Tuberculosis in Low Incidence States
2013 West Virginia Public Health Symposium

Michael Lauzardo, MD MSc
Director, Southeastern National Tuberculosis Center
Chief, Division of Infectious Diseases and Global Medicine
Case presentation: The case of the wayward professor

- RC is a 35yo woman from a country of high TB incidence who presented to her PCP 2 years earlier c/o cough
- The PCP at that time placed a PPD and ordered a CXR
- The PPD was 10mm and the CXR was “abnormal” so she was sent to a pulmonologist
Case: The wayward professor continued

- The pulmonologist attributed the CXR abnormality to BCG vaccination and the cough to allergies.
- Sputum was not obtained
- Lost to follow-up for two years
- Came back to her PCP accompanied by her husband “MC”, A faculty member at a prominent university
- Active hemoptysis in the waiting room
Case: “The chase begins”

- The PCP is very concerned about TB again
- A CXR is obtained and arrangements are made to have the pt seen immediately in the ER by a different pulmonologist
- They never show citing the fact that the husband does not think she has TB
- The health department is notified
Case

• The patient’s husband is called at home and the rationale and need for evaluation is expressed in carefully chosen words with their concerns addressed.

• The plan was that the patient may go to the ER of their choosing and will be met by me to discuss the case and obtain sputum.

• Patient and husband never went but sent an impostor who came to the Emergency Department with a chief complaint of “I don’t have TB.”
Lost to follow-up
(For a little while)

- After much deliberation and legal wrangling the HD sent a police officer to the home to locate the family.
- The officer was informed by MC that he sent his wife and kids away so that they would not be subject to the “conspiracy”.
- Threatening phone calls from family.
- Heard nothing for 6 weeks until a call from another state on the west coast.
The exciting conclusion to our story

- RC was diagnosed with smear positive cavitary TB after presenting to a local ER with hemoptysis once again
- Placed on court-ordered DOT and was banned from travel by the judge until therapy cleared her sputum
- MC felt humiliated by this and immediately brought his children to the health department for evaluation—skin tests were more than 25mm
- MC was evaluated with a CXR...
The microbe is nothing... the terrain is everything

LOUIS PASTEUR
Epidemiology of TB in the United States
Reported TB Cases
United States, 1982–2012*

*Updated as of June 10, 2013.
# TB Morbidity
United States, 2007–2012

<table>
<thead>
<tr>
<th>Year</th>
<th>No.</th>
<th>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>
</tbody>
</table>

*Cases per 100,000. Updated as of June 10, 2013.
TB Case Rates, * United States, 2012

*Cases per 100,000.

- ≤ 3.2 (2012 national average)
- >3.2
Trends in TB Cases in Foreign-born Persons, United States, 1992 – 2012*

*Updated as of June 10, 2013

No. of Cases

Percentage

Number of Cases

Percentage of Total Cases

*Updated as of June 10, 2013
Percentage of TB Cases Among Foreign-born Persons, United States*

2002

2012

Updated as of June 10, 2013.
TB Case Rates in U.S.-born vs. Foreign-born Persons, United States, 1993 – 2012*

*Updated as of June 10, 2013.
Components of a TB Prevention and Control Program

- There are six components of TB Prevention and Control Programs
- Every state health department needs the basic framework for a TB control program that includes all six components, and a designated program director.
- Sufficient capability in each of the following components is necessary for progress toward TB elimination:
Six Key Components

- Planning and developing policy
- Finding and managing suspected and confirmed tuberculosis cases
- Finding and managing latent tuberculosis infection
- Providing laboratory and diagnostic services
- Collecting and analyzing data
- Providing consultation, training, and education
Challenges

The decrease in TB incidence to historic low levels creates challenges for public health officials who are working to sustain programs and systems, especially when low incidence fails to indicate the full efforts required for comprehensive TB control.
Specific Challenges

- Loss of healthcare providers or specialists with TB expertise
- Scarcity of special facilities for prolonged health care
- Laboratory costs and decreased proficiency
- Travel in rural areas
- Loss of funds and personnel dedicated to TB control
Sustainability

- These challenges, particularly sustainability, are shared by TB programs in all states but are amplified by circumstances in low-incidence states.
- The Advisory Council for the Elimination of Tuberculosis (ACET) recommends that TB control programs in states or regions that have achieved low TB incidence status seek innovative approaches to meet these special challenges.
- ACET recognizes that the best solutions will be unique to each state and locality.
Consequences of Success
Patients Evaluated for TB at CDC-funded Public Health Laboratories, 2008-2009

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients evaluated for TB</td>
<td>103,708</td>
<td>97,568</td>
<td>-5.9%</td>
</tr>
<tr>
<td>Patients with cultures positive for <em>M. tuberculosis</em></td>
<td>4,972</td>
<td>4,217</td>
<td>-15.2%</td>
</tr>
<tr>
<td>Ratio of patients evaluated to patients diagnosed with TB</td>
<td>21 : 1</td>
<td>23 : 1</td>
<td></td>
</tr>
</tbody>
</table>
Getting Physicians to “Think TB” is asking them to look for a needle in a haystack

- Lung CA
- TB (0.3%)
- Community-acquired pneumonia
Can Physicians be Educated to “Think TB”? 

• As TB rates decline, general medical expertise and education targeted at TB will decline

• “Think TB” campaigns may have impact in targeted situations:  
  • In high-risk communities  
  • During outbreaks

• Untargeted campaigns may not be successful
Can Physicians be Educated to “Think TB”?  

**Challenges During TB Outbreaks**

- Most media stories about TB “outbreaks” describe contact investigations at schools.
- Most contact investigations at schools do not detect additional TB cases.
- Health Departments often work hard to keep information on large TB outbreaks out of media.
Measuring TB Diagnostic Delay

Results from TBESC Task Order 23:
National Study of Early Diagnosis of TB in the African-American Community

Co-Principal Investigators:
Dolly Katz, Ph.D., CDC
Rachel Royce, Ph.D., M.P.H., RTI International
Charles Wallace, Ph.D., Texas Department of Health
Summary of Findings from Task Order 23: Study of Patient and Provider Delay

- Snap shot in time (rather than trend over time)
- Both patient and provider delay observed
- Delay not worse for African Americans compared with whites
## Contribution of Provider Diagnostic Delay to 27 TB Outbreaks Investigated by CDC*

<table>
<thead>
<tr>
<th>Contributing factors</th>
<th>Number of Outbreaks where item was considered a contributing factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged infectious period</td>
<td>24</td>
</tr>
<tr>
<td>Provider-related diagnostic delay</td>
<td>12</td>
</tr>
<tr>
<td>Patient-related delay in access to care</td>
<td>6</td>
</tr>
</tbody>
</table>

* From: Mitruka et al., EID 2011;17(3):425
The Road to TB Elimination
Building (Maintaining) Capacity in Low Incidence States
Ending Neglect: Progress Toward TB Elimination

Improve access to and efficiency in using clinical, epidemiological, and other technical services by

- Regionalizing TB elimination activities
- Using a combination of federal and multistate initiatives

Source: Institute of Medicine Report: Ending Neglect
The Task Order 6 Goal:
Identify best practice models for regional capacity-building in low-incidence areas

Task Order 6 Methods:
- Assess needs
- Develop interventions
- Implement interventions
- Evaluate interventions
Needs Assessment

• Describe TB epidemiology in the region
• Describe infrastructure for TB control
• Identify challenges in each area of TB control
  – Core TB program functions
  – Private sector and partnerships
  – Laboratory
  – Training/Education
<table>
<thead>
<tr>
<th>State Population</th>
<th>Cases in 2006</th>
<th>2006 case rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idaho</td>
<td>20</td>
<td>1.4</td>
</tr>
<tr>
<td>(1,466,465)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana</td>
<td>13</td>
<td>1.4</td>
</tr>
<tr>
<td>(944,632)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utah</td>
<td>34</td>
<td>1.3</td>
</tr>
<tr>
<td>(2,550,063)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td>4</td>
<td>0.8</td>
</tr>
<tr>
<td>(515,004)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Identified Needs

- Clinical consultation
- Comprehensive guide to TB control for field and program staff
- Laboratory services assessment
- Training and education
- Outbreak surveillance
# Intervention Areas

<table>
<thead>
<tr>
<th>Intervention Areas</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policy &amp; Planning</td>
<td>TB Control Manual Template</td>
</tr>
<tr>
<td>2. Clinical Consultation</td>
<td>Regional Warm line</td>
</tr>
<tr>
<td>3. Laboratory Services</td>
<td>Surveys of laboratory practice</td>
</tr>
<tr>
<td>4. Surveillance</td>
<td>Regional laboratory trainings</td>
</tr>
<tr>
<td></td>
<td>Regional use of genotyping</td>
</tr>
<tr>
<td></td>
<td>Outbreak Response Plan Template</td>
</tr>
</tbody>
</table>
## Intervention Areas

<table>
<thead>
<tr>
<th>Intervention Areas</th>
<th>Outcomes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Training and Education</td>
<td>Training needs assessment</td>
</tr>
<tr>
<td></td>
<td>Conduct regional trainings</td>
</tr>
<tr>
<td>6. Advocacy/Collaboration</td>
<td>Regional TB Elimination Plan</td>
</tr>
<tr>
<td>7. Program Evaluation</td>
<td>Idaho case management teleconferences</td>
</tr>
<tr>
<td></td>
<td>Evaluation of interventions</td>
</tr>
</tbody>
</table>
TB Control Manual Template

Create a TB control manual template that translates national guidelines into “how-to guide” for field and program staff

- Applicable to low-incidence states
- Customizable to address each state’s unique epidemiologic and infrastructure circumstances
- Standardizes case management/CI and clinical practice

Available at www.nationaltbcenter.edu
Clinical Consultation

- Four states have access to specific medical consultants (Charles Daley, Charlie Nolan, Randall Reves) through the FJ Curry National TB Center Warmline
- Advantage compared to usual operation Warmline: Built relationships and continuity
Laboratory Services

- Assessed mycobacteriology laboratory practices across 4-state region
- Identified areas of concern
  - Lab safety issues
  - Turnaround times
  - Reporting issues
- Held laboratory trainings (included those from public and private sector)
- Ongoing network to share problems and solutions
Surveillance

- Regional approach to using genotyping data
  - Data sharing agreements
  - Regional genotyping coordinator
    - Routinely reviews genotyping data across region
    - Provides expertise and consultation to region and states
    - Facilitates communication between states
  - Policies and procedures for reviewing and sharing cluster findings
Surveillance cont.

- Identified 7 inter-state PCR clusters
  - 2 PCR clusters with isolates having different RFLP patterns
  - Rv/Ra “cluster”
  - Follow-up pending on 2 PCR clusters

- 1 regional outbreak among homeless

- Identified issues related to duplicate reporting of results in 2 different states
  - Developed lab notification system to prevent duplicate reporting in future
Outbreak Response Plan Template

- Outbreak response definitions
- Roles and responsibilities
- Communication and education
- Checklists for all activities
Case Management Teleconferences

- Bi-monthly teleconferences in Idaho with state and local participation
  - Local PHN presents case in standard format
  - State TB controller guides discussion
  - Include external TB experts (nurses and M.D.)

- Evaluation using CDC framework documented the usefulness of the ID case management teleconference format

- In New England, a regional case conference model
Lessons From Task Order 6

- Building capacity and sustaining improved TB control practices requires dedicated resources and infrastructure.
- Selective application of regional approach
  - Not applicable for all TB activities.
- TB elimination requires not only maintenance; *enhancement* of TB control required
  - TB in foreign-born
    - Cultural competence
    - Further prevention planning and activities
  - TB in American Indians- a racial disparity.
Conclusion and Next Steps

- Best-practice models
  - TB Manual Template
  - Outbreak Response Plan Template
  - Regional Surveillance Approach
  - Laboratory Advisory Group
  - Idaho Case Management Teleconferences

- Complete evaluation of these models and present findings to national TB audience
  - Post model tools at www.nationaltbcenter.edu
Effective Targeted Testing and Treatment of Latent TB Infection
Necessary Steps to an Effective Targeted Testing Program

- Target testing individuals who are from populations that are high-risk for progressing to active disease
- Establishing who in those populations are infected—diagnosing LTBI
- Medically evaluating infected persons
- Initiating therapy
- Completing therapy
Targeted Testing

• Targeted tuberculin testing programs should be designed for one primary purpose:
  To identify persons at high risk for TB who would benefit by treatment of LTBI.

• “The decision to tuberculin test is the decision to treat (and complete)”
At higher risk

- A risk of TB that is substantially higher than that of the general population of the United States is associated with:
  1. Recent infection with *Mycobacterium tuberculosis*
  2. The presence of clinical conditions that are associated with an increased risk of progression of LTBI to active TB
Groups at Increased Risk of TB Disease

- Targeted testing identifies persons at risk for TB who would benefit by treatment of LTBI, if detected.
- Highest risk individuals would be those recently infected or those with clinical conditions associated with an increased risk of progression to active disease.
- Screening of low-risk persons such as administrative screening should be replaced by targeted testing whenever possible.
How do we know that recent infection is a risk factor for developing active disease?

- Two controlled trials looking at the efficacy of LTBI treatment of contacts to TB cases in mental hospitals
- The skin tests of 1472 participants in the placebo arm converted from negative to positive
- In the first year of follow up 19 developed active disease (12.9 cases per 1000 person-years) versus only 17 persons over the next 7 years (1.6 cases per 1000 person-years)
- A study of British schoolchildren found similar results with 54% of those developing active disease doing so within the first year and 82% within 2 years
Who should be targeted for LTBI screening?

- Because of risk of recent infection to obvious high priority groups are recent contacts and documented skin test converters

- Persons from higher risk regions of the world will have TB rates that approach those of their home countries for several years after arrival to the US

- Review local epidemiological data but other groups to screen may include those in institutional settings, corrections, homeless individuals

- Consider likelihood of adherence prior to starting
Table 2. Incidence of active tuberculosis (TB) in persons with a positive tuberculin test, by selected risk factors

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>TB cases/1,000 person-years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recent TB infection</strong></td>
<td></td>
</tr>
<tr>
<td>Infection &lt;1 yr past</td>
<td>12.9 (6)*</td>
</tr>
<tr>
<td>Infection 1–7 yr past</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Human immunodeficiency virus</strong> (HIV) infection</td>
<td>35.0–162 (28)</td>
</tr>
<tr>
<td><strong>Injection drug use</strong></td>
<td></td>
</tr>
<tr>
<td>HIV seropositive</td>
<td>76.0 (31)</td>
</tr>
<tr>
<td>HIV seronegative or unknown</td>
<td>10.0 (31)</td>
</tr>
<tr>
<td><strong>Silicosis</strong></td>
<td>68 (36)</td>
</tr>
<tr>
<td><strong>Radiographic findings consistent with prior TB</strong></td>
<td>2.0–13.6 (32–34)</td>
</tr>
<tr>
<td><strong>Weight deviation from standard</strong></td>
<td></td>
</tr>
<tr>
<td>Underweight by $\geq$ 15%</td>
<td>2.6 (35)</td>
</tr>
<tr>
<td>Underweight by 10–14%</td>
<td>2.0</td>
</tr>
<tr>
<td>Underweight by 5–9%</td>
<td>2.2</td>
</tr>
<tr>
<td>Weight within 5% of standard</td>
<td>1.1</td>
</tr>
<tr>
<td>Overweight by $\geq$ 5%</td>
<td>0.7</td>
</tr>
</tbody>
</table>

* Numbers in parentheses are reference numbers.
**Table 3. Relative risk* for developing active tuberculosis (TB), by selected clinical conditions**

<table>
<thead>
<tr>
<th>Clinical condition</th>
<th>Relative risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicosis</td>
<td>30 ((37,38)^\dagger)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2.0–4.1 ((42–44))</td>
</tr>
<tr>
<td>Chronic renal failure/hemodialysis</td>
<td>10.0–25.3 ((39–41))</td>
</tr>
<tr>
<td>Gastrectomy</td>
<td>2–5 ((45–47))</td>
</tr>
<tr>
<td>Jejunoileal bypass</td>
<td>27–63 ((48–49))</td>
</tr>
<tr>
<td>Solid organ transplantation</td>
<td></td>
</tr>
<tr>
<td>Renal</td>
<td>37 ((50))</td>
</tr>
<tr>
<td>Cardiac</td>
<td>20–74 ((51,52))</td>
</tr>
<tr>
<td>Carcinoma of head or neck</td>
<td>16 ((53))</td>
</tr>
</tbody>
</table>

*Relative to control population; independent of tuberculin-test status.
\dagger Numbers in parentheses are reference numbers.
Summary and Conclusion