What is a Contact Investigation?

A systematic process to:

- Identify persons (contacts) exposed to cases of infectious TB disease
- Assess contacts for infection with *M. tuberculosis* and TB disease
- Provide appropriate treatment for contacts with LTBI or TB disease

Who are TB Contacts?

Contacts are persons who have shared airspace with a person with infectious TB disease. This might include:
- Household members
- Friends
- Co-workers
- Others (e.g., cellmates, shelter residents)
Why is it Important to Conduct TB Contact Investigations? (1)

CIs help to:

- Interrupt spread of TB
- Prevent outbreaks of TB
- Ensure appropriate treatment for LTBI or TB disease

Core Concepts and Skills Required for Conducting TB Contact Investigations

- Knowledge of TB transmission
- Knowledge of TB pathogenesis
  - Difference between LTBI and TB disease
  - Risk factors for progressing to TB disease
- Effective interviewing skills
- Data management and analysis skills

What Core Concepts and Skills are Required to Conduct TB Contact Investigations?
Contact Investigation
Core Concepts

TB Transmission

Remember: TB is Transmitted Person to Person!

Every TB case Began as a TB contact

- When a person with infectious TB disease coughs, sneezes, speaks, or sings, tiny particles containing M. tuberculosis (droplet nuclei) may be expelled into the air.
- If another person inhales droplet nuclei, transmission may occur; however, not everyone who is exposed to TB becomes infected with TB.
What Factors Influence TB Transmission?

The probability that TB will be transmitted depends on the following factors:

1. Infectiousness of person with TB disease
2. Duration and frequency of exposure
3. Environment in which exposure occurred

1. Infectiousness of Person with TB Disease

Characteristics associated with infectiousness:
- TB of the lungs, airway, or larynx
- Presence of cough
- Positive sputum smear
- Cavity on chest x-ray
- Positive cultures
- Not covering mouth when coughing
- Not receiving adequate treatment
- Undergoing cough inducing procedures

2. Duration and Frequency of Exposure

Contacts at higher risk for TB infection are those who:
- Frequently spend a lot of time* with the case
- Have been physically close to the case

* “A lot of time” is difficult to define, but may be determined locally based on experience
3. Environment in Which Exposure Occurred

Environmental characteristics that increase chances of TB transmission:
- Small or crowded rooms
- Areas that are poorly ventilated
- Rooms without air-filtering systems

STOP the Chain of Transmission

The BEST way to stop transmission is to
- Identify and isolate infectious persons
- Start infectious persons on effective treatment for TB disease

Contact Investigation
Core Concepts

TB Pathogenesis
What Happens Once Someone is Exposed To TB?

- Not every person who is exposed to TB becomes infected
- Persons who become infected will generally have a positive
  - Tuberculin skin test (TST)
  Or
  - Blood test (interferon gamma release assay [IGRA])
- Persons who become infected can have either:
  - LTBI
  - Active TB disease

Latent TB Infection (LTBI)

- LTBI - immune system keeps tubercle bacilli under control
- LTBI characteristics:
  - Usually positive TST or IGRA
  - Not infectious
  - No symptoms
  - Normal chest x-ray
  - Sputum smears and cultures are negative
- Not a “case” of TB

Active TB Disease

- TB disease - immune system cannot stop tubercle bacilli from multiplying leading to active TB disease
- Usually affects lungs, but can affect other areas of the body
- Characteristics usually include:
  - Positive TST or IGRA
  - Infectious (before treatment)
  - Symptoms
  - Abnormal chest x-ray
  - Positive sputum smear and culture
- Considered a “case” of TB
What are Symptoms of TB Disease?

- Cough lasting 3 or more weeks
- Coughing up sputum or blood
- Fever
- Chills
- Night sweats
- Weight loss
- Appetite loss
- Fatigue
- Malaise
- Chest pain

LTBI vs. TB Disease

<table>
<thead>
<tr>
<th>LTBI</th>
<th>TB Disease (in the lungs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive tubercle bacilli in the body</td>
<td>Active tubercle bacilli in the body</td>
</tr>
<tr>
<td>TST or IGRA usually positive</td>
<td>TST or IGRA usually positive</td>
</tr>
<tr>
<td>Chest x-ray usually normal</td>
<td>Chest x-ray usually abnormal</td>
</tr>
<tr>
<td>Sputum smears and cultures usually negative</td>
<td>Sputum smears and cultures usually positive</td>
</tr>
<tr>
<td>No symptoms</td>
<td>Symptoms such as cough, fever, weight loss</td>
</tr>
<tr>
<td>Not infectious</td>
<td>Often infectious before treatment</td>
</tr>
<tr>
<td>Not a case of TB</td>
<td>A case of TB</td>
</tr>
</tbody>
</table>

Conditions that Increase Risk of Progressing to TB Disease

- Children younger than 5 years of age
- Weakened immune systems
  - Infection with HIV
  - Diabetes mellitus
  - Organ transplant
  - Silicosis
  - Severe kidney disease
  - Certain types of cancer
  - Certain intestinal conditions
  - Prolonged therapy with corticosteroids and other immunosuppressive therapy, such as prednisone and tumor necrosis factor-alpha (TNF-α) antagonists
- Chest x-ray findings suggestive of previous TB
- Low body weight
- Cigarette smokers and persons who abuse drugs and/or alcohol
- Recent TB infection (within past 2 years)
LTBI Progressing to TB Disease

- Risk of developing TB disease is highest in the first 2 years after infection (or, if foreign-born, first 2 years after immigration)
- People with LTBI can be treated to prevent development of TB disease
- Detecting LTBI early and providing treatment helps prevent new cases of TB disease

Risk of Developing Disease
(Depends on Immune System)

- LTBI: 5% chance of developing TB disease within 5 years and 5% chance of remaining asymptomatic for the rest of life.
- LTBI+ untreated HIV: 10% chance of developing TB disease each year and 10% chance of remaining asymptomatic each year.

Decision to Initiate a Contact Investigation
When is a TB Contact Investigation Necessary?

Confirmed TB Cases
A full CI is required for all confirmed cases that have infectious forms of TB disease

- Generally, TB of lungs, airway, or larynx
- However, extrapulmonary cases can also transmit TB (during procedures, or wound care)

When is a TB Contact Investigation Necessary?

Suspect TB Cases
- A CI should be started for persons suspected of having infectious TB disease if they have
  - Positive sputum smears*
  - Cavities on chest x-ray
- Assessment of priority contacts can begin before case is confirmed
  - If case is eventually confirmed, continue with full CI
  - If person is found to NOT have infectious TB disease, stop the CI process

* Provided nucleic acid amplification (NAA) test, if conducted, is also positive

When is a TB Contact Investigation Necessary?

Suspect TB Cases
- For all other suspect cases, collect preliminary information about contacts (name, locations, and TB risk factors)
- Assess contacts at high-risk for progressing to TB disease without waiting for case confirmation
  - If case is eventually confirmed, continue with full CI
  - If person is found to NOT have infectious TB disease, stop the CI process
When is a TB Contact Investigation NOT Necessary?

TB CI is generally NOT necessary if a case

- Has positive sputum smears and a negative nucleic acid amplification (NAA) test
- Has a noninfectious form of TB disease (extrapulmonary disease) with no pulmonary involvement, (sometimes)
- Is a child under 10 years of age
  - However, if case less than 5 years of age, a source case investigation may be necessary

Why is it Important to Promptly Start a Contact Investigation?

- Some contacts may develop TB disease soon after exposure and infection, especially
  - Infants and children younger than 5 years of age
  - HIV-infected or other persons with weakened immune systems
- All contacts need to be found and evaluated promptly
  - As time increases, some contacts might be more difficult to locate (e.g., homeless or transient persons)
- There could be ongoing transmission of M. tuberculosis

Systematic Approach to TB Contact Investigations
### Systematic Approach to Contact Investigations

The systematic approach includes 10 steps:
1. Review existing information about the case
2. Determine an initial estimate for the infectious period and estimate the degree of infectiousness
3. Interview the case
4. Review information and develop a plan for the investigation
5. Refine the infectious period and degree of infectiousness

### Systematic Approach to Contact Investigations (2)

6. Prioritize contacts
7. Conduct field visits
8. Conduct contact assessments
9. Determine whether to expand or conclude an investigation
10. Evaluate the CI activities

*These steps may not always be done in sequential order*

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**Systematic Approach to TB Contact Investigations**

Review Existing Information about the Case

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Review Existing Information

- The process of reviewing existing information is sometimes called the pre-interview phase
- Reviewing information before the initial interview can ensure the right questions are being asked

Information to Collect and Review Before the Initial Interview

Become familiar with case’s medical history
- Current site(s) of TB disease
- Current TB treatment regimen
- TB symptoms and estimated onset date
- Chest x-rays and/or other diagnostic imaging dates and results
- TST or IGRA dates and results
- Sputum smear and culture dates and results
- NAA test dates and results
- Genotype results (if available)

Information to Collect and Review Before the Initial Interview (cont.)

- HIV test dates and results
- Details about prior diagnosis with LTBI or TB disease, and any treatment
- Medical risk factors that could have increased the case’s risk for infection with M. tuberculosis or development of TB disease
Systematic Approach to TB Contact Investigations

Determine an Initial Estimate for the Infectious Period and Estimate the Degree of Infectiousness

Estimating the Degree of Infectiousness

<table>
<thead>
<tr>
<th>Factors Associated with Infectiousness</th>
<th>Factors Associated with Noninfectiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of a cough</td>
<td>No cough</td>
</tr>
<tr>
<td>Cavity in the lung</td>
<td>No cavity in the lung</td>
</tr>
<tr>
<td>Acid-fast bacilli on sputum smear</td>
<td>No acid-fast bacilli on sputum smear</td>
</tr>
<tr>
<td>TB of the lungs, airway, or larynx</td>
<td>Most extrapulmonary (non-respiratory) TB</td>
</tr>
<tr>
<td>Patient not covering mouth or nose when coughing</td>
<td>Patient covering mouth or nose when coughing</td>
</tr>
<tr>
<td>Not receiving adequate treatment</td>
<td>Receiving adequate treatment for 2 weeks or longer</td>
</tr>
<tr>
<td>Undergoing cough-inducing procedures</td>
<td>Not undergoing cough-inducing procedures</td>
</tr>
<tr>
<td>Positive sputum cultures</td>
<td>Negative sputum cultures</td>
</tr>
</tbody>
</table>

What is the Infectious Period?

The time period during which a TB case is able to transmit *M. tuberculosis*
Why is it Important to Estimate the Infectious Period?

- Focuses investigation on contacts most at risk for exposure
  - Especially important if the investigation involves congregate settings
- Sets the time frame for contact assessment
  - Contacts with an initial negative test will need a 2nd TST or IGRA at least 8 weeks after date of last exposure

Estimating the Start of the Infectious Period

<table>
<thead>
<tr>
<th>Characteristic of Case</th>
<th>Likely Period of Infectiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB symptoms</td>
<td>AFB sputum smear positive</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>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Ending the Infectious Period

Biologically, a case’s infectious period ends with:
1. Effective treatment for 2 weeks or more,
2. Diminished symptoms, and
3. Mycobacteriologic response*  
  *A case returning to a congregate setting should have 3 or more consecutive negative sputum smears

However, for CI purposes effective isolation can also end the infectious period since the case is not likely to be in contact with additional persons
Introduction to Contact Investigation Process

Systematic Approach to TB Contact Investigations

Interview the Case

What is the Main Goal of a TB Interview?
The main goal of a TB interview is to identify contacts.
Why?
So you can assess them for TB disease and infection and start them on appropriate treatment.

How Do You Identify Contacts?
Ask the case about the following during their infectious period:

- Places WHERE they spent time
- Persons with WHOM they spent time
- Participation in activities and events (WHAT and WHEN)
Initial Interview with the TB Case

Initial case interview should be conducted:
• In-person
• At a hospital, TB clinic, case’s home, or any convenient location that allows for privacy
• In case’s primary language
• With cultural sensitivity
• Using appropriate infection control measures (e.g., respirators, masks, and ventilation)

Systematic Approach to TB Contact Investigations

Review Information and Develop a Plan for the Investigation

After conducting an interview with the case, the investigator should meet with his/her supervisor or the contact investigation team to

- Review all of the information obtained thus far
- Develop a plan on how to proceed
Contact Investigation Team

The CI team may include:
- Case managers
- Public health investigators
- Surveillance coordinators
- Program managers
- DOT workers
- Disease intervention specialists (DIS)

Developing an Investigation Plan

To develop a plan for the investigation, the team should do the following activities:
- Refine the infectious period and degree of infectiousness for the case as necessary
- Prioritize identified contacts for assessment
- Prioritize identified places to conduct field visits

Additional activities that are a part of developing a plan:
- Establish a communication plan
- Clarify any jurisdictional issues
- Establish timeframes and methods for investigation activities, data collection, and management
- Identify stakeholders
- Determine potential media interest
- Establish a schedule for meetings to review challenges and progress

Introduction to Contact Investigation Process

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Systematic Approach to TB Contact Investigations

Prioritize Contacts

Assigning Priority to Contacts

- Once a list of contacts is obtained, the contacts should be prioritized to determine who should be immediately located and assessed for TB disease or infection.
- The priority assigned to individual contacts should be based on the following:
  - Likelihood of transmission from the case
  - Contact's risk for development of TB disease

Which Contacts Should be Given Priority for TB Assessment?

Priority should be given to contacts who
- Have symptoms of TB disease
- Are at risk for rapid development of TB disease
- Had repeated or extended exposure to the case
- Were exposed to a case in an environment where transmission was likely, such as a small, crowded, or poorly ventilated room or vehicle
- Were exposed to a case undergoing medical procedures that can release substantial numbers of *M. tuberculosis* into the air (e.g., bronchoscopy)
Concentric Circle Tool

The concentric circle should only be used as a secondary tool to help further prioritize contacts based on exposure (duration, frequency, and distance).

- **High Risk**: Contacts spend a lot of time and close proximity with case.
- **Medium Risk**: Contacts spend some amount of time with case.
- **Low Risk**: Contacts spend little amount of time with case.

Later (Re)Prioritization of Contacts

- Re-examine priority level assigned to contacts throughout the investigation
  - If evidence of significant transmission has occurred in priority contacts, CI may need to be expanded to additional contacts.
- However, investigation should not expand to additional contacts if doing so would compromise TB program's ability to assess and treat the known priority contacts.

Systematic Approach to TB Contact Investigations

Conduct Contact Assessments
**Introduction to Contact Investigation Process**

After contacts have been identified and prioritized:

- Contacts should be located
- Contact assessments should be conducted

**What Happens After Contacts Have Been Identified and Prioritized?**

Why Conduct a Contact Assessment?

- Allows for
  - Determination of contacts’ potential TB symptoms
  - Gathering of social and medical information
  - Referral or in-person testing for TB infection with a TST or IGRA
  - Provision of treatment as indicated

*Key information to collect during contact assessment will be discussed later in the course*

When and How Should a Contact Assessment be Conducted?

- The initial contact assessment should be within 3 working days of the contact having been identified
- Should be conducted in-person
- Investigator should use effective communication skills
Introduction to Contact Investigation Process

Initial Contact Assessment: Contacts with TB Symptoms

During the initial assessment, all contacts with symptoms of TB disease should be immediately examined by a medical professional.

Initial Contact Assessment: Testing for TB Infection - TST or IGRA

- Contacts should receive a TST or IGRA unless a previous, documented positive result exists
- A TST induration of 5 mm or larger is positive
- A contact with a
  - Positive TST or IGRA should be medically examined for TB disease
  - Negative TST or IGRA should be re-tested 8 to 10 weeks after date of last exposure to the case

Window Period

- The window period is the time span between the contact’s last exposure to the case and when a TST or IGRA can reliably detect infection
- It takes 2 to 10 weeks after TB infection for the body to mount an immune response that is detectable by a TST
- Therefore, it is recommended to repeat a TST or IGRA for contacts 8 to 10 weeks after date of last exposure to a TB case

* Data on the timing of IGRA conversion after a new infection are not currently available; however, it is recommended to follow TST guidelines.
Calculating the Window Period

- What was the date of the contact’s last exposure to the case?
  - Identify the infectious period of the case
  - Identify when each contact had last exposure
- Calculate 8 to 10 weeks from last exposure
  - Administer a TST or IGRA for each contact who tested negative

What if a Contact has LTBI or TB Disease?

- The decision to test a contact is a commitment to offer treatment
- If TB disease is ruled out, contacts with a positive TST or IGRA should be offered LTBI treatment
  - Regardless of whether they received BCG vaccine in the past
  - Unless there is a compelling reason not to treat
- Contacts with TB disease need to be treated under DOT

Assessment and Management of Contacts with Weakened Immune Systems

- A full medical evaluation, including a chest x-ray, should be given to contacts
  - With HIV/AIDS
  - On immunosuppressive therapy for organ transplant
  - Taking anti-tumor necrosis factor alpha (TNF-α) agents
- If both initial and follow-up TST/IGRA are negative, a full course of prophylactic LTBI treatment is recommended (after TB disease is excluded)
- Expert consultation should be sought for contacts with other immunocompromising conditions
**Systematic Approach to TB Contact Investigations**

**Determine Whether to Expand or Conclude an Investigation**

When Can you Close a Contact Investigation?

A CI can be closed if
- Identified contacts have been assessed for TB in accordance with local policy
  - At some point, the TB program must decide when all reasonable investigative efforts have been exhausted
- Contacts with LTBI have completed or are close to completing treatment
- No additional active TB cases among contacts

When Should a Contact Investigation be Expanded?

Sometimes a CI has to be expanded if there is evidence of recent transmission
- Unexpectedly high TB disease or LTBI rates among priority contacts
- Large number of contacts with change in infection status from negative to positive
- TB disease in any contacts who had been assigned low priority or TB disease in those previously not identified as contacts
- Infection in any contacts younger than 5 years of age
Expanding a Contact Investigation

• Decision to expand CI should be based on the investigation data
  – Results should be reviewed weekly
• Decision should be made by supervisory staff
• In the absence of recent transmission, the investigation should not be expanded to lower-priority groups

Other Important Considerations During a Contact Investigation

• If a second TB case is found during the CI, this second case needs their own CI.
• If a case is considered highly infectious and you find few contacts and/or find little evidence of transmission, you may need to go back and review your records and determine if a re-interview is needed.

Systematic Approach to TB Contact Investigations

Evaluate the Contact Investigation Activities
Introduction to Contact Investigation Process

Evaluating Contact Investigation Activities (1)

The purpose of evaluating the activities of the CI is to determine:

- If an appropriate number of contacts were identified
- How many contacts were identified with LTBI
- How many contacts with LTBI completed treatment
- How many additional cases of TB disease were identified

Evaluating Contact Investigation Activities (2)

- How many contacts were not located
- How many contacts were located but did not complete assessment
- Timeliness of identifying and assessing contacts, and starting them on treatment
- If the CI was performed in all necessary settings
- If the CI was expanded appropriately
- If secondary cases completed treatment for TB disease

Iowa TB control program

- Allan Lynch
  Iowa TB Control Manager
  (515) 281-7504

- Shirlee Hasstedt
  TB Nurse Consultant
  (515) 281-8636

- TB Program FAX: (515) 281-4570
Thank you

jorge-salinas@uiowa.edu
Twitter: jlsalinas7