XDR-TB: Evolving Role of Public Health in Tuberculosis

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Columbia, Maryland

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Howard County, Maryland

References: United State Census Map, 2015
Howard County Demographics

• Howard County is one of the wealthiest counties in the United States.

• Population of 304,000: 1 out of 6 residents is foreign born.

• 95 % are High School graduates

• 60 % are College/Professional graduates
## Howard County TB cases

<table>
<thead>
<tr>
<th>Year</th>
<th>Angola</th>
<th>China</th>
<th>Ethiopia</th>
<th>India</th>
<th>Iran</th>
<th>Korea</th>
<th>Malaysia</th>
<th>Mexico</th>
<th>Myanmar</th>
<th>Nigeria</th>
<th>Russia</th>
<th>Thailand</th>
<th>US</th>
<th>Vietnam</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2014</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>
MDR-TB in the U.S.

*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.
XDR-TB in the U.S.
Pediatric XDR – TB Case Background

• Healthy U.S. born two-year-old of foreign-born parents
• Parents are healthcare professionals experienced with TB
• Traveled to India from 5/31/13 – 8/20/13
• Healthy household members: mother, father, five-year-old sibling
• U.S. daycare attendee before and after India trip
Pediatric XDR-TB Timeline

8/13  Sx onset (India)
8/20  Returned to USA home
8/23  PCP eval
8/26  Hospital Adm
      CXR abnl
      Chest CT abnl
      Gastricasp x 4
9/4   Hospital DC
      LHD begins DOT
9/30  Rx tolerated
      New daycare enrollment
10/3  Cx + for MTB
      (1 of 4 gastric asp)
      Hospital notified parent
10/8  LHD Notified of MTB
11/27 XDR-TB confirmed
11/14 Notified of drug resistance,
      Home isolation begins
12/2  Hosp Adm
12/4  Hickman cath placed
      New drug regimen started
# Pediatric XDR-TB Case

## XDR-TB Drug Resistance Profile

<table>
<thead>
<tr>
<th>First-line drugs</th>
<th>Fluoroquinolone</th>
<th>Second-line drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoniazid</td>
<td>Moxifloxacin</td>
<td>Amikacin</td>
</tr>
<tr>
<td>Rifampin</td>
<td></td>
<td>Kanamycin</td>
</tr>
<tr>
<td>Pyrazinamide</td>
<td></td>
<td>Capreomycin</td>
</tr>
<tr>
<td>Ethambutol</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Pediatric XDR-TB Regimen**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streptomycin intravenous (25 mg/kg)</td>
<td>Once daily</td>
</tr>
<tr>
<td>Linezolid (20 mg/kg/day-divided dose)</td>
<td>Twice daily</td>
</tr>
<tr>
<td>PAS (150 mg/kg/day-divided dose)</td>
<td>Twice daily</td>
</tr>
<tr>
<td>Cylcoserine (20 mg/kg/day-divided dose)</td>
<td>Twice daily</td>
</tr>
<tr>
<td>Clofazimine (50 mg)</td>
<td>Once daily</td>
</tr>
<tr>
<td>Vitamin B₆ (12.5 mg)</td>
<td>Once daily</td>
</tr>
</tbody>
</table>

- Regimen changed during course of treatment based upon patient weight, drug levels, and ongoing consultations
- Total treatment period was 21 months
Pediatric XDR-TB LHD Challenges

– Care Coordination
  • Family
  • Private provider
  • Local and state health departments and the CDC
  • Other academic faculty working in TB clinical practice and research

– Public Health Responsibilities
  • Consultations with local, state, federal, and international TB experts
  • DOT
  • Contact/Source case investigations
Pediatric XDR-TB DOT Challenge

- Small LHD TB Program

- Special order medications

- Lack of DOT awareness and acceptance

- Multiple DOT visits
  - Morning visits 90 minutes
  - Evening visits 30-45 minutes
  - Residence 45 minutes from the LHD
## Pediatric XDR-TB Investigation Challenge

### Index case information:
- Symptoms of fever began: 8/13/2013.

### Relationship to Case

<table>
<thead>
<tr>
<th>Relationship to Case</th>
<th>Travel History</th>
<th>Tuberculin skin test (TST)</th>
<th>CXR/DS/DTB</th>
<th>Imaging</th>
<th>Results reviewed</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father</td>
<td>India in 2012 for 3-4 weeks to visit family and friends. Traveled to and from India with kids in June 2013.</td>
<td>History of positive PPD (5mm) in 1996 at Hospital. QFT (+) 7/6/2011. Refused TST/TB.</td>
<td>CXR done 11/25/2013, per report is normal</td>
<td>Yes</td>
<td>CIC considered, no evidence of TB.</td>
<td>Family members live in the Mumbai area: have never been treated for TB, none have symptoms. One brother lives out of state, and visits family about 1 x a year; no symptoms of TB. No visitors from India, or anywhere else, to home over past 6 months.</td>
</tr>
<tr>
<td>Mother</td>
<td>India in 2011 for 3-4 weeks. No travel in the last year.</td>
<td>QFT (+) in Sept. and Nov.</td>
<td>None</td>
<td>Yes</td>
<td>CIC considered, no evidence of TB.</td>
<td>May be traveling to U.S. late Dec./early Jan. to care for child for 2-3 months. Father denies any symptoms of TB or prior tx for TB. Update: Grandmother was not able to travel to U.S. due to an undiagnosed health problem.</td>
</tr>
<tr>
<td>Sibling (5y.o.)</td>
<td>To India 5/31/2013 - Returned 8/20/2013. India in 2011 for 3-4 weeks.</td>
<td>QFT (+) in Sept. and Nov. 2013 by HID. TST (+) June 2013 in India per report from father. Rec’d BCG vaccine 6/12/2013 per report.</td>
<td>CXR done 12/14/2013</td>
<td>Yes</td>
<td>CIC considered, no evidence of TB.</td>
<td>Father denies cook has any TB symptoms</td>
</tr>
<tr>
<td>Self: Primary case (3y.o.)</td>
<td>To India 5/31/2013 - Returned 8/20/2013. India in 2011 for 3-4 weeks.</td>
<td>QFT (+) in Aug. pos, culture MTB: gomycin aspirate TST (+) June 2013 in India per report from father. Rec’d BCG vaccine 6/10/2013 per report.</td>
<td>CXR done in India 11/15/2013, per report is normal</td>
<td>Yes</td>
<td>CIC considered, no evidence of TB.</td>
<td>Father denies cook has any TB symptoms</td>
</tr>
</tbody>
</table>

### Timeline

- **June 1, 2013:** Arrive in India
- **June 17, 2013:** Start daycare, 2 hours per day
- **August 13, 2013:** Fever begins
- **August 20, 2013:** Diagnosed with TB
Strengths

• Federal, state, local agencies and private provider worked efficiently, collaboratively, and compassionately as a team

• Customized medications were facilitated
  – Patient had private health insurance
  – Hospital pediatric pharmacy prepared unit dosing and provided guidance for administering meds and for monitoring possible side effects

• LHD provided DOT twice daily 7 days a week
  – LHD funds used to hire agency nurse for evening and weekend DOT

• Child responded favorably to treatment
Weaknesses

• Multiple conference calls
  – Up to 24 people on initial calls
    • Numerous private and public health experts

• Varying and conflicting opinions expressed by experts

  Example:
  – Experts stated that child was not infectious
  – LHD was not using respiratory precautions BUT...
    • Airborne isolation was in place while patient was in the hospital, AND
    • Respiratory precautions ordered for pediatric home health team

• Funding was not readily available for specialized medications or staff overtime – private insurance and HO approved county funds to assist
Opportunities

• Positive culture allowing for susceptibility testing

• Family had health insurance
  – Allowed for purchase / preparation of medications
  – Paid for appointments including labs, vision, audiology and vestibular assessments, and consultations with specialists

• Private provider was open and willing to collaborate with LHD

• Medications were tolerated
  – Minimal side effects
Threats

• Toddler with XDR-TB

• Multiple Voices
  – Notoriety of diagnosis
  – Family priorities versus public health priorities

• DOT
  – Missed DOT doses extended treatment
  – Identifying funding for extensive DOT coverage
Lessons Learned

• Collaboration is the key to treatment success

• Consider effects of long-term intense treatment on child and family
  – Length of treatment

• DOT Schedule:
  – Initial twice daily visits
  – Length of home visits due to IV therapy and spacing of medications
  – Consider DOT team – initially, various LHD nurses provided DOT
  – Adjust work schedules to provide DOT into evening hours and weekends

• Staff Awareness:
  – Resource packets
  – HD provided respiratory training for additional staff
  – Cultural Competency
  – Navigating the experts
Update on child with XDR

• Seen by private provider in October, 2015
• No symptoms of TB
• Bronze skin color from Clofazimine slightly improved – expect complete resolution to take several years
• TSH and free T4 is normal – off Synthroid
• Child is enjoying kindergarten, and gaining weight appropriately
• Next follow up in March, 2016
Acknowledgements

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  – Nancy Baruch RN, MBA, Maryland TB Controller
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  – Wendy Kensie, RN, JPS
  – Fiori Tesfamarian, LPN
  – Marilyn Birkner, Clerical
  – Zakariya Kmri, HCPSS Gifted & Talented Program Student Intern
Moving Forward

If everyone is moving forward together, then success takes care of itself. - Henry Ford
Questions?