Total Counted Cases (%) by Year:
- Male
- Female

Proportion of Total Counted Cases (%)


Distribution by Age:
- 0-4 yrs
- 5-14 yrs
- 15-24 yrs
- 25-44 yrs
- 45-64 yrs
- 65+ yrs

Proportion of Total Counted Cases (%)

Distribution of TB Cases by Race & Ethnicity – Michigan 2010-2014

<table>
<thead>
<tr>
<th>Race &amp; Ethnicity</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black / African American</td>
<td>32.38%</td>
</tr>
<tr>
<td>Asian</td>
<td>38.10%</td>
</tr>
<tr>
<td>Caucasian – Hispanic</td>
<td>9.52%</td>
</tr>
<tr>
<td>Caucasian – Non-Hispanic</td>
<td>10.47%</td>
</tr>
<tr>
<td>Caucasian – Unknown Hispanic Ethnicity</td>
<td>0.95%</td>
</tr>
<tr>
<td>Hawaiian / Pacific Islander</td>
<td>0.95%</td>
</tr>
<tr>
<td>American Indian / Alaskan Native</td>
<td>0.00%</td>
</tr>
<tr>
<td>Other – Hispanic</td>
<td>3.81%</td>
</tr>
<tr>
<td>Other – Non-Hispanic</td>
<td>2.86%</td>
</tr>
<tr>
<td>Unknown Race</td>
<td>0.95%</td>
</tr>
</tbody>
</table>

![Graph showing distribution of TB cases by race and ethnicity from 2010 to 2014](image-url)
Distribution of TB by Country of Birth – Michigan 2014

- 62 foreign-born cases
- 21 different countries
- Top 5 countries:
  - India – 11 cases
  - Mexico – 10 cases
  - China – 8 cases
  - Philippines – 6 cases
  - Vietnam – 4 cases

US-Born and Foreign-Born Cases of Tuberculosis - Michigan, 2010-2014

Proportion of Total Counted Cases (%)

Year
- 2010
- 2011
- 2012
- 2013
- 2014

Foreign-Born
US-Born
Unknown

0 10 20 30 40 50 60 70 80 90 100
Distribution of TB by HIV status – Michigan

2014

- Four (4%) HIV positive
- Twelve (11%) Unknown
  - Three Refused
  - Three Not Offered
  - Six Unknown
- Of those HIV positive
  1. Female, 45-64, US-born

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% indicates the proportion of total counted cases per year reported as having each characteristic or risk factor.
## Trends in TB – Viral Hepatitis (B&C) Comorbidity – Michigan, 2010-2014

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Trends in TB – Other Life Style Risk Factors – Michigan, 2010-2014

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## Trends in TB – Prior TB Disease & Treatment – Michigan, 2010-2014

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% indicates the proportion of total counted cases per year reported as having each characteristic or risk factor.

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### Previous TB Diagnosis

- **2010**: 5
- **2011**: 5
- **2012**: 5
- **2013**: 10
- **2014**: 20

### Incomplete LTBI Treatment

- **2010**: 5
- **2011**: 5
- **2012**: 1
- **2013**: 5
- **2014**: 20

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Mayo Clinic Center for Tuberculosis
### Trends in TB – High Risk Exposures to TB – Michigan, 2010-2014

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*% indicates the proportion of total counted cases per year reported as having each characteristic or risk factor*
Culture Positive TB Cases Genotyped and Within a Cluster – Michigan, 2009-2014

Proportion of culture confirmed TB cases (%)

Year

2010 2011 2012 2013 2014

92.4 99.2 96.1 99.0 97.4

2020 National Indicator 100%

2015 National Indicator 94%
TB in Ohio
TB Cases and Case Rates-OH, 2010-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Cases</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>190</td>
<td>1.6</td>
</tr>
<tr>
<td>2011</td>
<td>145</td>
<td>1.3</td>
</tr>
<tr>
<td>2012</td>
<td>149</td>
<td>1.3</td>
</tr>
<tr>
<td>2013</td>
<td>148</td>
<td>1.3</td>
</tr>
<tr>
<td>2014</td>
<td>156</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Ohio TB Cases by County, 2014
156 Total Cases

Number of Cases
- 0
- 1 - 4
- 5 - 9
- 10+

Ohio Department of Health
TB Registry, February 2, 2015

Mayo Clinic Center for Tuberculosis
TB Cases by Sex
OH, 2010-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>% Males</th>
<th>% Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>60.0</td>
<td>40.0</td>
</tr>
<tr>
<td>2011</td>
<td>60.7</td>
<td>39.3</td>
</tr>
<tr>
<td>2012</td>
<td>63.8</td>
<td>36.2</td>
</tr>
<tr>
<td>2013</td>
<td>64.9</td>
<td>35.1</td>
</tr>
<tr>
<td>2014</td>
<td>60.9</td>
<td>39.1</td>
</tr>
</tbody>
</table>
TB Cases by Age Groups
OH, 2010-2014
TB Cases by Site of Disease
OH, 2010-2014

Year
Percentage of TB Cases

2010 2011 2012 2013 2014

PBH %

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Both Extrapulmonary Pulmonary

Percentage of TB Cases
US-Born and Foreign-Born TB Cases OH, 2010-2014

Percentage of TB Cases

Year

2010 2011 2012 2013 2014

US-Born

Foreign-Born
Country of Birth Among Foreign-Born TB Cases
OH, 2014

- Somalia: 9.3%
- Philippines: 8.1%
- Bhutan: 8.1%
- Ethiopia: 7.0%
- India: 7.0%
- Nepal: 5.8%
- China: 4.7%
- *Other*: 50.0%
- *34 Other Countries*
HIV & TB Co-infection OH, 2010-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of TB Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3.2%</td>
</tr>
<tr>
<td>2011</td>
<td>4.1%</td>
</tr>
<tr>
<td>2012</td>
<td>7.4%</td>
</tr>
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<td>7.4%</td>
</tr>
<tr>
<td>2014</td>
<td>5.8%</td>
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</tbody>
</table>
Primary Anti-TB Drug Resistant Cases
OH, 2010-2014

**INH Resistant Cases**

- 2010: 4.2%
- 2011: 3.4%
- 2012: 3.6%
- 2013: 2.0%
- 2014: 2.6%

**MDR Resistant Cases**

- 2010: 1.6%
- 2011: 1.4%
- 2012: 0.0%
- 2013: 2.0%
- 2014: 2.6%
Risk Factors Among TB Cases OH, 2014

- Excess Alcohol Use: 11.5%
- Non Injecting Drug Use: 4.5%
- Healthcare Provider: 7.1%
- Resident of Correctional Facility: 1.3%
- Resident of Long Term Care Facility: 3.2%
- Homelessness: 5.8%
- Other: 12.2%
- End-Stage Renal Disease: 1.3%
- Missed Contact: 0.6%
- Incomplete LTBI Therapy: 3.8%
- Immunosuppression (not HIV/AIDS): 5.8%
- Diabetes Mellitus: 11.5%
- Contact of Infectious TB Patient: 7.7%
TB Treatment Completion
OH, 2010-2014

Percentage of TB Cases

Year

2010: 89.3%
2011: 89.8%
2012: 87.2%
2013: 86.5%
2014: 82.1%
Mode of Treatment Administration TB Cases OH, 2010-2014

Year

2010

2011

2012

2013

2014

Percentage of Treatment Mode

90%

80%

70%

60%

50%

40%

30%

20%

10%

0%

SA only

DOT + SA

DOT

Mayo Clinic Center for Tuberculosis
Documented Culture Conversion within 60 Days of Treatment Initiation
OH, 2010-2014

Year
Percentage of TB Cases

2010: 49.3%
2011: 48.3%
2012: 58.3%
2013: 58.8%
2014: 67.2%
Contacts to Sputum Smear +TB Cases Evaluated OH, 2010-2014

Percentage of Contacts

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>2010</td>
<td>81.4</td>
</tr>
<tr>
<td>2011</td>
<td>89</td>
</tr>
<tr>
<td>2012</td>
<td>94</td>
</tr>
<tr>
<td>2013</td>
<td>74.3</td>
</tr>
<tr>
<td>2014</td>
<td>91.5</td>
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Contacts Started & Completed Treatment
OH, 2010-2014

Year
2010  2011  2012  2013  2014
78    69.2  81.3  77.6  65.1

Percentage of Contacts
Quick Quiz

Let’s review to make sure the presentation was clear
Which state had the highest number of TB cases counted in 2014?

A. Michigan
B. Indiana
C. Ohio
Question 1

A: Which state had the highest number of TB cases counted in 2014?

a. Michigan
b. Indiana
c. Ohio

- Ohio had 156 cases
- Indiana had 108 cases
- Michigan had 105 cases
In Indiana, Michigan, and Ohio there are more US-born counted TB cases than foreign-born cases?

A. True
B. False
Question 2

A: In Indiana, Michigan, and Ohio there are more US-born counted TB cases than foreign-born cases?

• True
• False

There are now more foreign-born cases than US-born cases.
Which risk factor was reported with the highest percentage in 2014 in each state?

Indiana
A. Homelessness
B. Injecting drug use
C. Residing in a long-term care facility

25% 25% 25% 25%
Which risk factor was reported with the highest percentage in 2014 in each state?

Michigan

A. Incomplete LTBI treatment
B. HIV
C. Residing in a long-term care facility

25% 25% 25% 25%
Which risk factor was reported with the highest percentage in 2014 in each state?

Ohio
A. Homelessness
B. Contact to an infectious TB patient
C. Diabetes Mellitus