Learning Objectives

- By the end of this session, you will be able to:
  - Use national and/or state TB contact investigation guidelines to determine when to conduct a TB contact investigation
  - Describe how the infectious period for TB is calculated to guide the scope of a TB contact investigation
  - Describe which contacts should be considered high-priority to maintain attention on those contacts most at risk for infection or progression to TB disease if infected
Background

12/2005 – CDC National Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis
- Provide a standard framework for assembling information related to a TB exposure
- Describe how to use findings to:
  - Assess for evidence of transmission
  - Inform decisions on whether to expand the investigation

11/2011 – CDPH/CTCA Joint Addenda to the National guidelines were published to increase utility of the guidelines for TB Control practice in California

TB Contact Investigations: An Essential Prevention Activity

- ~1% of contacts have TB disease
- Finding & treating these additional cases may interrupt further transmission

- 20 – 30% of all contacts have latent TB infection (LTBI)
- Greatest risk of progression to active disease within the first 2 years following exposure
- Finding & treating those with LTBI will prevent future cases
National TB Contact Investigation Indicators and Targets

<table>
<thead>
<tr>
<th>Objectives on Contact Investigations</th>
<th>2020 Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Elicitation</td>
<td>100%</td>
</tr>
<tr>
<td>For TB patients with positive AFB sputum-smear results, increase the proportion who have contacts elicited.</td>
<td></td>
</tr>
<tr>
<td>Examination</td>
<td>93%</td>
</tr>
<tr>
<td>For contacts to sputum AFB smear-positive TB cases, increase the proportion who are examined for infection and disease.</td>
<td></td>
</tr>
<tr>
<td>Treatment Initiation</td>
<td>91%</td>
</tr>
<tr>
<td>For contacts to sputum AFB smear-positive TB cases diagnosed with latent TB infection, increase the proportion who start treatment.</td>
<td></td>
</tr>
<tr>
<td>Treatment Completion</td>
<td>81%</td>
</tr>
<tr>
<td>For contacts to sputum AFB smear-positive TB cases who have started treatment for latent TB infection, increase the proportion who complete treatment.</td>
<td></td>
</tr>
</tbody>
</table>

The Program Manager’s Role in Contact Investigation (1)

- Work with media in special situations – “high profile” outbreaks, congregate settings, workplace exposures, etc.
- Monitor progress / findings of contact investigations – case reviews & problem-solving
  - Too many or too few contacts?
- Know the science - TB prevention and control
- Know laws and limitations
- Go to “the trenches”. Participate in contact investigations with experienced staff
The Program Manager’s Role in Contact Investigation (2)

- Ensure that staff have appropriate TB training, skills, experience, and time to complete contact investigations
- Maintain staff communication and support – regular field visits – go back to “the trenches”
- Evaluate and report on programmatic activities – prospective & retrospective
  - Are contact investigations effective?
  - Collect & review data – programmatic, genotyping, etc.
  - Use data evaluation tools
  - Are local, state and NTIP objectives being met?

CIS: Contact Investigation Steps

1. Collect and evaluate index case information: Decide whether to initiate a contact investigation
2. Investigate index case & sites of transmission
3. Prioritize contacts
4. Locate & evaluate contacts
5. Treatment & follow-up of contacts
6. Decide whether to expand the investigation
7. Data management & evaluation of contact investigation activities
Key Terms

- **Case** – A particular instance of a disease (e.g., TB). A case is detected, documented, and reported.

- **Contact** – Someone who has been exposed to *M. tuberculosis* by sharing air space with a person with infectious TB.

- **Index** – The first case or patient who comes to attention as indicator of a potential public health problem.

- **Source case or patient** – The case or person who was the original source of infection for secondary cases or contacts; can be, but is not necessarily, the index case.

**ATS TB Classifications**

<table>
<thead>
<tr>
<th>Class</th>
<th>Stage of Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB-0</td>
<td>No exposure, no infection</td>
</tr>
<tr>
<td>TB-1</td>
<td>Exposure, no evidence of infection</td>
</tr>
<tr>
<td>TB-2</td>
<td>TB infection, no disease</td>
</tr>
<tr>
<td>TB-3</td>
<td>TB, clinically active</td>
</tr>
<tr>
<td>TB-4</td>
<td>TB, not clinically active</td>
</tr>
<tr>
<td>TB-5</td>
<td>TB suspect (may be sub-classified as high- or low-suspicion)</td>
</tr>
</tbody>
</table>
Step 1:
Collect and Evaluate Index Case Information:
Decide whether to initiate a Contact Investigation?

What Information is Collected?

Background information regarding the patient and circumstances of the illness:

- Demographics, identifiers, and locating information
- Site of disease, TB regimen, and start date(s)
- History of previous TB exposure
- History of previous TB disease and treatment
- TB symptoms and the onset date(s)
- Results of diagnostic tests
- Concurrent medical conditions, diagnoses, or important social factors
Assessing Transmission Risk

<table>
<thead>
<tr>
<th>TB CASE FACTORS</th>
<th>LIKELIHOOD OF DISEASE TRANSMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MORE LIKELY</td>
</tr>
<tr>
<td>Site of TB Disease</td>
<td>Laryngeal / pulmonary or pleural</td>
</tr>
<tr>
<td>Smear status</td>
<td>Positive</td>
</tr>
<tr>
<td>Chest x-ray</td>
<td>Cavitation</td>
</tr>
<tr>
<td>Symptoms/behaviors</td>
<td>Coughing, singing, sneezing, sociability</td>
</tr>
<tr>
<td>Age</td>
<td>Adult or adolescent</td>
</tr>
<tr>
<td>Anti-TB drugs</td>
<td>No or ineffective Rx</td>
</tr>
</tbody>
</table>

*Acid-fast bacilli
†Nucleic acid assay
§Approved indication for NAA
¶Chest radiograph

Decision to Initiate a TB Contact Investigation

Review Handout 1.1 (a&b)
Applying Step 1: Case Scenario

- 17-year-old male high school senior presents to community health clinic Sept. 22nd after passing out in class
- H/o treatment for CAP 2 months earlier
- Reports cough has been getting worse, has been losing weight and gets short of breath
- CXR shows persistent RUL interstitial infiltrates
- Initial sputum AFB smear-negative x 2, cultures pending
- Standard 4 drug anti-TB regimen is initiated for suspect pulmonary TB

Step 2:
Investigate Index Case and Sites of Transmission
Step 2a: Investigate Index Case

- Review case information
  - Medical & other health records

Step 2a: Investigate Index Case (2)

- Interview the TB patient (index case) to gather information to:
  - Help estimate onset of the infectious period
  - Identify contacts & locating information
  - Identify sites where transmission may have occurred

Review Handout 1.2 (a & b)

### Characteristic

<table>
<thead>
<tr>
<th>TB symptoms</th>
<th>AFB sputum smear positive</th>
<th>Cavitory chest radiograph</th>
<th>Recommended minimum beginning of likely period of infectiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>3 months before symptom onset or 1st positive findings consistent with TB disease, whichever is longer</td>
</tr>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
<td>4 weeks before date of suspected diagnosis</td>
</tr>
</tbody>
</table>

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**Closing the Infectious Period**

Infectious period closed when **ALL** the following criteria are met:

- Effective treatment for ≥ 2 weeks
- Diminished symptoms
- Mycobacteriologic response (e.g., ↓ number AFB seen on smear microscopy)
### Estimating the Beginning of IP – Case Scenario

<table>
<thead>
<tr>
<th>TB Classification</th>
<th>Index Case Characteristics</th>
<th>Minimal recommendation for beginning of the likely period of infectiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB5/High: (culture pending)</td>
<td>Either AFB S+, Cavitary CXR, or TB symptoms</td>
<td>3 months before symptom onset or 1&lt;sup&gt;st&lt;/sup&gt; positive finding consistent with TB disease, whichever is longer</td>
</tr>
<tr>
<td>TB Rx started</td>
<td>All of the following: AFB smears, NAAT or MB neg. or ND; CXR abnormal (not cavitary); and no TB symptoms</td>
<td>4 weeks prior to date of diagnosis as a TB suspect</td>
</tr>
</tbody>
</table>

**17 y/o Male HS senior:**
- Symptom onset = July 4<sup>th</sup>
- First positive finding consistent with TB= July 20<sup>th</sup> abnormal CXR
- 3 months before symptom onset = April 4<sup>th</sup>
- Chest CT scan shows RUL 2cm cavitary lesion; sputum now smear +

### Estimating the Beginning of the Infectious Period

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<td></td>
<td></td>
</tr>
<tr>
<td>No No No</td>
<td>No No No</td>
<td>4 weeks before date of suspected diagnosis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 2:** Guidelines for estimating the beginning of the period of infectiousness of persons with tuberculosis (TB), by index case characteristic. Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis, Recommendations from the National Tuberculosis Controllers Association and CDC. 2005.
Step 2b: Examine Sites of Transmission
(Field Investigation)

- Visit the sites where the patient spent time during infectious period

- Components include:
  - Assess physical conditions of the setting (room size, ventilation, airflow, etc.)
  - Interview, arrange for evaluation & provide TB information to contacts
  - Identify additional contacts

Case Scenario continued

- Rapid drug sensitivity test result= identified mutations associated with INH and RIF resistance (MDR-TB)

- Medical record review revealed that:
  - Case had prior MDR-TB contact with a classmate 4 years earlier; did not complete evaluation (was TST positive/incomplete eval)
Case Scenario continued (2)

- Several interviews revealed that the case:
  - Lives with mother, father and 3 sisters ages 16, 13 and 6
  - Worked at a fast food restaurant May 15-Sept. 20th
  - Started classes Aug. 26th until Sept. 22nd when he passed out
  - Named several friends he hung out with at school
  - Home isolation since Sept. 23rd
    - EXCEPT for orthodontist appointment he attended Sept. 29th (also on July 10th, Aug. 7th)
School and Work Site Investigations

- Establish lines of communication early
- Discuss importance of and specifics around maintaining confidentiality
- Anticipate media coverage and plan accordingly
- Opportunity to educate the public about TB
- Often have large numbers of contacts
  - Be strategic in prioritizing contacts and in facilitating testing
  - A database is hugely helpful in large CI’s!

Step 3: Prioritize Contacts
How to Prioritize Contacts

- Consider both:
  - Factors associated with transmission
  - Factors associated with increased risk for progression to TB disease (vulnerability)

High Priority Contacts (1)

High Priority Contacts are:
1. Most likely to be infected (exposure)
2. Most likely to progress to disease if infected
3. Most likely to suffer increased morbidity or mortality from TB disease

Review Handout 1.3 (a & b)
Assigning Priorities to Contacts

- Priorities should be assigned to contacts and resources allocated to complete all investigative steps for high- and medium-priority contacts.
- Any contact not classified as high or medium priority is assigned a low priority.
- Initial evaluation can occur 8-10 weeks following break in contact.

Infectiousness
Exposure
Susceptibility

Case Scenario: Prioritizing Contacts

- **High Priority contacts:** Total = 66
  - Household = 5 (parents and sisters)
  - Other family (non-HH) = 2 (brother and 4 mo. old niece)
  - Friends = 9
  - CoWorkers = 39
  - School = 11 (≥ 60 total exposure hours)

- **Medium Priority contacts:** Total = 84
  - Other family (non-HH) = 2 (brother and sister-in-law)
  - Orthodontist office = 4
  - School = 78 (30-59 total exposure hours)

- **Low Priority contacts:** Total = 78
  - Other family = 1; Orthodontist office = 7; School = 69; Friend = 1
Step 4: Evaluate Contacts

Evaluating Contacts

1. Medical and TB history
2. TB symptom evaluation
3. Tuberculin skin test or IGRA
   • If initial test is negative, repeat 8 - 10 weeks post contact

If symptomatic or positive TB test:
   • Obtain chest X-ray and medical evaluation
   • Consider sputum for AFB smear and culture if indicated
Evaluation: Special Contact Groups

- Contact is a **child < 5 y/o or immunocompromised:**
  - Medical history
  - Physical exam
  - Chest X-ray (PA & lateral views)
  - Tuberculin skin test

- Contact has documented **prior positive** TST or IGRA:
  - Obtain medical and exposure history
  - Obtain prior treatment history
  - If treatment for LTBI is indicated, obtain CXR prior to treatment initiation

**Review Handout 1.4**

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**Step 5:**

Treatment and Follow-up of Contacts
Treatment & Follow-up of Contacts

- 2020 NTIP Objective: complete treatment in 81% of infected contacts of pulmonary TB who start treatment
- Prioritize efforts with contacts who are most in need of treatment
- Monitor throughout treatment (monthly face-to-face)
- “Window-period” prophylaxis – for high-risk contacts with a negative TST during the period following last contact until the follow-up TST (8-10 weeks after last contact)
- MDR-TB exposure – seek expert consultation; follow-up 2 years post exposure

Treatment Regimen Options?

Luckily we have newer short course regimens, so you may not have as many pills to take.
Step 6:
Decide Whether to Expand the Investigation

When should CI be expanded?

Consider both of the following:

- Program objectives with high and medium priority contacts have been achieved
  
  **AND**
  
  - There is evidence of recent transmission
Evidence of Recent Transmission

- Unexpectedly high rate of infection or disease in high priority contacts
- Infection in a young child (< 5 yr. old)
- TST/IGRA conversion (from negative 1st test to positive 2nd test)
- Secondary case
- TB disease in any contact assigned a low priority

Step 7:
Data Management and Evaluation of Contact Investigation Activities
Step 7: Data Management & Evaluation of CI Activities

- Management of care & follow up of TB case & contacts
- Epidemiologic analysis of the investigation in progress to allow prioritization of program activities & resources
- Program evaluation – measure how well objectives are being met

Case Scenario – CI Outcomes

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Performance</th>
<th>NTIP Objective</th>
<th>Achieved?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contacts identified?</td>
<td>100%</td>
<td>100%</td>
<td>Yes</td>
</tr>
<tr>
<td>Contacts evaluated?</td>
<td>88%</td>
<td>93%</td>
<td>??</td>
</tr>
<tr>
<td>H+M Contacts evaluated?</td>
<td>92%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- High priority: 66/66 completed evaluation (100%)
- Medium priority: 72/84 completed evaluation (86%)
- Low priority: 62/78 completed evaluation (79%)
Source Case Investigation

- Seeks the source of recent *M. tuberculosis* infection, perhaps newly diagnosed TB disease.

- Two different kinds
  - When child is identified with active or latent TB
  - In corrections – when a group or area has increased conversions or positive TSTs

*MMWR Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis, 2005*

Initiating a Source Case Investigation

- Corrections
  - Once the need for a source case is identified
    - Notify the local health department
    - Obtain all TST/IGRA information for review

- Discuss
  - TST/IGRA positivity rate in the facility
  - # of conversions in staff and long-term inmates
  - Develop an investigation plan

**Best Practice** – health department and correctional facility staff review the information together

- Child TB/LTBI
  - Discuss family/friends who have been around and coughing
Steps in a Source Case Investigation

- Identify the problem
  - Begin with the obvious
    - Check movement of inmate/assigned work areas for officers/claims from family members
    - Ask inmates/officers, where they were assigned
    - Ask family members if they’ve been to the doctor/how many times
    - Identify the areas of increased positive TSTs/IGRAs
      - Does anything overlap/coincide?

- Do a risk assessment on each TST converter
  - When did they convert the TST/IGRA?
  - Were they around someone who was coughing?

- Always go with what you know
  - If staff
    - Identify where they worked
    - Is there a common denominator?
  - Monitor sick times/callouts for staff and inmates/family members
  - Note any inmates/family members who may have one or more symptoms of TB
Look for Clues

Check the footprints

- See where they lead
- Is there something that makes you stop and wonder?

When looking for clues, think outside the box!

Tips for Sick Call Review in a Source Case Investigation

- Review sick call/doctor visits (and skin test logs in corrections) for any TB-related symptoms
  - Cough
  - Fever
  - Weight Loss
  - Chest Pain
- Note – If inmate/family member keeps complaining with the same or worsening symptoms – think TB!
Case Finding in a Source Case Investigation (for corrections)

- Once you identify potential source case
  - Watch for changes in trends in the facility or institution
- Sick call
  - Identify any inmates who left the facility and returned who may have TB-related symptoms
- Check to see if the symptom(s) have resolved
- If continuing to see positive TSTs/IGRAs increase, continue to identify source (possibly more than one)

Follow-Up of Findings

- Experts should review chest x-rays
- View the films of anyone who may have ANY symptoms
- Isolate identified suspects in respiratory isolation (AIIR)
- Look at computer contact lists and cross-match with a suspect/case (for corrections)
- Identify probable exposure interval

**Remember** – always report suspects/cases to the health department
Put all the pieces together!

• Remember the **duck theory**!
• If it looks like tuberculosis, think TB first, rule it out, then once it’s ruled out, proceed on to another diagnosis
• Don’t let TB be the last thing you rule out!

Exercise – Source Case Investigation
Why do I need to look?

• Using the scenario provided, check the background information
• Do you think there is a problem in this facility?
Exercise

- There are 4 housing units in your local jail
- In reviewing the TST/IGRA logs over the last three months, you note the following:

<table>
<thead>
<tr>
<th>UNIT</th>
<th># TESTED</th>
<th>INMATES POS TST</th>
<th>STAFF POS TST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>90</td>
<td>2 (2%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Unit 2</td>
<td>87</td>
<td>3 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>Unit 3</td>
<td>102</td>
<td>2 (2%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Unit 4</td>
<td>101</td>
<td>31 (31%)</td>
<td>3 (3%)</td>
</tr>
</tbody>
</table>

Is there a problem?

Summary

- Contact investigations are an essential component to TB control & prevention
- Training can improve the information solicited to ensure those potentially exposed are identified
- Evaluating C.I. activities in real time will help maintain a focus on priorities.
- Special situations (drug-resistance, outbreak, large C.I., etc.) may benefit from consultation
Contact investigation is hard work!
...maybe coffee and donuts would help!

Acknowledgements & References

**Acknowledgements:**
- CDC/DTBE, CDPH/TBCB
- CBS: CSI cast and crew

**References:**