PEDiatric TUBERCULOSIS (TB) CONTACT INVESTIGATION IN AN ELEMENTARY SCHOOL SETTING: A CASE STUDY

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Nnenna Wachuku & Lukas Ayers have the following disclosures to make:

- No conflicts of interest
- No relevant financial relationships with any commercial companies pertaining to this educational activity/conference
The following is an overview of a complex pediatric tuberculosis (TB) contact investigation that occurred from October 2018-April 2019 in a public elementary school setting within Wayne County, Michigan.
OBJECTIVES

- Outline processes used for a complex pediatric TB contact investigation
- Revisit discussion on infectiousness of TB in children
- Highlight the importance of multi-organizational partnerships and collaboration during complex TB contact investigations
- Discuss challenges and strengths of this contact investigation
**PEDIATRIC TB IN THE U.S.**

- Defined as TB disease in a person <15 yrs. of age
- 9,025 total *new* TB cases reported in 2018
  - 372 cases in children under 15 yrs. of age (4.1%)

In Michigan...

- 108 total *new* TB cases reported in 2018
  - 8 cases in children under 15 yrs. of age (7.4%)
TB IN CHILDREN

- Manifests differently than in adults and/or adolescents
- Considered a marker for recent transmission
- Young children diagnosed are typically asymptomatic with fewer tubercle bacilli in lungs
- Lack physical force to produce airborne bacilli while coughing
- Rarely considered to be infectious
  - However, more likely to develop life-threatening forms of TB disease
INFECTIOUSNESS OF YOUNG CHILDREN WITH PULMONARY TB

- Presumed low risk of transmission by young children
- Most likely infected by adult contacts
- Determine source of the child’s infection
- Limited contact investigation surrounding the child
- Few studies available focused on TB contact investigations in school-aged children
INDEX CASE
Ten-year old female presented to an urgent care facility and is diagnosed with pneumonia.

Immigrated to U.S. from Vietnam in March 2018.

Referred to area hospital for possible TB.

Patient was admitted and placed in Airborne Infection Isolation (AI).

Wayne Co. notified of potential TB case.

Treatment initiated: Community Acquired Pneumonia (CAP).
Additional Info.

- Evaluated overseas prior to immigrating per CDC guidelines
  - Had a negative TB skin test
- Third-grade student at a local public elementary school
- Rides school bus to & from school
Acid-fast bacillus (AFB) smear of 4++
QuantiFERON Gold (QFT) positive
*M. tuberculosis* DNA detected by PCR
TB treatment initiated:
- Isoniazid (INH)
- Rifampin
- Pyrazinamide (PZA)
- Ethambutol
- Pyridoxine (B6)
TB CONTACT INVESTIGATION BEGINS

November 01, 2018
Wayne Co. conducted a hospital visit to interview patient and patient’s family

Dual-handset phone (“blue-phone”) utilized due to language barrier

Four household contacts identified as having prolonged exposure to the patient
All contacts were born abroad in Vietnam
- Likely received Bacillus Calmette-Guérin (BCG) vaccine as children

All contacts had negative TB skin tests prior to immigrating to U.S.

QFT blood tests administered to each contact

All four QFT tests were positive with normal chest x-rays

Latent TB Infection (LTBI) treatment initiated at Beaumont/Wayne Co. TB Clinic
Wayne Co. conducted a site visit at index case’s elementary school

- Met with school administrators and staff
- Determined physical layout of the building
  - Airflow, ventilation
  - Set up of classrooms by grade & location
- Learned class schedules and activities (index case)

Conference call held with Michigan Dept. of Health & Human Services (MDHHS) TB program
Wayne Co. hosted an in-service for the elementary school administrators, teachers & auxiliary staff

- Education on TB disease
- Explained active TB disease vs. LTBI
- Outlined plan for contact investigation
- Answered questions/concerns

Wayne Co. provided school administrators with testing consent forms & informational letters to be distributed to students’ parents/guardians
AND THEN...
Public Health Department confirms tuberculosis case at [redacted] school

By Priya Mann - Reporter, Dana Spero Kelly - Web Producer

[Image]

[Image]

Tuberculosis Confirmed In Wayne County Elementary School Student

The child is not attending classes, so other children will not be exposed.

Tuberculosis being investigated at [redacted] school

[Image]

Case of tuberculosis confirmed at metro Detroit elementary school

[Image]
10/29/18
• Index case presents to urgent care facility

10/31/18
• Confirmation of TB diagnosis

11/01/18
• Contact investigation initiated by Wayne Co.

11/02/18
• Local news media breaks story of confirmed TB case in local elementary school
SECONDARY CASE

...also on November 02, 2018
5-yr. old girl presented to her pediatrician’s office with worsening cough for 3-days.

Due to respiratory distress & pale skin presentation, patient referred to area hospital.

Admitted & initiated treatment for CAP.

Parent contacted school officials to report illness.

School staff realized this child lives near the index case and rides the same school bus.

School principal contacted Wayne Co.
Wayne Co. informed patient’s pediatrician of potential TB exposure

Pediatrician contacted the hospital’s ID team

Patient placed in AII

Positive AFB smear

Negative QFT

Negative skin test

Negative PCR (?)

However, gastric aspirate specimen was not neutralized within 4 hrs according to protocol, it was neutralized over 24-hrs later
Four household contacts identified as having prolonged exposure to secondary case

Due to all contacts being U.S.-born, each contact was administered a TB skin test

All results were negative
Wayne Co. hosted conference call with MDHHS TB program to provide updates and discuss need for additional resources

Wayne Co. hosted conference call with school administrators to finalize logistics of on-site testing/contact investigation

School distributed informational letters and testing consent forms to students’ parents/guardians
FIRST-STEP SKIN TESTING AT THE SCHOOL
Identified Contacts

- All kindergarten (secondary case’s grade) & third grade (index case’s grade) students
- All students who rode the same school bus as the index/secondary cases
- All students whose classrooms were ‘split’ or ‘shared’ with a kindergarten or third grade class
- 5th and 4th grade students who acted as “reading buddies” with index or secondary case’s classrooms
- Teachers, auxiliary staff
  - Lunch room staff
  - Bus drivers who drove the case’s bus
  - Janitorial staff
First-Step Skin Testing at the School

11/07/18
- Tests administered

11/09/18
- Tests read from 11/07
- Tests administered to those absent on 11/07

11/12/18
- Tests read from 11/09

11/13/18
- Tests administered to those absent on 11/07 or 11/09

11/16/18
- Tests read from 11/13
# No. of First-Step Tests Administered by Contact Type

<table>
<thead>
<tr>
<th>Contact type</th>
<th>No. of first-step tests administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>224</td>
</tr>
<tr>
<td>Teachers, Auxiliary Staff</td>
<td>41</td>
</tr>
<tr>
<td><strong>Total First-Step Tests Administered</strong></td>
<td><strong>265</strong></td>
</tr>
</tbody>
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# No. of First-Step Tests Administered to Students by Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>No. of first-step tests administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten</td>
<td>56</td>
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<tr>
<td>1st grade</td>
<td>7</td>
</tr>
<tr>
<td>2nd grade</td>
<td>22</td>
</tr>
<tr>
<td>3rd grade</td>
<td>73</td>
</tr>
<tr>
<td>4th grade</td>
<td>26</td>
</tr>
<tr>
<td>5th grade</td>
<td>40</td>
</tr>
</tbody>
</table>
3 POS (+) skin tests

- One 3rd grade male student
  - Same classroom as index case
- One kindergarten female student
  - Same grade as secondary case, but different classroom
- One 1st grade male student
  - Classroom ‘split’ with secondary case’s class

Four children of staff contacts referred to TB clinic for window prophylaxis due to age (under 5 yrs.)
November 29, 2018
- Initial susceptibility testing indicated resistance to INH
- Index case discontinued INH
- Replaced with moxifloxacin

December 05, 2018
- MDHHS lab confirmed resistance to INH
School principal contacted Wayne Co. to inform that the secondary case participates in a bible study group hosted on-site at the school by external church volunteers.

Wayne Co. coordinated skin testing of the external volunteers with the school principal.

Wayne Co. returned to the school on 12/04/18 to administer tests to 8 identified volunteers.

Tests read 12/07/18 and all results were negative.
## First-step Skin Testing Concludes

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<tbody>
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</tr>
<tr>
<td>Teachers, auxiliary staff</td>
<td>41</td>
</tr>
<tr>
<td>Bible study volunteers</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total first-step tests administered</strong></td>
<td><strong>273</strong></td>
</tr>
</tbody>
</table>
10/29/18
• Index case presents to urgent care facility

11/02/18
• Local news media break story of confirmed pediatric TB case
• Secondary case presents to pediatrician’s office

11/07/18
• First-step skin testing initiated on-site at school

11/09/18
• 1 POS (+) test in a 3rd grade student

11/16/18
• 2 POS (+) tests; 1 kindergarten student and 1 1st-grade student

11/29/18
• Index case resistant to INH, started on moxifloxacin

12/04/18
• First-step tests administered to bible study volunteers

12/07/18
• Tests read from 12/04
• First-step skin testing concludes
SECOND-STEP SKIN TESTING

Step 2
SECOND-STEP SKIN TESTING AT THE SCHOOL

**02/05/19**
- Tests administered

**02/08/19**
- Tests read from 02/05

**02/19/19**
- Tests administered to those absent on 02/05

**02/21/19**
- Tests read from 02/19
### No. of Second-Step Tests Administered by Contact Type

<table>
<thead>
<tr>
<th>Contact type</th>
<th>No. of second-step tests administered</th>
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</thead>
<tbody>
<tr>
<td>Students</td>
<td>275</td>
</tr>
<tr>
<td>Teachers, Auxiliary Staff</td>
<td>45</td>
</tr>
<tr>
<td>Bible Study Group Volunteers</td>
<td>8</td>
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<tr>
<td><strong>Total Second-Step Tests Administered</strong></td>
<td><strong>328</strong></td>
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<tr>
<td>Grade</td>
<td>No. of second-step tests administered</td>
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<tr>
<td>Kindergarten</td>
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<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; grade</td>
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</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; grade</td>
<td>22</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; grade</td>
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<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; grade</td>
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<td>49</td>
</tr>
<tr>
<td>Special Education</td>
<td>2</td>
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</tbody>
</table>
RESULTS FROM SECOND-STEP SKIN TESTING

- 22 POS (+) skin tests
  - 1 male kindergarten student
    - “Reading buddy” in index case’s classroom
  - 1 female kindergarten student
    - Same classroom as secondary case
  - 19 3rd grade students
    - 1 later diagnosed as active TB
  - 1 female 5th grade student
10/29/18
• Index case presents to urgent care

11/02/18
• Secondary case presents to pediatrician office

11/07/18
• First-step skin testing begins on-site at the school

11/09/18
• 1 POS (+) test

11/16/18
• 2 POS (+) tests

02/05/19
• Second-step skin testing concludes
• No additional POS (+) results

02/08/19
• 22 POS (+) skin tests

12/07/18
• First-step skin testing concludes
THIRD ACTIVE CASE
Female 3rd-grade student with a POS (+) skin test

Both preliminary and confirmatory chest x-rays abnormal

Wayne Co., MDHHS and pediatric ID specialist determined to treat patient as active TB case

TB treatment initiated
Household Contacts of Third Active Case

- **Five** household contacts identified as having prolonged exposure to case
- Due to all contacts being U.S.-born, each contact was administered a TB skin test
- All results were negative
Wayne Co. informed by the school principal that the third case participates in an external cheerleading group.

Wayne Co. worked with the school to obtain contact information for cheerleading group.

Wayne Co. notified parents/guardians of exposure.

Contacts referred to TB clinic for skin testing.
CONTACT INVESTIGATION CONCLUDES
“EXIT” MEETING

- Wayne Co. hosts informational “exit” meeting on-site at the school for students’ parents/guardians, school administrators, teachers and other staff
- Provide conclusion of contact investigation, as well as additional information/resources on TB
- Answer questions or concerns parents or staff may have
CHALLENGES

CHALLENGE ACCEPTED
- Language barrier
- Cultural beliefs, attitudes about TB
- Relocation of identified contacts
- News media
- Staffing
  - DOT coverage
- Contact investigation involving minors
  - Parent/guardian consent required
  - Needle/shot anxiety
- Absenteeism
  - Students, staff
- School organization
  - Shared or ‘split’ classes
- Treatment compliance/adherence
- Drug resistance
- Socioeconomic status of cases
  - Use of incentives
  - Housing
- Inclement weather
  - Investigation during winter months
  - Forced to reschedule on-site testing dates due to school district closures
STRENGTHS
MULTI-ORGANIZATIONAL COLLABORATION

- MI Dept. of Health & Human Services (MDHHS) TB Program
- Beaumont/Wayne Co. TB Clinic
- Administrators and teachers from the school and district
- Area hospital infection control, infectious disease teams
- Wayne Co. Public Information Officer (PIO) and senior administration
STRENGTHS CONT’D.

- School principal's rapport w/ staff, parents/guardians & students
- Providing honest, direct information to school staff & parents/guardians on TB contact investigation
- Offering the opportunity for school staff & parents/guardians to ask questions
- Knowledge and dedication of Wayne Co. CD/DOT nurses and staff
- Additional nursing support from MDHHS & TB clinic staff
LESSONS LEARNED

- Pediatric TB *can* be infectious & should not be overlooked
- Establishing a working partnership w/ school district administrators & staff is paramount
- Have policies in place for responding to news media
  - Know your PIO
- Always collaborate w/ state & local partners
  - MDHHS TB program, Beaumont TB clinic, hospital ICPs, local physicians
LESSONS LEARNED CONT’D.

- Ask for help or additional resources when (or before) needed
- Allow space & time for parents/guardians to ask questions
- Always be prepared & equipped for any type of contact investigation
QUESTIONS?