



# CHAPTER 11: CONTACT INVESTIGATION

## INTRODUCTION

Contact investigation is a key strategy employed by the New York City (NYC) Bureau of Tuberculosis Control (BTBC) to identify individuals recently exposed to patients with infectious tuberculosis (TB) disease (contacts). Contacts are more likely to develop active TB disease than any other risk group. Future cases of TB can be prevented by prompt identification and evaluation of contacts, and by ensuring that those diagnosed with TB or latent TB infection (LTBI) complete treatment.

## CONTACT INVESTIGATION ACTIVITIES

A contact investigation begins at the first interview of a patient with infectious TB disease. BTBC staff elicit names and other information for individuals who have spent time (e.g., live or work) with the person while they were infectious. The contact investigation continues until the case management team has made a final status determination for all contacts. BTBC is responsible for identifying, prioritizing, and ensuring evaluation for all contacts.

The activities of contact investigation include:

1. Determining the need for a contact investigation
2. Defining the infectious period
3. Defining the window period
4. Interviewing patients with infectious TB disease and eliciting contacts
5. Conducting a home assessment
6. Prioritizing contacts for evaluation
7. Interviewing and educating contacts
8. Evaluating contacts and determining the need for treatment
9. Screening and testing for human immunodeficiency virus (HIV)
10. Assessing transmission
11. Conducting an expanded contact investigation
12. Conducting case management for contacts being treated for LTBI
13. Supervisory review

## DETERMINING THE NEED FOR A CONTACT INVESTIGATION

A contact investigation is performed for all patients with TB disease who are considered to be potentially infectious. Patients are considered potentially infectious based upon a number of clinical factors including site of disease, acid-fast bacilli (AFB) sputum smear and culture status, length of symptoms, and radiographic findings. The likelihood of TB transmission to contacts is influenced by clinical characteristics, the extent and duration of exposure, and environmental factors.

The following factors determine the priority of a contact investigation:

**ANATOMICAL SITE OF DISEASE:** Patients with pulmonary, laryngeal, or other respiratory sites of disease are potentially infectious as TB is spread through the air. Cough is associated with an increased likelihood of transmission.

**RESPIRATORY SPECIMEN TEST RESULTS:** A contact investigation is immediately initiated for all patients with a respiratory specimen that is AFB smear-positive and those with a positive nucleic acid amplification (NAA) test or *Mycobacterium tuberculosis* (*M. tuberculosis*) culture. A higher AFB smear grade is associated with increased infectiousness. When NAA test results are negative for TB, but the AFB is smear-positive, the contact investigation may be interrupted if the treating provider does not consider TB as a likely diagnosis and discontinues TB treatment.

**RADIOGRAPHIC FINDINGS:** Patients with lung cavities observed on their chest radiograph (CXR) and/or computed tomography (CT) scan are more likely to be infectious than patients without cavitation; contact investigations for these patients are prioritized.

**SYMPTOMS:** A patient's duration and severity of symptoms, such as hemoptysis and productive cough, directly impact likelihood of infectiousness and determine the length of the infectious period.

**ENVIRONMENTAL FACTORS:** Room size, crowding, ventilation, and degree of air circulation at a site (e.g., home, school, workplace) contribute to the risk of transmission.

**AGE:** Children have a higher risk of progressing to active TB disease once infected than other age groups. Exposures involving children (e.g., schools, daycares, etc.) are prioritized to identify and treat infected individuals early and prevent progression to TB disease.

**MEDICAL RISK FACTORS:** Immunocompromised individuals (e.g., people with human immunodeficiency virus [HIV] infection, people on chemotherapy, etc.) are at increased risk of developing TB disease once infected and thus require timely testing, evaluation, and treatment for LTBI.

(See *Table 11.1: Decision to Conduct or Continue Contact Investigation by Bacteriological Status and Clinical Suspicion of Respiratory Tuberculosis.*)

## DEFINING THE INFECTIOUS PERIOD

The infectious period is the timeframe during which a patient is most likely to transmit TB to others. Focusing the investigation on the infectious period allows prioritization of contacts who are most at increased risk of infection. The infectious period begins at symptom onset or 12 weeks prior to the start of airborne infection isolation or anti-TB treatment, whichever is earlier. This date may be adjusted based on clinical characteristics and epidemiologic considerations.

The infectious period ends when the patient with active TB disease is isolated, or two weeks after beginning appropriate TB treatment, determined by drug-susceptibility test (DST) results. The infectious period is revised when necessary to account for unusual situations (e.g., when there is a need to change the antibiotic regimen if the isolate is found to be drug-resistant).

## DEFINING THE WINDOW PERIOD

Since there can be a delay in obtaining an accurate immune response to *M. tuberculosis* following a TB exposure, BTBC recommends an eight-week window period be established. The window period is therefore defined as the eight-week period after a contact's last exposure to a patient with infectious TB disease.

The window period begins on the day of the contact's last exposure to the infectious patient. For most household contacts, the last day of exposure occurs when the patient is isolated or no longer considered infectious, whereas contacts from a non-household setting (i.e., work or school) may have a different last day of exposure if the infectious patient left these settings before diagnosis.

During the window period, a contact's negative test for TB infection is considered preliminary. Steps are taken to ensure all contacts are tested soon after elicitation and then retested once the window period has ended.

**TABLE 11.1:** Decision to conduct or continue contact investigation by bacteriological status and clinical suspicion of respiratory tuberculosis

RESPIRATORY SMEAR-POSITIVE FOR AFB					
NAA result	Culture result	Clinical suspicion or epidemiologic concern	Contact investigation		
			Start (elicit contacts)	Continue (test high-priority contacts)	Complete
Positive for <i>M. tuberculosis</i> OR Not done	Pending		Yes	Yes	Yes, if verified
	Positive		Yes	Yes	Yes
	Negative		Yes	Yes	Yes, if verified
	Not done		Yes	Yes	Yes
Negative for <i>M. tuberculosis</i>	Pending		Yes	Delay	Yes, if verified
	Positive		Yes	Yes	Yes
	Negative	High	Yes	Continue	Yes, if verified
		Low	Yes	Delay	No, unless verified
	Not done	High	Yes	Continue	Yes, if verified
		Low	Yes	Delay	No, unless verified
RESPIRATORY SMEAR-NEGATIVE FOR AFB					
NAA result	Culture result	Clinical suspicion	Contact investigation		
			Start (elicit contacts)	Continue (test high-priority contacts)	Complete
Positive for <i>M. tuberculosis</i>	Pending	High (cavitary CXR)	Yes	Yes	Yes, if verified
	Positive		Yes, after NAA	Yes	Yes
	Negative	High (cavitary CXR)	Yes, after NAA	Yes (If medical/epidemiological review determines need)	Yes, if verified
	Not done		Yes, after NAA	Yes	Yes, if verified
Negative for <i>M. tuberculosis</i> OR Not done	Pending	High (cavitary CXR)	Yes	Delay	No, unless verified
	Positive		Yes, after culture	Yes	Yes
	Negative	High (cavitary CXR)	Yes	Delay	Yes, if verified
		Low	No	No	No
	Not done	High (cavitary CXR)	Yes	Delay	Yes, if verified
		Low	No	No	No

\*When both respiratory smear (positive) and negative NAA are known at time of assignment, and the patient is not being treated for TB, the Network Owning Group will place the case on hold and contacts should not be elicited.

\*\*Provide post-window testing and medical evaluation as appropriate; promptly initiate or continue contact elicitation and testing if previously put on hold or not done, and continue to completion.

**Abbreviations Used:** AFB=acid-fast bacilli; CXR=chest radiograph; *M. tuberculosis*=*Mycobacterium tuberculosis*; NAA=nucleic acid amplification; TB=tuberculosis

In certain situations, BTBC physicians may determine the need to extend or create a new window period for contacts who remain in close contact with an infectious patient. This occurs when initial drug therapy is not adequate (e.g., initial treatment with standard TB regimen, but the patient was subsequently found to have drug-resistant TB [DR-TB]), or when the patient with infectious TB becomes newly smear- or culture-positive.

In situations where a second window period needs to be established for contacts (i.e., the first window period has ended but the index patient is still/newly infectious), the following contacts are tested (or re-tested) during the newly established window period and after:

- Contacts who were not initially tested during the first window period
- Contacts who tested negative during the first window period
- Contacts who tested post-window negative

In situations where the first window period is extended, the following contacts are tested (or retested) both during the extended window period and after:

- Contacts who were not initially tested
- Contacts who tested negative during the window period

## INTERVIEWING PATIENTS WITH INFECTIOUS TUBERCULOSIS DISEASE AND ELICITING CONTACTS

Once a contact investigation has been deemed necessary, the framework for subsequent patient interviews and the ensuing investigation is determined. All patient interviews are conducted in settings that are private and ensure confidentiality of the patient and any identified contacts.

As part of the initial patient interview, the patient's medical chart is reviewed to obtain information that may assist with either the identification of contacts and exposure sites, or to help establish the infectious period. More specifically, the following information is identified:

- Date of onset of symptoms attributable to TB, which is used to determine the infectious period
- Details of treatment and evaluation (particularly any hospitalizations) during the infectious period
- Next of kin
- Residential address to confirm it matches what is provided upon interview
- Work history
- Other congregate settings where the patient may have spent time during the infectious period

Many patients find it difficult to recall who they have interacted with during their infectious period; to identify all potential contacts and exposure sites, specific prompts and probing questions are used. (See *Chapter 10: Case Management for Patients with Tuberculosis*.) Relevant demographic and contact information for each potential contact identified is elicited. This information allows contacts to be located and evaluated in a timely manner.

## CONDUCTING A HOME ASSESSMENT

In the context of a contact investigation, home assessments provide the opportunity to identify individuals not previously mentioned by the patient and environmental conditions that may facilitate TB transmission in the household (i.e., crowding, poor ventilation, etc.). The home assessment is also an opportunity to offer testing to any contacts who may be present at the time of the visit. Trained BTBC staff carry the necessary equipment to test any contacts identified in the home.

## PRIORITIZING CONTACTS FOR EVALUATION

Contacts are classified into one of four categories based on the extent of their exposure to a patient with infectious TB disease:

- » **Close contact:** Persons who have prolonged, intense, or frequent contact—on average eight hours or more per week of exposure—with a patient with active TB disease during the infectious period.
- » **Other-than-close (OTC) contact:** Persons who have less prolonged, intense, or frequent contact with a patient with active TB disease during the infectious period
- » **Limited exposure contact:** Persons who have more casual and less extensive exposure than OTC contacts
- » **Unknown exposure contact:** Persons who a patient has identified as a contact, but there is insufficient information regarding the extent of interaction and level of exposure

BTBC uses the concentric circle approach to organize, prioritize, and test contacts. The concentric circle is categorized by specific exposure settings (i.e., household, school, workplace, leisure).

Each setting is further categorized according to the extent of exposure. The inner circle refers to close contacts and the outer circle refers to OTC contacts. Evaluation of the first concentric circle (close) typically begins with household contacts since their exposures are usually of greatest extent or duration.

If transmission is observed among close contacts, testing is expanded to include OTC contacts in the same setting, or to contacts in other settings. Sometimes non-household contacts are as close as or closer than household contacts and their testing is not dependent on household results. (See *Figure 11.1: Concentric Circle Approach to Evaluating Contacts and Expanding Tuberculosis Contact Investigations.*)

**FIGURE 11.1:** Concentric circle approach to evaluating contacts and expanding tuberculosis contact investigations

Extent of exposure: ■ Close ■ OTC ■ Limited

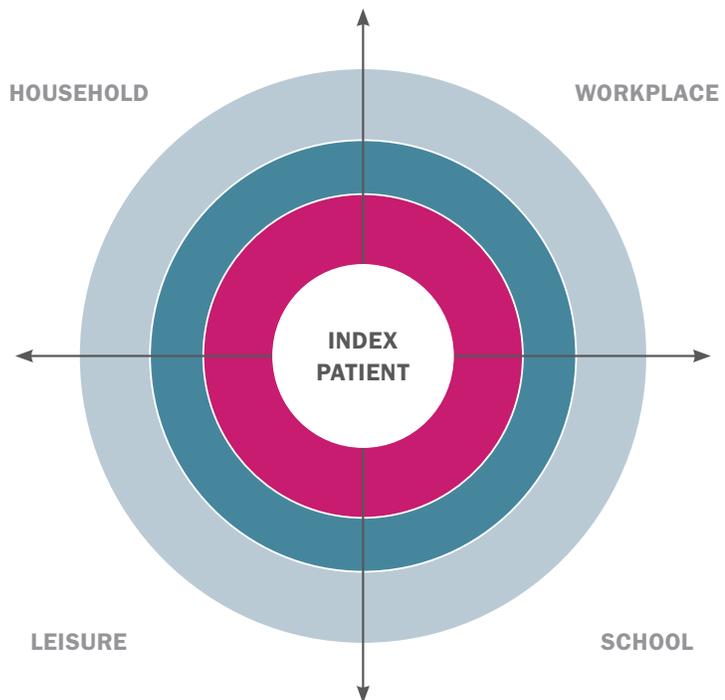
*BTBC uses the concentric circle approach to organize, prioritize, and test contacts to patients with infectious TB disease.*

*The concentric circle is categorized by specific exposure settings (e.g., household, school, and workplace).*

*Each setting is further categorized according to the extent of exposure. The inner circle refers to close contacts and the outer circles refer to OTC and limited exposure contacts.*

*Evaluation of the first concentric circle (close contacts) typically begins with household contacts since their exposures are usually of greatest extent or duration.*

*If transmission is observed among close contacts, testing is expanded to include either OTC contacts in the same setting, or to contacts in other settings.*



Although it is important that all elicited contacts complete evaluation, contacts are prioritized for contact evaluations based upon the following characteristics:

- 1.** Close contacts of patients with clinical characteristics associated with infectiousness:
  - Smear- and culture-positive pulmonary or laryngeal TB disease
  - Cavitory lesions on CXR
- 2.** All contacts (close and OTC) who have one or more of the following factors associated with an increased risk of progressions to active TB disease once infected:
  - HIV infection
  - Other immunosuppressive conditions or taking immunosuppressive medications
  - Low body weight
  - Children younger than five years of age
- 3.** Contacts with symptoms consistent with active TB disease
- 4.** Contacts of an infectious patient with multidrug-resistant TB (MDR-TB)

**TABLE 11.2:** Criteria for prioritization of contacts and subsequent public health action

CATEGORY	CRITERIA	PRIORITY/ACTIONS
Contacts most likely to be infected	<ul style="list-style-type: none"> <li>• Close contacts</li> <li>• Contacts exposed to highly infectious patients based on:               <ul style="list-style-type: none"> <li>- AFB sputum smear-positive</li> <li>- Cavitory disease on CXR</li> <li>- Cough</li> </ul> </li> <li>• Contacts who were:               <ul style="list-style-type: none"> <li>- Exposed in small, crowded, or poorly ventilated spaces</li> <li>- In close proximity to the patient</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• High priority for contact investigation</li> <li>• Initiate contact investigation within 3 working days (phone call and at least 1 home visit)</li> </ul>
Contacts at increased risk of developing TB disease once infected	<ul style="list-style-type: none"> <li>• Children younger than 5 years of age</li> <li>• Contacts with any of these characteristics/conditions:               <ul style="list-style-type: none"> <li>- HIV/AIDS</li> <li>- Other immunosuppressive conditions</li> <li>- Diabetes mellitus</li> <li>- Silicosis</li> <li>- Prolonged corticosteroid therapy (e.g., receiving the equivalent of more than 15 mg of prednisone for longer than 1 month)</li> <li>- Receiving other immunosuppressive agents (e.g., chemotherapy)</li> <li>- Cancers of the head, neck, or lung</li> <li>- Hematologic or reticuloendothelial malignancies (e.g., leukemia, Hodgkin’s disease)</li> <li>- Chronic renal failure</li> <li>- Chronic malabsorption syndromes</li> <li>- Intestinal bypass or gastrectomy</li> <li>- Low body weight (10% or more below ideal)</li> <li>- Radiologic evidence of old, healed TB lesions</li> <li>- Various dermatological, rheumatological, or GI disorders (e.g., inflammatory bowel disease, psoriasis, rheumatoid arthritis, chronic hepatitis) who are likely to be placed on medications that may impair their immune systems</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• High priority for contact investigation</li> <li>• Initiate contact investigation within 3 working days (phone call and at least 1 home visit)</li> </ul>
Contacts to MDR-TB index patients	<ul style="list-style-type: none"> <li>• Both close and OTC</li> </ul>	<ul style="list-style-type: none"> <li>• Initiate contact investigation within 3 working days (phone call and at least 1 home visit)</li> </ul>

**Abbreviations Used:** AFB=acid-fast bacilli; AIDS=acquired immunodeficiency syndrome; CXR=chest radiograph; GI=gastrointestinal; HIV=human immunodeficiency virus; MDR-TB=multidrug-resistant tuberculosis; mg=milligrams; OTC=other-than-close; TB=tuberculosis

## INTERVIEWING CONTACTS

Similar to interviews for patients with active TB disease, all interviews with contacts are conducted under conditions that are private and confidential, whether conducted by phone, in person, or using another method. The identity of the patient with active TB disease is not identified when interviewing contacts (e.g., avoid using gender specific pronouns). The purpose of the interview is to:

- Notify the contact of their exposure to an infectious person with TB disease
- Confirm contact information provided by the index patient including name, phone number, and address
- Ascertain specific medical history information:
  - Are symptoms of active TB disease present?
  - Does the contact have medical risk factors (e.g., immunosuppressive medical conditions)?
  - Any prior history of LTBI or TB disease?
- Educate the contact about TB transmission and the steps and reasons for a contact investigation. This includes:
  - Educating the patient about TB pathogenesis and transmission
  - Explaining why evaluation is recommended for the individual contact
  - Describing the types of tests for TB infection that are available (tuberculin skin test [TST] and interferon gamma release assay [IGRA]), the meaning of results, and the need for a CXR for contacts with a prior history of positive TB test result
  - Explaining the need to perform a test both during the window period and—if the initial test is negative—during the post window period to ensure an accurate result
  - Describing next steps that will occur if the test for TB infection is positive
- Establish a mutually agreed upon plan for evaluation as soon as possible

The details of the interview are documented in the electronic surveillance and case management system. Arrangements are made with the individual to be evaluated at a location mutually agreed upon (e.g., tested in the community by trained BTBC staff, at a NYC Health Department TB clinic, or at a provider chosen by the individual). If the contact chooses to see a community provider, the provider is informed of the contact exposure and window period to ensure that proper evaluation and evaluation results are obtained and entered into the TB case management and surveillance system.



To ensure systematic information is collected on all identified contacts, the **TB 77** form is used to collect demographic and clinical risk factors that may influence a contact's risk of progressing to TB disease. The **TB 77** can be found on the NYC Health Department intranet at <https://nycdohmh.sharepoint.com/sites/dis5/TBadministration/Forms/BTBC%20Forms%20by%20Name/TB%20Testing%20Form%20-%20TB%2077.pdf#search=TB%2077>

## EVALUATING CONTACTS AND DETERMINING THE NEED FOR TREATMENT

A contact evaluation includes a review of TB symptoms, medical risk factors, and history of TB screening, as well as a test for TB infection (except for individuals with a documented prior positive test result). Although either the TST or a blood-based IGRA can be used to screen a contact for TB infection, BTBC prefers the IGRA for any individual older than two years of age. IGRAs have operational advantages (only one patient visit), as well as greater specificity (decreased false-positive test results due to the bacilli Calmette-Guérin [BCG] vaccination and most other nontuberculous mycobacterium [NTM]).

Any contact with symptoms consistent with active TB disease, who may be immunosuppressed (due to a medical condition or treatment), or who has risk factors for progression to active TB disease once infected (e.g., children younger than five years of age) has a physical examination and a CXR regardless of the initial IGRA or TST test result as soon as possible, and is retested shortly after the window period ends.

Immune-competent contacts or those without medical risk factors who test IGRA or TST negative, but whose last day of exposure is less than eight weeks prior to testing, should be retested shortly after this eight-week (window) period and re-interviewed for TB symptoms.

Contacts who test IGRA- or TST-positive are referred for a CXR and medical evaluation. Close contacts who have tested IGRA- or TST-positive prior to their current exposure are referred for medical evaluation, a CXR, and consideration for treatment (or re-treatment) of LTBI.



**Contacts exhibiting signs and symptoms consistent with active TB disease are referred for medical evaluation regardless of their test for TB infection result. (See *Chapter 3: Diagnosis of Tuberculosis Disease in Adults.*)**

## SPECIAL CONSIDERATIONS FOR EVALUATING CONTACTS

### PREGNANT CONTACTS

Individuals who are pregnant and identified as contacts to infectious TB patients undergo evaluation to rule out active TB disease, and if necessary, receive treatment for LTBI. Evaluation includes:

- Medical history (i.e., review of TB symptoms, medical risk factors, and history of TB screening)
- Test for TB infection
- CXR

Pregnant persons with a positive IGRA or TST require a CXR to rule out active pulmonary TB disease. A CXR is immediately obtained for the following persons with any of the following, even during the first trimester of pregnancy:

- Symptoms suggestive of TB disease (e.g., fever, cough, chills, night sweats, chest pain)

- HIV infection or other immunosuppressive conditions
- Recent close contact to a person with infectious TB

If active TB disease is ruled out, treatment for LTBI is based on individual risk factors; however, pregnant patients who have HIV infection and/or are close contacts to infectious TB patients can begin treatment for LTBI during the first trimester of pregnancy. (See *Chapter 2: Diagnosis and Treatment of Latent Tuberculosis Infection*.)

### INFANT AND CHILD CONTACTS

Infants (younger than one year of age) and children younger than five years of age (up to the day of their fifth birthday) who are contacts of persons with infectious TB are at high risk for TB infection and progression to active TB disease and are prioritized for TB screening.

To ensure appropriate evaluation and reduce the risk of progression to active TB disease for infant and child contacts, pediatric evaluations include:

- Medical history
- Physical exam
- Baseline test for TB infection
- CXR (both posterior-anterior and lateral) regardless of the test for TB infection result
- Window prophylaxis treatment until the result from the retest is known

Medical providers may use clinical discretion when performing a test for TB infection on children younger than six months of age, as these tests are not considered reliable until at least six months of age. As a result, some child contacts may have a window period longer than eight weeks if their last day of exposure to an infectious patient was prior to six months of age.

If children younger than five years of age live in the same household as a person with infectious TB disease, the infectious patient is kept out of the home until one of the following conditions is met:

- The person with infectious TB is taking appropriate anti-TB treatment and has demonstrated an adequate clinical response to treatment (i.e., AFB-negative smears and improvement in symptoms).
- The child has started LTBI treatment, including window period prophylaxis.
- If the patient remains infectious due to unresponsive MDR-TB and cannot be separated from the child, BCG vaccine can be considered for the child if the test for TB infection is negative (least desirable option). (See *Appendix D: The Use of Bacille Calmette-Guérin Vaccine*.)

Any infant or child contact with an abnormal CXR consistent with TB requires treatment for active TB disease regardless of the results of baseline or repeat IGRA or TST tests. (See *Chapter 2: Diagnosis and Treatment of Latent Tuberculosis Infection* and *Chapter 7: Diagnosis and Treatment of Pediatric Tuberculosis Disease*.)

## CONTACTS TO MULTIDRUG-RESISTANT TUBERCULOSIS

BTBC staff work diligently to ensure that contacts to patients with MDR-TB are evaluated and started on treatment for LTBI when appropriate. Similar to other contacts, evaluations include:

- Medical history
- Physical exam
- Test for TB infection
- CXR, when indicated

Once active disease has been ruled out, a clinical decision of whether to treat for LTBI is made. If treatment is deemed appropriate, the LTBI regimen is based on the index patient's drug-susceptibility results.

If the contact is not treated for LTBI, follow-up evaluations including a physical exam and CXR are conducted at regular intervals (four, eight, 12, 18, and 24 months) to ensure the contact has not developed active TB disease. BTBC staff conduct comprehensive patient education for the contact regarding the symptoms of active TB disease and when to seek clinical care. (See *Chapter 2: Diagnosis and Treatment of Latent Tuberculosis Infection*.)

## ENSURING THE POST-WINDOW EVALUATION OF CONTACTS

If the reaction to the initial (window period) IGRA or TST is negative, contacts are tested again immediately eight weeks after their last date of exposure to the patient with infectious TB disease (i.e., after the window period).

The following individuals are recommended to start window prophylaxis for LTBI, even if the initial test is negative:

- Children younger than five years of age
- Individuals between five and 15 years of age, at the physician's discretion
- Individuals with HIV infection or other immunosuppressive condition

The evaluating provider reviews the window period and ensures that the patient is scheduled for a repeat test for TB infection.

If the reaction to the post-window IGRA or TST is negative and the individual is both asymptomatic and no longer exposed to a patient with infectious TB disease, follow-up is discontinued for immune-competent contacts (including immune-competent children). Window period prophylaxis, if started, can be discontinued. Close contacts have HIV infection or are otherwise immunosuppressed require a full course of LTBI treatment, regardless of age or previous treatment.

If the reaction to the post-window IGRA or TST is positive, the provider completes the evaluation with a CXR and physical examination. Once active TB disease is ruled out, LTBI treatment is initiated.

## SCREENING AND TESTING FOR HUMAN IMMUNODEFICIENCY VIRUS

All contacts should be evaluated for HIV infection, as HIV increases the risk of disease progression for persons with LTBI. HIV counseling and testing is offered to all contacts not previously known to have HIV infection. Rapid HIV testing is available at all NYC Health Department TB clinics; all contacts can be referred to a NYC Health Department TB clinic or to their private physician for HIV counseling and testing.

## ASSESSING TRANSMISSION IN A CONTACT INVESTIGATION

The results of TB testing and evaluation among contacts are reviewed to assess the likelihood that transmission occurred within an exposure setting. In household contact investigations, BTBC uses the following indicators as criteria to expand the contact investigation using the concentric approach:

- Child born in the United States (U.S.) with no history of travel outside the continental U.S. who tests positive for TB infection or is diagnosed with TB disease
- Contact(s) who are diagnosed with active TB disease (secondary case[s])

Additionally, if 50% or more of the household contacts, regardless of the contacts' country of birth, test positive for TB infection, then the contact investigation will be expanded to include additional contacts.

In household contact investigations, the approach used to determine when expansion of an investigation is necessary is less exact than the analysis used in larger congregate setting exposures.

## CONDUCTING AN EXPANDED CONTACT INVESTIGATION

If expansion of a contact investigation is indicated, the next circle of contacts may be in congregate settings such as a workplace, school, correctional facility, hospital/healthcare setting, and shelter or other non-household setting.

A decision to initiate an expanded contact investigation (ECI) in a non-household setting is influenced by multiple factors:

- Identification of transmission among closest contacts (household contacts, family, and friends)
- Presence of medical risks in contacts (e.g., HIV infection, children younger than five years of age)
- Characteristics of the index patient that suggest infectiousness (AFB smear-positive, cavitory CXR, and presence of cough)
- Extent and duration of exposure in the congregate setting

When a decision has been made to initiate an investigation at a congregate setting, a BTBC staff member informs the case management team, coordinates the investigation at the site, and serves as the primary point of contact for the investigation. The infectious patient is informed about the initiation of the ECI, and if relevant, steps are taken to protect the confidentiality of the patient (e.g., the patient may agree to attend the site screening, but is not actually tested).

BTBC works closely with site management by educating them about TB and explaining the need for the investigation. BTBC facilitates testing by explaining how to notify contacts at the site, setting parameters for information exchange, communicating requirements to maintain confidentiality of any patient information site management may be aware of, conducting a walk-through at the site, and establishing the plan for a TB educational session, and notification and testing of contacts. Screening is conducted on site at the convenience of site management. Contacts at the congregate setting who are not evaluated at the site may go to their private provider or may be referred to a NYC Health Department TB clinic or to BTBC staff for follow-up and evaluation. In certain situations, senior level Health Department staff and the Press Office are notified of an ECI initiation, especially for investigations occurring in sensitive exposure settings.

Contact investigation results are reviewed to assess the likelihood that transmission occurred within an exposure setting. (See *Table 11.2: Transmission Assessment Criteria for Contact Investigation in Congregate Settings*.) If there is evidence of transmission at the site, a determination is made about further expansion to other site contacts or possibly other congregate settings identified by the index patient.

Transmission assessments are made by reviewing TB evaluation results using the following definitions:

» **Probable transmission** (prompts expansion of the contact investigation)

- Contact who has been diagnosed with active TB disease (i.e., secondary case)
- Contact(s) with a documented test for TB infection conversion from a negative to positive within two years
- Proportion of positive test results among contacts is higher than expected in a similar non-exposed population and 75% or more of eligible contacts were evaluated

» **Possible** (prompts expansion of the contact investigation)

- Proportion of positive test results among contacts is higher than expected in a similar non-exposed population and fewer than 75% of eligible contacts were evaluated

» **Unlikely** (contact investigation is not usually expanded)

- Proportion of positive test results among contacts was less than or equal to expected in a similar non-exposed population and 75% or more of eligible contacts were evaluated

» **Cannot be assessed** (usually need to expand contact investigation)

- Proportion of positive test results among contacts was less than or equal to expected in a similar non-exposed population and fewer than 75% of eligible contacts were evaluated

On occasion, there may be a need to conduct an environmental assessment at a congregate setting. This typically occurs when there is the possibility that poor ventilation may contribute to a more intense TB exposure. BTBC or other Health Department staff with environmental science expertise are engaged to further investigate an exposure site where findings cannot be readily explained and/or when a secondary case is identified. Environmental assessment findings are shared with site management.

**TABLE 11.2:** Transmission assessment criteria for contact investigation in congregate settings

ASSESSMENT	CRITERIA
Transmission likely	<ul style="list-style-type: none"> <li>• Secondary case or</li> <li>• Documented TB test conversion from a negative to positive within two years, or</li> <li>• Proportion of positive test results among contacts is higher than expected in a similar non-exposed population* and 75% or more of eligible contacts were evaluated</li> </ul>
Transmission possible	<ul style="list-style-type: none"> <li>• Proportion of positive test results among contacts is higher than expected in a similar non-exposed population* and fewer than 75% of eligible contacts were evaluated</li> </ul>
Transmission unlikely	<ul style="list-style-type: none"> <li>• Proportion of positive test results among contacts was less than or equal to expected in a similar non-exposed population* and 75% or more of eligible contacts were evaluated</li> </ul>
Cannot be assessed	<ul style="list-style-type: none"> <li>• Proportion of positive test results among contacts was less than or equal to expected in a similar non-exposed population* and fewer than 75% of eligible contacts were evaluated</li> </ul>

\*Data sources include data from the National Health and Nutrition Examination Survey (NHANES) and Stennis et al. Estimated prevalence of tuberculosis infection among a New York City clinic population using Interferon-gamma release assays. *Open Forum Infect Dis.* 2014 Sept; 1(2)

Abbreviations Used: TB=tuberculosis

### SPECIAL CONSIDERATIONS FOR CONTACT INVESTIGATIONS IN HEALTHCARE SETTINGS

Following an exposure in a healthcare setting, BTBC and infection control staff at the facility review the exposure scenario to determine what actions to take. Although facility personnel are responsible for conducting the investigation and New York State (NYS) oversees the investigation, BTBC is available to provide technical assistance and guidance during the investigation, if needed. Typically, the facility's staff contacts are tested by the facility's employee health program, whereas patient contacts (no longer at the facility) may be referred to BTBC for screening and follow-up. Results of contacts who are tested by the facility are shared with BTBC. The final results are reviewed and transmission assessments are made as described above.

### CONDUCTING CASE MANAGEMENT FOR CONTACTS BEING TREATED FOR LATENT TUBERCULOSIS INFECTION

Every contact started on treatment or window prophylaxis for LTBI is managed through treatment completion or until the contact is dispositioned. Since case management responsibilities are assigned based upon where the patient obtains care, it is not infrequent that several BTBC staff members are responsible for the follow-up and care of contacts and the infectious patient.

The BTBC staff member managing the contact is responsible for the following:

- Updating the contact's event in the electronic surveillance and case management system
- Reminder phone calls for upcoming medical visits
- Monitoring monthly follow-up medical visits
- Performing “return to service (RTS)” activities
- Collecting/requesting information from the treating provider regarding treatment status and completion for contacts
- Providing treatment and treatment outcome information for all contacts to the BTBC staff managing the patient with infectious TB

The BTBC staff member managing the index patient is responsible for the following:

- Verifying that all contacts are being case managed (done via the electronic surveillance and case management system or discussion with other BTBC staff)
- Knowing the status of all contacts, even if another staff member is managing those individuals
- Reporting the outcome of the contact investigation at the weekly case management meeting where the index patient is being presented

## SUPERVISORY REVIEW OF CONTACT INVESTIGATIONS

The status of all contact investigations performed by BTBC are reviewed by supervisory staff on an on-going basis to ensure appropriate care for all patients. The status of contact investigations are also reviewed by the BTBC Director during quarterly cohort reviews for all TB patients. (See *Chapter 16: Program Evaluation and Research*.)

## SOURCE CASE INVESTIGATIONS

Source case investigations attempt to identify the unknown person with infectious TB disease who transmitted TB to a child less than five years of age who has been diagnosed with TB disease or who has signs and symptoms consistent with TB disease (i.e., the source who infected the child). Given the low prevalence of TB disease in the NYC population, TB disease in a U.S.-born child who generally stays in the country constitutes evidence of recent transmission. The assumption is that any child with TB disease must have been exposed very recently to someone close to them, and that person may have undiagnosed TB disease. Young children with active TB disease usually do not transmit TB to others, and their contacts are unlikely to be infected.

A source case investigation follows many of the same procedures as a standard contact investigation except that retesting is not required for associates who test negative (unless an index is found; however in those situations a new window period for all contacts around that index patient needs to be set). BTBC staff work closely with parents or guardians to identify anyone “associated” with the child. Parents or guardians

are asked about any child associates who may be symptomatic in order to prioritize evaluation for anyone with symptoms and prevent further exposure to others. Any associate identified is evaluated for symptoms of TB disease, tested for LTBI, and given a CXR and medical evaluation; any associates who have symptoms consistent with TB disease also provide sputum for smear and culture. The source case investigation begins with the closest associates and expands out as needed (i.e., household members, babysitters, day care providers, teachers, etc.).

Regardless of the child's site of disease, a source case investigation is initiated to identify:

- The source case (i.e., the individual with active TB disease who may have infected the child)
- Other secondary TB cases
- Other children and adults who may have been infected in the same setting. These individuals are technically “associates” since children of this age are not routinely considered infectious and thus these individuals are not “contacts.”

## ADDRESSING NON-ADHERENCE

Adherence to LTBI treatment among contacts is essential to prevent progression to active TB disease. Adherence to the recommended evaluation is essential to ensure that contacts have been fully evaluated for active TB disease and LTBI. Contacts who miss any scheduled appointments by telephone or home visits are followed up with, when necessary. To encourage adherence, phone calls are conducted prior to each appointment. (See *Chapter 10: Case Management for Patients with Tuberculosis* and *Chapter 17: Laws Governing Tuberculosis Care in New York City*.)

## SUMMARY

Contacts have the greatest risk of developing TB disease compared to other risk groups. As a result, contact investigations are utilized to identify and control TB transmission to prevent future cases of TB disease. To ensure appropriate care and follow-up is provided to all contacts, the case management team works collaboratively, utilizing BTBC staff and resources, as well as external partner cooperation and support.

## KEY SOURCES

Anger HA, Proops D, Harris TG, et al. Active case finding and prevention of tuberculosis among a cohort of contacts exposed to infectious tuberculosis cases in New York City. *Clin Infect Dis*. 2012 May;54(9):1287-95.

National Tuberculosis Controllers Association; Centers for Disease Control and Prevention (CDC). Guidelines for the investigation of contacts of persons with infectious tuberculosis. Recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR Recomm Rep*. 2005 Dec 16;54(RR-15):1-47.