Fundamentals of Contact Investigations

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TB Control and Prevention

Priority 1 – Index patient
- Promptly detect, report and treat with effective drug regimens all persons who have, or are suspected of having, active TB disease

Priority 2 – Contact investigation
- Identify high priority contacts of patients with contagious TB and completely treat those who are found to be infected.

Priority 3 – Targeted testing
- Prevent TB among populations infected with LTBI who are at greatest risk for progressing to disease.

Priority 4 – Infection control
- Prevent transmission in settings at high risk for transmission through effective infection control measures
A Critical TB Control Strategy
Contact Investigation

Most effective strategy for preventing future cases of TB

On average, 10 contacts are identified for each case with infectious TB in the U.S.

30 - 40% of high quality contacts are expected to be infected

Infected contacts are 5% more likely to progress to active TB disease during the first two years after infection

Goal and Objectives

To prevent further cases of TB by
- Identifying those who have been infected
- Finding secondary TB cases
- Treating infected contacts to completion

Additional benefits
- Prevent uninfected contacts from becoming infected
- Educate individuals and the community
Who is Responsible

Your **health department** is legally responsible for:

- ensuring a complete contact investigation is done for the TB cases reported in your district
- follow-up of TB case investigations originating in your district that move to other jurisdictions

Definitions (1)

**Index case:**
- The first patient that comes to your attention as a TB Case

**Contact:**
- Refers to someone who shares air space with a person who has infectious tuberculosis

**High Priority (vulnerable) Contact:**
- Refers to a contact who has a high risk of progression to disease if infected

**Secondary Case of TB:**
- Active TB cases identified within an ongoing contact investigation
Definitions (2)

**Infectious period:**
- Time period when a person with infectious TB disease is capable of transmitting TB bacilli

**Window period:**
- 8 - 10 week interval from a contact’s last exposure to an infectious TB case

**Exposure:**
- Length of time a person spends with an infectious TB case

**Date of last exposure (Break in exposure):**
- Date a contact was last exposed to an infectious TB case

Definitions (3)

**Proxy Interview:**
- Interviews with someone other than the index case

**Contact Interview:**
- Interview which verifies extent of exposure and vulnerability

**Site Investigation/Interview:**
- Investigation occurring at sites identified as potential locations of TB transmission

**Source Case Investigation:**
- An investigation to locate the source of TB infection. This activity most commonly occurs when young children are involved
Contact Investigation Process

Is a contact investigation indicated?

Collect information about the client’s TB disease, symptoms, bacteriology, x-ray results, and treatment regimen

Determine whether the client is infectious and, if yes, when did infectious period begin

Gray areas exist

Pit falls

• Jumping in
• Standing still
Decision to Initiate a TB Contact Investigation

SITE OF DISEASE

PULMONARY/LARYNGEAL/PLEURAL

AFB SPUTUM SMEAR POSITIVE

AFB SPUTUM SMEAR NEGATIVE OR NOT PERFORMED

NAA POSITIVE OR NOT PERFORMED

NAA NEGATIVE

CONTACT INVESTIGATION SHOULD ALWAYS BE INITIATED

CONTACT INVESTIGATION NOT INDICATED

CONTACT INVESTIGATION SHOULD BE INITIATED IF SUFFICIENT RESOURCES

CONTACT INVESTIGATION SHOULD BE INITIATED IF SUFFICIENT RESOURCES

CONTACT INVESTIGATION SHOULD BE INITIATED ONLY IN EXCEPTIONAL CIRCUMSTANCES

PULMONARY SUSPECT (tests pending, e.g., cultures)

NON-PULMONARY (pulmonary and laryngeal sites ruled out)

CI NOT INDICATED

LARYNGEAL/PLEURAL

AFB SPUTUM SMEAR NEGATIVE OR NOT PERFORMED

ABNORMAL CXR

ABNORMAL CXR NOT CONSISTENT WITH TB

AFB SPUTUM SMEAR POSITIVE

AFB SPUTUM SMEAR NEGATIVE OR NOT PERFORMED

NAA POSITIVE OR NOT PERFORMED

NAA NEGATIVE

CONTACT INVESTIGATION SHOULD ALWAYS BE INITIATED

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Index case behavioral characteristics

Engaging in risky behaviors
Sociability
Singing

• Acid-fast bacilli
• Approved indication for NAA
• Nucleic acid assay
• Chest radiograph

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Rank the following patients in order of priority for starting a CI

1. Lymph node smear +/-, CXR-abnormal

2. Bone culture +M.tb, sputum smear -/culture pending, CXR-normal

3. Sputum smear +3, culture AFB +, ID pending

4. Sputum smear -, sputum culture -, CXR normal, HIV +, 400 CD4, TST 10mm

Environmental Factors that Predict Likely Transmission

Exposure exceeding environmental limits

VDH TB Control has suggested the following environmental exposure limits allowing for some nursing discretion to warrant expansion or limitation of Contact Investigations:

<table>
<thead>
<tr>
<th>Estimated Time</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Hours</td>
<td>Very Small</td>
<td>Car, small office</td>
</tr>
<tr>
<td>24 Hours</td>
<td>Small/Medium</td>
<td>Classroom, meeting room</td>
</tr>
<tr>
<td>50 Hours</td>
<td>Medium/Large</td>
<td>Cafeteria, small church</td>
</tr>
<tr>
<td>100 Hours</td>
<td>Large/Very large</td>
<td>Gymnasium, auditorium</td>
</tr>
</tbody>
</table>
Initial Index Case Interview Questions

One day after notification for infectious patients then repeat during course of care
Includes:

- Potential contacts
  - unique identifying characteristics
  - demographics - eg. nicknames
  - relationship/connection
  - known medical risk factors
- Potential exposure sites
  - environmental characteristics
  - Frequency and duration at site

Determining the Infectious Period

There is no scientific method to determine the period of infectiousness

Determine (estimate) the infectious period using:

- Symptoms – cough, weight loss, fever, fatigue
- Bacteriology – smear: negative, rare, 1+, 2+, 3+ or 4+
- Chest X-ray – cavities present?
Guidelines for Estimating the Start of the Infectious Period for TB Cases

<table>
<thead>
<tr>
<th>Index Case Characteristics</th>
<th>Estimated Start of Infectious Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TB Sx</strong></td>
<td><strong>Sputum Smear +</strong></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
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<td>No</td>
<td>Yes</td>
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<tr>
<td>Yes</td>
<td>No</td>
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<tr>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Estimate the start of the Infectious period for hospitalized patient

Current symptoms and findings (4/1/13)
- hemoptysis, TB symptoms, cavitary CXR

Hospital history obtained prior to interview:
- 2/14/13 - pt. seen in ER - SOB, cough, fever, chills, night sweats, loss of appetite. Diagnosed with pneumonia, given Levoquin and discharged

CI content - Public health
- Attended party New Years day (1/1/13)
- Told to leave because of sever cough
- Admits to 4 week cough prior to party

- Admits to 4 week cough prior to party
- Also had night sweats, occasional fever, unexplained weight loss in Dec. (Totals 4 months of symptoms)
- *Felt fine on Thanksgiving
Estimate the start of the infectious period for a patient at home

4/12/13, a pt. went to his PMD for a TST after returning from a trip to Africa. The pt. had no TB symptoms.

4/15/13, the TST was 15mm, a CXR was abnormal, consistent with TB, non-cavitary, and the HD was notified that RIPE began. A sputum sample was collected.

4/16 and 4/17, 2 more sputum samples were collected and all were reported as smear negative on 4/20/13.

Determining the end of the Infectious Period

Determine the likelihood of resistance.

After a client has received adequate multidrug treatment for at least two to three weeks

If there is a demonstration of adherence

If there is demonstrated evidence of clinical improvement

More stringent criteria if returning to a congregate setting:

- Three negative sputum smears obtained at least 8 hours apart, with no less than one early morning specimen
Estimate the infectious period

- Cough since Christmas 2012, Hospitalized 1/15/13
- Smear positive/MTD positive 1/16/13
- RIPE started 1/16/13
- Leaves Hospital AMA 1/20/13

1. 1/15/06 - 1/30/06
2. 9/20/05 - ?
3. 8/20/05 - 1/30/06
4. 11/25/05 - ?

Who do you evaluate first?

Prioritize the contacts with the information you have up to this point and evaluate these groups first.

- Symptomatic Contacts
- Those with certain medical risk factors, e.g.
  - Transplant patients
  - HIV-infected/AIDS
  - TNFα antagonist
  - Diabetes
- Children < 5
- Anyone with extensive exposure
I. Sputum Smear Positive, Culture Positive and/or Cavitary X-ray

High Priority Contacts
- Household
- Children < 5
- Medical Risk Factors
- Exposure during medical procedures
- Congregate setting
- Exceeds duration of exposure limits

Medium Priority
- Children aged 5-15
- Exceeds duration of exposure limits for medium priority contacts

II. Sputum Smear Negative, Culture Positive

High Priority
- Children < 5
- Medical Risk Factors
- Exposure during medical procedures smear negative, culture positive

Medium Priority
- Household
- Congregate settings
- Exceeds duration of exposure limits for medium priority contacts
III. Pulmonary Suspects

Smear negative, NAA/culture negative, abnormal chest x-ray not consistent with TB disease

- All medium priority
  - Household
  - Children < 5
  - Medical risk factors
  - Exposure during a medical procedure

Prioritize these contacts to a sputum smear and culture positive index case

1. 10 y/o middle school student
2. 20 y/o college student with syphilis
3. 30 y/o with insulin dependent diabetes
4. 40 y/o dialysis patient
Prioritize these contacts to a sputum smear negative, culture positive index case

1. 50 y/o taking TNFα-blockers
2. 40 y/o AIDS patient
3. 30 y/o wife
4. 20 y/o recently released from prison

Initial Contact Interview

Face to face meeting within 3 working days of identification.

Components of a contact interview

- Provide TB education
- Assess for symptoms of TB
- Check for other medical and psychosocial co-morbidities
- Assess extent of exposure to the index case
- Determine TB history/testing
- Collect demographics
- Place the TST at this time if possible
- Perform HIV test if status is unknown
Initial Contact Medical Evaluation

Complete within 1 week for high priority contacts

Draw HIV Testing if not done at initial interview
Place TST if not done at initial interview
Chest X-ray and Medical Exam
  - Children ≤4 years old
  - HIV + individuals
  - TB symptoms
  - TST ≥5 mm
Sputum Exam X 3 (early morning specimens)
  - TB symptoms
  - Suspicious chest x-ray

Evaluating Contacts with Documented Previous Positive TST

Gather background health/psychosocial information.
Determine current risk for progression to disease.
Assess for symptoms of active TB. If present:
  - Medical evaluation
  - Chest x-ray
  - Sputum for AFB x 3
Site Investigation

Site visits augment the interview

- Home
  - 3 days of the initial interview
  - Additional contact information is elicited; especially helpful for finding children
- Work
- Social

Avoiding site visits contributes to TB outbreaks!

Prioritizing Sites

Infectiousness of the Index Case
Vulnerability of contacts
Site characteristics
Duration of Exposure
Frequency of Exposure
Prioritize these sites for need of follow-up. Case is smear & culture +

1. Daycare
2. Big box store
3. Prison/Jail
4. High school
5. Animal shelter

What is “post exposure” testing?
Repeat (2nd round) TST done at the end of the window period if the initial TST was negative

What is a completely evaluated contact?
Post exposure testing
CXR
Medical exam if indicated
The 502

- Helps keep important data organized
- Necessary for collecting reportable data needed by CDC
- Useful for keeping track of missing data that leads to closure
- Only single place that displays all of the hard work done

Expanding a Contact Investigation

Based on review of all available information

Factors which indicate recent transmission

- Higher than expected infection rate
- Secondary cases identified
- Evidence post exposure infection

Do Not Expand a CI Unless Data Indicate Recent Transmission
Contact Investigation Scenarios

Putting it all together
Both patients are currently hospitalized
Who do you visit first? Why?

Patient 1
- 22 y/o
- Sputum smear 4+
- Culture pending
- HIV negative
- CXR: RUL cavitory lesion
- Productive cough for 6 wks
- Blood tinged sputum
- RIPE started

Patient 2
- 35 y/o
- Sputum smear =/-
- Culture pending
- HIV positive
- CXR: bilateral middle lobe infiltrates
- Fatigue, fever, dry cough
- RIPE started

Which site visits have the highest priority? Why?

Patient 1
- 22 y/o
- Sputum smear 4+
- Culture pending
- HIV negative
- CXR: RUL cavitory lesion
- Productive cough for 6 wks
- Blood tinged sputum
- RIPE started
- Lives alone/apartment
- Work - Landscaping

Patient 2
- 35 y/o
- Sputum smear =/-
- Culture pending
- HIV positive
- CXR: bilateral middle lobe infiltrates
- Fatigue, fever, dry cough
- RIPE started
- Lives in a Ryan White facility
- Work - Manages R.W. facility
Do priorities change? Why or why not?

Patient 1
- 22 y/o
- Sputum smear 4+
- Culture pending
- HIV negative
- CXR: RUL cavitory lesion
- Productive cough for 6 wks
- Blood tinged sputum
- RIPE started
- Lives alone/apartment
- Work - Landscaping
- Symptoms improving
- DNA probe +M. tb

Patient 2
- 35 y/o
- Sputum smear +/-
- Culture pending
- HIV positive
- CXR: bilateral middle lobe infiltrates
- Fatigue, fever, dry cough
- RIPE started
- Lives in a Ryan White facility
- Work - Manages R.W. facility
- Cough worsening
- DNA probe +MAC

Next Investigation!
PCP reports 24 y/o from Mexico in her first trimester of pregnancy with c/o:

Symptoms
• Productive cough for 4 weeks
• Chest pain - predominatley on the upper left side
• Hyperhidrosis

Procedures performed:
CXR: bilateral upper lung fibronodular infiltrates
TST: 0 mm
Lab: IGRA pending

Patient sent home with no further instructions. PCP after thought: important to report as a potential suspect.

What would your next step be?

PCP reports 24 y/o from Mexico in her first trimester of pregnancy with c/o:

Symptoms
• Productive cough for 4 weeks
• Chest pain - predominatley on the upper left side
• Hyperhidrosis

Procedures performed:
CXR: bilateral upper lung fibronodular infiltrates
TST: 0 mm
Lab: IGRA pending

Patient sent home with no further instructions. PCP thought is was important to report potential suspect.
Discuss questions you would ask to elicit contacts and sites of transmission

PCP reports 24 y/o from Mexico in her first trimester of pregnancy with c/o:

Symptoms
• Productive cough for 4 weeks
• Chest pain – predominantly on the upper left side
• Hyperhidrosis

Procedures performed:
CXR: bilateral upper lung fibronodular infiltrates
TST: 0 mm
Lab: IGRA pending
HIV status: pending

Patient sent home with no further instructions. PCP thought it was important to report potential suspect

Next Investigation!
High School exposure - 11\textsuperscript{th} grade/17 y/o

Index case characteristics

- Diagnosed with pneumonia 2x, past 7 months
- Cough, fever, SOB
- Smear negative/culture positive \textit{M. tb}
- CXR: cavitary infiltrates in the RUL
- HIV pending
- Intermittent fever
- TST - 20 mm
- Arrived in the US 13 months ago from Ahmedabad, India
- Attends ESOL classes
- Member of the IT club
- Plays soccer

Data collection drives decisions

School

- Total student population 551
  - 12\textsuperscript{th} grade - 99
  - 11\textsuperscript{th} grade - 121
    - ESOL classes - 28
  - 10\textsuperscript{th} grade - 132
  - 9\textsuperscript{th} grade - 199
- Total educator population - 45
- IT club - 7
- Soccer team 31, all grades

Household - mother, father, grandmother
Data collection drives decisions

School
- Total student population 551
  - 12th grade - 99
  - 11th grade - 101
    - ESOL class - 28
  - 10th grade - 132
  - 9th grade - 199
- Total educator population - 45
  - IT club - 7
  - Soccer team 31, all grades

Household - mother, father, grandmother

School
- ESOL class - 28
- IT club - 7
- Soccer team 31, all grades
- Educators/Coach - 4

Household - 3

Identifying highest exposure areas and people in them = 73

Household contacts - next steps

Mother - IGRA positive
- 41 y/o - from India
- no identified medical risk factors
- CXR neg - LTBI

Father - TST 13 mm
- 44 y/o - US born
- no identified medical risk factors
- CXR neg - LTBI

Maternal Grandmother - IGRA positive
- 68 y/o - from India
- Cough, weight loss 23 #, fatigue, night sweats, fevers
Grandmas the trouble maker!
IGRA positive
Cough, weight loss 23 #, fatigue, night sweats, fevers, for 18 mths
CXR - multiple upper lobe cavities bilaterally
RIPE started
NEW CASE OF TB - SECONDARY CASE OF TB - SOURCE ??????

Don’t forget the School -
School
ESOL class - 28
• All foreign born
• All BCG in past
IT club - 7
• 5 American born
• 2 foreign born, BCG in past
Soccer team 31, all grades
• 25 foreign born all BCG in past (20 from ESOL)
• 6 American born (1 from IT club)
Educators/Coach - 4 American born

ESOL - 28 IGRA
IT club - 7
• 5 TST, 2 IGRA
Soccer Team - 34 10
• 5 IGRA, 5 TST
Teachers - 4 TST

Total for evaluation at school = 49
**Initial Reactor Rate (1\textsuperscript{st} Round)**

<table>
<thead>
<tr>
<th>Groups to be Tested</th>
<th>Group Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESOL - 28</td>
<td>ESOL - 43%</td>
</tr>
<tr>
<td>IT club - 7</td>
<td>12 positive IGRA</td>
</tr>
<tr>
<td>Soccer Team - 10</td>
<td>16 negative IGRA</td>
</tr>
<tr>
<td>Teachers - 4</td>
<td>IT - 0%</td>
</tr>
<tr>
<td>school evaluation = 49</td>
<td>7 negative TST/IGRA</td>
</tr>
<tr>
<td>home evaluation = 3</td>
<td>Soccer Team - 50%</td>
</tr>
<tr>
<td>Total CI contacts = 52</td>
<td>IGRA 4 positive, 1 negative</td>
</tr>
<tr>
<td></td>
<td>TST 1 positive, 4 negative</td>
</tr>
<tr>
<td></td>
<td>Teachers - 0%</td>
</tr>
<tr>
<td></td>
<td>4 negative TST</td>
</tr>
</tbody>
</table>

**Overall Initial Reactor Rate**

\[
\frac{20}{52} \times 100 = 38.4\% 
\]

**Post Exposure Testing (2\textsuperscript{nd} Round)**

<table>
<thead>
<tr>
<th>Group Results</th>
<th>Group Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESOL - 43%</td>
<td>ESOL (12+4)</td>
</tr>
<tr>
<td>12 Positive</td>
<td>4 Positive</td>
</tr>
<tr>
<td>16 Negative</td>
<td>12 Negative</td>
</tr>
<tr>
<td>IT - 0%</td>
<td>IT (0+7)</td>
</tr>
<tr>
<td>7 Negative</td>
<td>7 Positive</td>
</tr>
<tr>
<td>Soccer Team - 50%</td>
<td>Soccer Team (5+2)</td>
</tr>
<tr>
<td>5 Positive</td>
<td>2 Positive</td>
</tr>
<tr>
<td>5 Negative</td>
<td>3 Negative</td>
</tr>
<tr>
<td>Teachers - 0%</td>
<td>Teachers (0+1)</td>
</tr>
<tr>
<td>4 Negative</td>
<td>1 Positive</td>
</tr>
<tr>
<td></td>
<td>3 Negative</td>
</tr>
</tbody>
</table>

**Overall Conversion Rate**

\[
\frac{14}{32} \times 100 = 43.7\% 
\]
School Infection Rate overall of CI

Entire group of contacts = 49
Entire group of positives = 32

\[
\text{Positives} / \text{contacts (N)} = \text{Infection Rate}
\]

\[
32 / 49 \times 100 = 65.3\%
\]

Do you Expand or Limit? Data tells all!

Breakdown population to estimate background rate
Number of Foreign born - 35
Number US born - 14 (9 were positive 64%)

Consider expansion at school
  Talk to key players
  Consider help from state health office
  Prepare media statement (contact COC)
  Plan for worried well (concern since the beginning)
Prioritize and discuss plan of action for each contact investigation

1. Mother with pulmonary TB living with her three year-old daughter
2. Grandfather with pulmonary TB going to dialysis 3X week
3. Teen with Lymphatic TB making monthly visits to the HIV clinic pulmonary TB ruled out
4. Laryngeal TB in your local prison

Questions?

Remember!
Every TB case started out as a contact