Presentation Outline

• Maryland TB Epidemiology (2014)
  – Maryland TB numbers and trends
  – Country of origin
  – Demographics
  – Drug resistance
  – Risk factors

• TB Genotyping
  – Refresher on what genotyping is
  – Alerts
  – Uses

3/24/2015
Maryland TB, 2010-2014

Case Numbers

- 2010: 220 cases
- 2011: 225 cases
- 2012: 220 cases
- 2013: 180 cases
- 2014: 200 cases

Case Rate/100,000

- 2010: 3.3 per 100,000
- 2011: 3.3 per 100,000
- 2012: 3.3 per 100,000
- 2013: 2.5 per 100,000
- 2014: 3.4 per 100,000

N=195
Rate= 3.3/100,000
Maryland, Maryland Trend, and US TB Rates, 2005-2014

MD: 195 cases
US: 9,412 cases
TB Case Rates per 100,000, United States, 2014*

Case no. 9,412

CDC, 3/20/2015
State TB Case Rates per 100,000 Population, by Jurisdiction, 2014

- Montgomery: <3.0/100,000
- Prince George's: 3.0-3.3/100,000
- Caroline: No reported cases
- Baltimore City: >3.3/100,000
- Baltimore County: 3/24/2015
- Wicomico: 3/24/2015

Legend:
- Red: >3.3 /100,000
- Pink: 3.0-3.3/100,000
- Green: <3.0/100,000
- White: No reported cases
TB rates among US and foreign born, Maryland vs. US, 2014
6 Top Countries of Origin-MD, 2014

- Philippines: 12%
- Ethiopia: 9%
- El Salvador: 7%
- Nigeria: 4%
- Cameroon: 4%
- India: 5%
- Other: 58%
# WHO Estimates of TB Incidence 2013

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence/100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philippines</td>
<td>292 (261-331)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>224 (188–276)</td>
</tr>
<tr>
<td>El Salvador</td>
<td>39 (35-42)</td>
</tr>
<tr>
<td>India</td>
<td>171 (162–184)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>338 (194–506)</td>
</tr>
<tr>
<td>Cameroon</td>
<td>235 (210–265)</td>
</tr>
</tbody>
</table>

Foreign-born TB Case Numbers, by Time from U.S. Arrival to Diagnosis, 2012-2014
TB Cases by Race and Origin, 2014

U.S. Born
- White: 59%
- Black/A.A.: 38%
- Hispanic: 3%

Foreign Born
- White: 2%
- Black/A.A.: 39%
- Asian: 38%
- Hispanic: 24%
- Other: 1%
Cases by Age Group  Maryland, 2010-2014

![Chart showing cases by age group in Maryland from 2010 to 2014.](chart.png)
The Canary in the Coal Mine

• Children under 5 years old
  – At high risk for TB meningitis, disseminated TB
  – Disease can progress quickly
  – Important to find source case
    • Stop further transmission
  – Can represent undiagnosed adult cases
Maryland Drug Resistance, 2014

195 cases total

153 (78%) cases: susceptibility results

19 (12%) cases: any resistance

1 (<1%) MDR
Maryland Drug Resistance, 2014

195 cases total

153 (78%) cases: susceptibility results

19 (12%) cases: any resistance

1 (<1%) MDR

RIF - 1
PZA – 6
INH – 15
EMB - 1

3/24/2015
Starting Treatment with 4 Drugs

INH resistance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL:</td>
<td>7.7%</td>
<td>8.8%</td>
</tr>
<tr>
<td>US born:</td>
<td>4.0%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Foreign born:</td>
<td>10.9%</td>
<td>10.5%</td>
</tr>
</tbody>
</table>

- **97%** of eligible Maryland patients started treatment with 4 drugs, vs. 87% in 2013 !!!!
- National goal is 93.4%
With Fewer Cases Why Are We Still Working So Hard?

• Risk factors
  – Living and Occupation
  – Substance Use
  – TB HIV co-infection
  – Diabetes

• They are more complex!
# TB Risk Factors: Living and Occupational

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>National</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Congregate Setting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homeless</td>
<td>5%</td>
<td>3%</td>
<td>4%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Corrections</td>
<td>0.5%</td>
<td>0%</td>
<td>1%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Long Term Care</td>
<td>1%</td>
<td>1%</td>
<td>2.5%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>9%</td>
<td>6%</td>
<td>6%</td>
<td>11-12%</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Care</td>
<td>9%</td>
<td>3%</td>
<td>6%</td>
<td>4%*</td>
</tr>
<tr>
<td>Correctional</td>
<td>0.5%</td>
<td>0%</td>
<td>0%</td>
<td>0.1%*</td>
</tr>
</tbody>
</table>

*2013 National Data*
TB HIV Co-Infection Trends, 2010-2014
TB HIV Co-Infection, Origin of Birth

- 77% foreign-born
- 73% foreign-born
- 86% foreign-born

2012: 77% foreign-born
2013: 73% foreign-born
2014: 86% foreign-born

Case numbers

US Born | Foreign Born
TB and Diabetes

The graph shows the number of cases and the percentage of cases over the years 2010 to 2014. The number of cases ranges from 25 to 35, with a peak in 2011. The percentage of cases ranges from 0% to 16%, with a peak in 2011.

- **2010**: No. = 25, % = 0
- **2011**: No. = 35, % = 20
- **2012**: No. = 25, % = 15
- **2013**: No. = 25, % = 10
- **2014**: No. = 20, % = 8

**Legend:**
- Green bars: Cases
- Red dots: Percent

No significant changes in the number of cases are observed, but there is a significant decrease in the percentage of cases from 2011 to 2014.
## Status of DOT in Maryland

**Maryland Goal: 100%**

<table>
<thead>
<tr>
<th>Year</th>
<th>Self-Administered</th>
<th>Directly Observed</th>
<th>Both SAT &amp; DOT</th>
<th>TOTAL</th>
<th>% DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>8</td>
<td>156</td>
<td>18</td>
<td>182</td>
<td>86%</td>
</tr>
<tr>
<td>2011</td>
<td>5</td>
<td>158</td>
<td>32</td>
<td>195</td>
<td>81%</td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>166</td>
<td>29</td>
<td>199</td>
<td>83%</td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
<td>135</td>
<td>31</td>
<td>168</td>
<td>80%</td>
</tr>
</tbody>
</table>
Questions?
TB Genotyping
Role of TB Genotyping

• Use genetic patterns of specific parts of the *M. tuberculosis* organism to:
  – Identify and intervene in ongoing transmission (outbreaks)
  – Determine relapse versus reinfection
  – Identify or “confirm” false positive cultures
Mycobacterium tuberculosis “Isolate”

- **Definition**: a pure culture of *Mycobacterium tuberculosis* organism from a single patient
# Genotyping terminology

<table>
<thead>
<tr>
<th>Spoligotype</th>
<th>MIRU</th>
<th>MIRU2</th>
</tr>
</thead>
<tbody>
<tr>
<td>777776777760601</td>
<td>224325153323</td>
<td>444234423337</td>
</tr>
</tbody>
</table>

**PCRType**

PCR00233

**GENType**

G00011
## Genotype Cluster

When a TB case’s isolate genotype matches at least one other TB case’s isolate genotype

<table>
<thead>
<tr>
<th>PCRType</th>
<th>GENType</th>
<th>Cluster Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCR00002</td>
<td>G01143</td>
<td>MD0002_001</td>
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Epi-Links

• Epi-links are essential for determining ongoing transmission
  – Person: named contacts; similar demographic and risk characteristics

  – Place: location where the TB patients spent time together

  – Time: exposure during infectious period
Epi Links → Genotype Cluster?

- Local Health Dept calls CTBCP
- Provider or ICP calls CTBCP
- CTBCP gets routine genotyping report from CDC (TB-GIMS) and calls LHD
- CDC (TB-GIMS) sends an “Alert”
- Laboratory calls CTBCP
Genotyping Can Enhance Contact Investigations

Adapted from Etkind 1993
Genotype Cluster Alerts

• Statistical method performed by CDC (Log likelihood ratio)
• Low, Medium, High (recent transmission risk)
• Based on
  – Two or more cases
  – Geographic location (same county vs. US)
  – Time: 3 years or less
  – Change in number of patients in the cluster
TB-GIMS

The last TB GIMS Surveillance Upload includes data transmitted to CDC through: 03/17/2015

Searches and reports will only include data reported to CDC by the state and included in the latest TB GIMS surveillance upload.

Recent GENType Cluster Alert Changes*:

<table>
<thead>
<tr>
<th>GENType</th>
<th>County</th>
<th>Change in Alert Level</th>
<th>Alert Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>G18722</td>
<td>CHARLES</td>
<td>None to Medium</td>
<td>01/28/2015</td>
</tr>
<tr>
<td>G15291</td>
<td>BALTIMORE (CITY)</td>
<td>None to Medium</td>
<td>01/21/2015</td>
</tr>
</tbody>
</table>

*Up to five shown-click PDF icon for full list.
1 – County A
2 – County B

County B

County C
2- County B Alert

County B

County C

County B
3- County D

County D
3- County D

County D

County D
3- Wicomico County

County D

Worried well?

County D
### Relapse or exogenous re-infection?

<table>
<thead>
<tr>
<th>Case</th>
<th>PCRtype</th>
<th>GENtype</th>
<th>Cluster_ name</th>
<th>Genotype Report Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeless outbreak strain</td>
<td>PCR01047</td>
<td>G10248</td>
<td>MD_0002_001</td>
<td>January 2012 – June 2014</td>
</tr>
<tr>
<td>Rodney Holmes</td>
<td>PCR17481</td>
<td>G05540</td>
<td></td>
<td>February 2008</td>
</tr>
<tr>
<td>Rodney Holmes</td>
<td></td>
<td></td>
<td></td>
<td>(2014)</td>
</tr>
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Relapse or exogenous re-infection?

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<td>PCR17481</td>
<td>G05540</td>
<td>MD_0104</td>
<td>Sept 2014</td>
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False Positive Cultures
False Positive Cultures
False Positive Cultures

Causes
• Laboratory cross-contamination
• Clinical device contamination: bronchoscope
• Clerical errors: mislabeling of patient specimens

Consequences
• Incorrect TB diagnosis!
• Unnecessary anti-TB treatment
• Delays in correct diagnosis and treatment
• Overestimation of the TB case rate
Questions?