

Contact Investigation

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Forms Used in this Section

- [Contact Investigation](#)
- [Contact Investigation Instructions](#)
- [Health Advisory](#) (Clark/Cowlitz/Skamania/Wahkiakum Counties)
- [Protocol and Standing Orders](#) (SHD)

Quick Start Check List: Contact Investigation

This check list is designed to assist public health nurses in conducting a contact investigation. The tasks below should be performed by licensed nursing, medical, and laboratory staff. This check list requires understanding the instructions in the manual and familiarity with local protocols and standing orders.

Forms can be submitted by fax to the attention of the Washington State TB Services at 360-236-3405 or mail to:

Washington State TB Services

Mailing address: P.O. Box 47837 Olympia, WA 98504

Physical address: 111 Israel Rd SE Tumwater, WA 98501

| Tasks for Contact Investigation | Instructions and Forms |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Decide whether to initiate a contact investigation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Evaluate the index patient <input type="checkbox"/> Gather the index patient's medical records (from hospital, clinic, and/or healthcare provider) <input type="checkbox"/> Decide if a contact investigation is indicated <input type="checkbox"/> If an investigation is indicated, start the contact investigation within ≤1 business day of the case report <input type="checkbox"/> Submit the "Tuberculosis Contact Investigation Form" to WA State TB Services within 2 weeks <p>Note: Contact investigations are conducted for persons with suspected or confirmed pulmonary, laryngeal, or pleuropulmonary tuberculosis (TB) disease with the following:</p> <ul style="list-style-type: none"> • Pulmonary cavities and/or • Respiratory specimens positive for acid-fast bacilli (AFB) sputum smear | <p>Instructions:</p> <p>Contact Investigation Guidelines</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/pdf/rr/rr5415.pdf • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |
| <p>Determine the time frame for potential exposure:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Determine the start of the index patient's infectious period | |
| <p>Interview the index patient:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Conduct the first interview within ≤1 business day of the case report <input type="checkbox"/> Visit the index patient's residence within ≤3 business days after first interview, if not already done in the first interview <input type="checkbox"/> Reinterview the index patient within 1 to 2 weeks after the first interview <input type="checkbox"/> Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <p>Contact Investigation Guidelines</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/pdf/rr/rr5415.pdf • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |

| Tasks for Contact Investigation | Instructions and Forms |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>During the interviews, gather information regarding the following:</p> <ul style="list-style-type: none"> • Additional medical history • Residence(s) • Transmission sites, with dates and times • Contacts | <p>Note: The interviews for contact investigation also gather data for the initial assessment in case management and provide patient education</p> |
| <p>List and prioritize contacts:</p> <ul style="list-style-type: none"> □ During the index patient interview, list names and locating information of named contacts (plan to update this list throughout the investigation) □ Assign an initial priority classification to each contact (plan to revise as needed when new information is received) □ Review all documentation to ensure that the contact list is complete □ Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <p>Contact Investigation Guidelines</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/pdf/rr/rr5415.pdf • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |
| <p>Complete the field investigation:</p> <ul style="list-style-type: none"> □ Visit all potential transmission sites within 5 days after starting the investigation □ Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <p>Contact Investigation Guidelines</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/pdf/rr/rr5415.pdf • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |
| <p>Start contacts on treatment for LTBI:</p> <ul style="list-style-type: none"> □ Assure that treatment for LTBI is started for high-priority and high risk contacts (children under 5 years of age and persons who are at high risk of developing active TB disease) within 5 business days after initial encounters. □ Assure that treatment for LTBI is started for adult high- and medium-priority contacts without high-risk factors within 10 business days of their medical evaluations □ Review and assess the timeliness of initiating the treatment plans for contacts within 10 business days after their medical evaluations □ Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <p>Contact Investigation Guidelines</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/pdf/rr/rr5415.pdf <p>Targeted Tuberculin Testing and Treatment of LTBI</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/PDF/rr/rr4906.pdf • Roadmap (8.11) • Protocols and Standing Orders (SHD) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |

| Tasks for Contact Investigation | Instructions and Forms |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Review data and documentation weekly throughout the contact investigation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Reassess information about the index patient at least weekly until drug susceptibility results are available for the <i>Mycobacterium tuberculosis</i> isolate or for 2 months following notification, whichever is longer <input type="checkbox"/> Review documentation to ensure that the contact list is complete <input type="checkbox"/> Collect and analyze data on contacts and TST or IGRA tests <input type="checkbox"/> Reassess contact priorities <input type="checkbox"/> Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <ul style="list-style-type: none"> • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |
| <p>Report on the contact investigation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Report results of the initial TST/IGRA testing to the WA State TB Services after the initial testing is completed <input type="checkbox"/> Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <ul style="list-style-type: none"> • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |
| <p>Monitor contacts on treatment for LTBI:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Assure that contacts are assessed at least monthly for <ul style="list-style-type: none"> • Clinical follow-up • Adherence to LTBI treatment • Adverse reactions to LTBI treatment | <p>Instructions:</p> <ul style="list-style-type: none"> • Roadmap (8.11) |
| <p>Retest contacts:</p> <ul style="list-style-type: none"> <input type="checkbox"/> On contacts whose results were initially negative, repeat tuberculin skin testing/IGRA 8 to 10 weeks after each contact's last exposure to the index patient during the infectious period <input type="checkbox"/> After retesting, reevaluate contacts who were initially TST- or IGRA - negative and started on LTBI treatment to determine if treatment should be continued <input type="checkbox"/> After retesting, determine if transmission occurred and whether to expand the investigation <input type="checkbox"/> Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <ul style="list-style-type: none"> • Roadmap (8.11) <p>Contact Investigation Guidelines</p> <ul style="list-style-type: none"> • www.cdc.gov/mmwr/pdf/rr/rr5415.pdf <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |

| Tasks for Contact Investigation | Instructions and Forms |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Report on the contact investigation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Report results of the second round of testing to the WA State TB Services after retests are completed <input type="checkbox"/> Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <ul style="list-style-type: none"> • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |
| <p>Confirm contacts' completion of treatment for LTBI:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Verify completion of treatment 6 to 12 months after treatment was started depending upon <ul style="list-style-type: none"> • Regimen • Adherence • Number of weeks on treatment • Number of doses taken • Chest radiograph | |
| <p>Report on the contact investigation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Report completion of treatment to the WA State TB Services after contacts complete treatment for LTBI <input type="checkbox"/> Submit the TB Contact Investigation Form to WA State TB Services within 2 weeks | <p>Instructions:</p> <ul style="list-style-type: none"> • Roadmap (8.11) <p>Forms:</p> <ul style="list-style-type: none"> • Contact Investigation • Instructions |

Introduction

Purpose

A contact investigation is the process of identifying, examining, evaluating, and treating all persons who are at risk for infection with *Mycobacterium tuberculosis* due to recent exposure to a newly diagnosed or suspected case of pulmonary, laryngeal, or pleural tuberculosis (TB).

The primary goal of a contact investigation is to do the following:

- Identify persons who were exposed to an infectious case of TB
- Ensure that contacts receive
 - Testing for *M. tuberculosis* infection;
 - Screening for TB disease;
 - Medical evaluation, if indicated;
 - Prompt initiation of treatment for latent tuberculosis infection (LTBI) if at high risk for developing TB disease (younger than 5 years of age or immunocompromised); and
 - A complete, standard course of treatment, unless medically contraindicated.¹

Secondary goals of a contact investigation are to

- Stop transmission of *M. tuberculosis* by identifying persons with previously undetected infectious TB; and
- Determine whether a TB outbreak has occurred (in which case, an expanded outbreak investigation should ensue).²

Use this section to understand and follow national and Washington State guidelines to address the following:

- Decide when to initiate a contact investigation
- Understand the time frames for key contact investigation activities
- Estimate the infectious period
- Conduct index patient interviews
- Assign priorities to contacts
- Complete contact evaluation, treatment, and follow-up
- Determine when to expand a contact investigation
- Manage data and evaluate contact investigations
- Conduct an outbreak investigation

Except in rare cases, every case of TB begins as a contact to a person with active pulmonary, laryngeal, or pleural TB disease. For this reason, the Centers for Disease Control and Prevention (CDC) has identified contact investigations (i.e., seeking and evaluating contacts) as a fundamental strategy for the prevention and control of TB. To control and prevent TB, our healthcare resources and efforts in Washington State should be directed to meeting the priorities outlined in the 2005 “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America.” One of the recommended strategies for achieving the goal of reduction of TB morbidity and mortality is prompt identification of contacts to patients with infectious TB and timely treatment of those at risk with an effective drug regimen.³ National recommendations for contact investigations are provided in the CDC’s “Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis: Recommendations from the National Tuberculosis Controllers Association and CDC, and Guidelines for Using the QuantiFERON®-TB Gold Test for Detecting *Mycobacterium tuberculosis* Infection, United States” (MMWR 2005;54[No. RR-15]:1–49).

One of the major challenges to successful control of TB is preventing development of TB disease in contacts of persons with infectious TB and in preventing and responding to TB outbreaks.⁴ Reducing the risk of TB among contacts through the development of better methods of identification, evaluation, and management would lead to substantial personal and public health benefits and facilitate progress toward eliminating TB in the United States.⁵

The evaluation of contacts of cases of infectious TB is one of the most productive methods of identifying adults and children with LTBI at high risk for progression to TB disease and persons already in the early stages of TB disease. Contact investigations, therefore, serve as an important means of detecting TB cases and, at the same time, identify persons in the early stage of LTBI, when the risk for progression to TB disease is high and the benefit of treatment is greatest.

Policy

A contact investigation is recommended for the following forms of suspected or confirmed TB because they are likely to be infectious:

Pulmonary, laryngeal, or pleuropulmonary disease with either:

- Pulmonary cavities or
- Respiratory specimens that have acid-fast bacilli (AFB) on microscopy or
- (Especially) both.⁶

Persons with AFB sputum smear negative results are less likely to be infectious, but are still capable of infecting others.

Structure of a Contact Investigation

Basic Steps of a Contact Investigation

A successful contact investigation requires the careful gathering and evaluation of detailed information, often involving many people. In general, contact investigations follow a process that includes these steps:

1. Preinterview preparation
2. Index patient interviews
3. Field investigation
4. Risk assessment for *Mycobacterium tuberculosis* transmission
5. Decision about priority of contacts
6. Evaluation of contacts
7. Treatment and follow-up of contacts
8. Decision about whether to expand testing
9. Evaluation of contact investigation activities^{7,8}

Although these steps are presented in sequence above, it is important to remember that contact investigations do not always follow a predetermined sequence of events.⁹

Contact Investigation Plan

The investigation plan starts with information gathered during interviews and site visits. It should include a registry of the contacts, their assigned priorities, and a written timeline. The timeline sets expectations for monitoring the progress of the investigation, and it assists the local health jurisdiction TB Services staff in informing public health officials about whether additional resources are needed for finding, evaluating, and treating the high- and medium-priority contacts.

The plan is a work in progress and should be revised if additional information indicates a need to expand a contact investigation. It is part of the permanent record of the overall investigation available for later review and program evaluation.



“Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis” at <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf>

Decision to Initiate a Contact Investigation

Factors Predicting Transmission of Tuberculosis

Decide when to initiate a contact investigation using the criteria provided in this topic. Competing demands restrict the resources that can be allocated to contact investigations. Therefore, local health jurisdiction personnel must decide which contact investigations are more significant and which contacts to evaluate first.

The index patient is the first patient that comes to the investigator's attention as an indicator of a potential public health problem. Whether or not to investigate an index patient depends upon factors predicting transmission. See Table 1: Index Patient Factors Increasing Transmission Risk. In addition, other information about the index patient, such as social habits or workplace environments, can influence the investigative strategy.¹⁰

TABLE 1: INDEX PATIENT FACTORS INCREASING TRANSMISSION RISK¹¹

| Characteristics of the Index Patient | Behaviors of the Index Patient |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none">• Pulmonary, laryngeal, or pleuropulmonary tuberculosis (TB)• Positive acid-fast bacilli sputum smear results• Cavitation on chest radiograph• Adolescent or adult patient• Lack of treatment or ineffective treatment of TB disease | <ul style="list-style-type: none">• Frequent coughing• Sneezing• Singing• Close social network |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and Guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54 (No. RR-15):4.

Anatomical Site of Disease

Ordinarily, patients with pulmonary or laryngeal tuberculosis (TB) are the only ones who can transmit infection. For contact investigation purposes, pleural disease is grouped with pulmonary disease because sputum cultures can yield *Mycobacterium tuberculosis* even when no lung abnormalities show on radiography. Rarely, extrapulmonary TB causes transmission during medical procedures, such as autopsy and embalming, that release aerosols.

Sputum Bacteriology

The relative infectiousness increases when the sputum culture results are positive, and increases further when the acid-fast bacilli (AFB) sputum smear results are also positive.¹² The significance of results from respiratory specimens other than expectorated sputum, such as bronchial washings or bronchoalveolar lavage fluid, is undetermined. Expert opinion recommends that these specimens be regarded as equivalent to sputum.

Radiographic Findings

Patients who have lung cavities observed on a chest radiograph are more infectious than patients with noncavitary disease. This is an independent predictor after bacteriologic findings are taken into account. The significance of small lung cavities that are detectable with computerized tomography (CT), but not with plain radiography, is undetermined.

Isolated instances of highly contagious endobroncheal TB in severely immunocompromised patients who temporarily had normal chest radiographs have contributed to outbreaks. The number and relative significance of such instances is unknown, but in one case series with human immunodeficiency virus (HIV)-infected TB patients, 3% who had positive AFB sputum smears had normal chest radiographs at the time of diagnosis.

Social Characteristics

Social issues can influence transmission. To assess the risk of transmission, it is important to consider the index patient's social factors, such as a close social network, residential setting or homelessness, employment, work setting, non-work-related activities, recent arrival from a foreign country, substance abuse and intravenous drug use.

Age

Transmission from children younger than 10 years of age is unusual, although it has been reported in association with those pulmonary forms of disease typically seen in adults. Contact investigations to evaluate transmission from pediatric cases should not be undertaken, except for those unusual cases. However, children younger than 5 years with TB, regardless of the site of disease, should have a contact investigation to identify the source case. A source-case investigation seeks the source of recent *M. tuberculosis* infection, perhaps newly diagnosed TB disease. TB disease in children younger than 5 years typically indicates that the infection is recent. Young children usually do not transmit TB to others, and their contacts are unlikely to be infected because of exposure to them.

Human Immunodeficiency Virus Status

Evaluation of HIV status must be performed promptly since progression to active TB may occur within weeks of exposure among individuals with acquired immunodeficiency syndrome (AIDS). HIV-infected TB patients with low CD4 T-cell counts frequently have chest radiographic findings that are not typical of pulmonary TB.¹³ In particular, they are more likely to have mediastinal adenopathy and less likely to have upper-lobe infiltrates and cavities. The atypical radiographic findings increase the potential for delayed diagnosis, which increases transmission. However, HIV-infected patients who have pulmonary or laryngeal TB on average are only as contagious as similar patients who are not HIV infected. Contacts to HIV-infected index TB cases are also more likely to be HIV infected. Therefore, for all persons who were exposed to HIV-infected TB cases (or those with risk factors for HIV) and whose infection status is unknown, HIV counseling and testing is recommended.¹⁴ Regardless of known HIV status, HIV counseling and testing should be recommended for all patients as a part of the screening process.¹⁵

After Starting Chemotherapy

TB patients rapidly become less contagious while under treatment. This has been corroborated by measuring the number of viable *M. tuberculosis* organisms in sputum samples and by observing infection rates in household contacts. However, the exact amount of time it takes for an individual patient to be non-infectious cannot be accurately predicted. Therefore, each patient's situation must be evaluated according to their sputum sample results, response to therapy and results of contact investigation. .

Treatment After Exposure to Drug-Resistant Tuberculosis



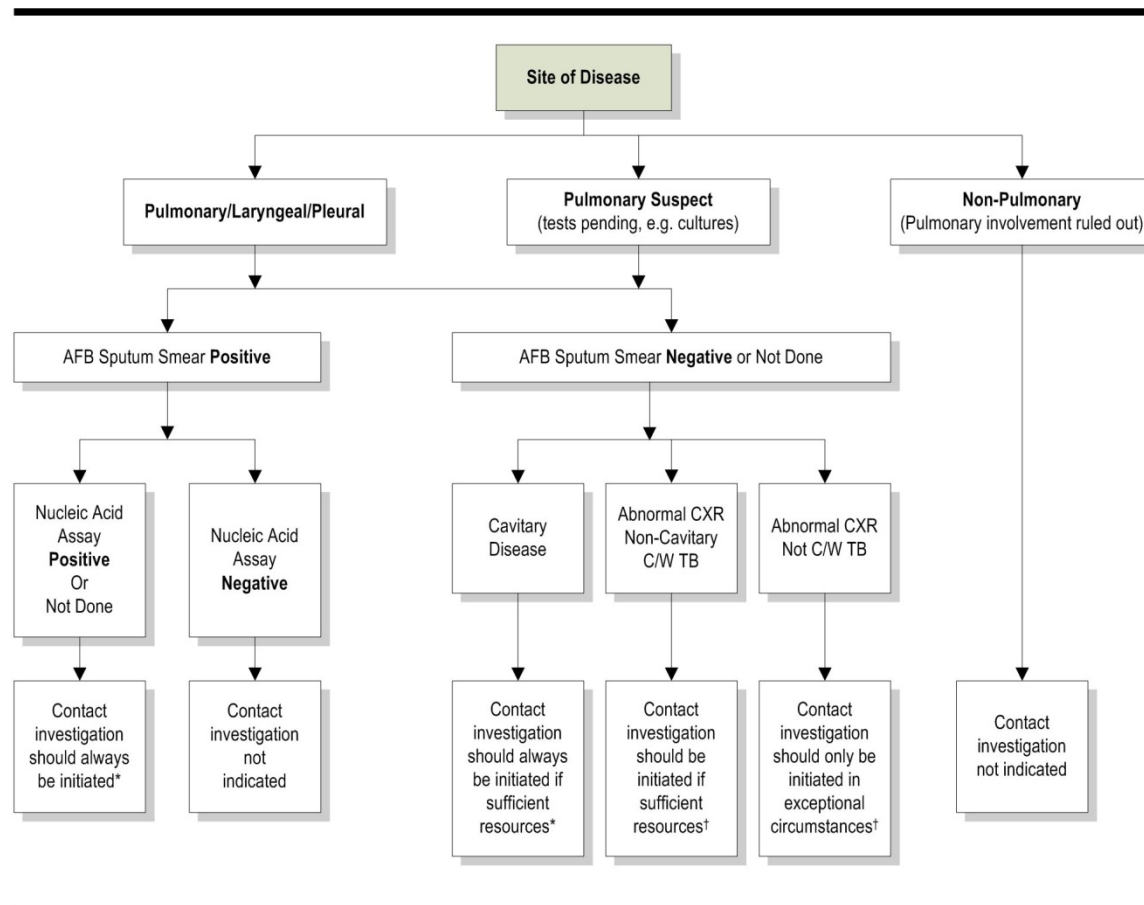
Drug susceptibility results for the *M. tuberculosis* isolate from the index patient (i.e., the presumed source of infection) are absolutely necessary for selecting the treatment regimen.

Resistance to isoniazid (INH) alone leaves the option of preventive treatment of contacts with four months of daily rifampin (RIF), but resistance to both INH and rifampin constitutes multidrug-resistant TB (MDR-TB). Treatment by all potential regimens is poorly tolerated to some extent, while none of these regimens have been tested fully for efficacy. Therefore, a consultation with a physician having expertise in this area is strongly recommended for selecting a regimen and managing the care of contacts. Monitor contacts who are suspected to be infected with multidrug-resistant *M. tuberculosis* for two years after exposure.

Deciding to Initiate a Contact Investigation

Consider a contact investigation for any patient with confirmed or suspected pulmonary, laryngeal, or pleuropulmonary TB. Refer to Figure 1 to help determine whether to start a contact investigation.

FIGURE 1: DECISION TO INITIATE A CONTACT INVESTIGATION¹⁶



Definitions of abbreviations: AFB = acid-fast bacilli; C/W = consistent with; CXR = chest radiograph; TB = tuberculosis.

* Use time frames from the middle column of Table 2 in the “Time Frames for Contact Investigation” topic.

† Use time frames from the right-hand column of Table 2 in the “Time Frames for Contact Investigation” topic.

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):5.

In general, a contact investigation should be promptly initiated for an AFB sputum smear-positive pulmonary, laryngeal or pleural TB suspect. Although sputum smear-positive suspects may eventually prove to have nontuberculous mycobacteria, (NTM) rather than *M. tuberculosis*, opportunities for appropriate contact investigation may be delayed, or even lost, if the TB program is waiting for confirmation of TB disease by positive culture.

If AFB are not detected by microscopy of three sputum smears, an investigation is still recommended if the chest radiograph shows cavities in the lung. Small parenchymal cavities that can be detected only by computerized imaging techniques (e.g., computed tomography [CT], computerized axial tomography [CAT] scan, or magnetic resonance imaging [MRI] of the chest) are not considered to be “cavitary disease.”

When sputum samples have not been collected, either because of an oversight or the patient’s inability to produce sputum samples, results from other types of respiratory specimens (e.g., gastric aspirates or bronchoalveolar lavage) may be interpreted in the same way as in the above recommendations. However, whenever feasible, sputum samples for each case should be collected before or while initiating chemotherapy.

For patients whose samples were reported to be positive on smear or culture at other laboratories, local health jurisdictions (LHJ) should consider collection and submission of sputum specimens on TB suspects to the Washington State Department of Health Public Health Laboratory. Doing so facilitates more rapid completion of testing and reporting to the LHJ. In addition, this provides an isolate to be sent automatically for universal genotyping.



For information regarding submission of sputum specimens to the Washington State Department of Health Public Health Laboratory, refer to the “Specimen Collection” topic in the Laboratory Services Section of the manual ([10.13](#))

A contact investigation may still be considered for high-risk contacts of suspects with non-cavitary disease and negative AFB sputum smears. The decision depends on the amount of resources that can be allocated and on whether goals are being met for higher priority contact investigations.

Contact investigations generally should not be initiated around index patients who have suspected TB disease and minimal diagnostic findings in support of pulmonary TB. Possible exceptions can be found during outbreak investigations, especially when vulnerable or susceptible contacts are found, or during a source-case investigation. Outbreak investigations and source-case investigations are explained briefly below.

- **Outbreak Investigation:** Definitions for TB outbreaks are relative to the local context. Outbreak cases can be distinguished from other cases only when some association in time, location, patient characteristics, or *M. tuberculosis* attributes (e.g., drug resistance or genotype) becomes apparent. In low-incidence jurisdictions, any temporal cluster will cause suspicion regarding an outbreak. In places where cases are more common, clusters can be obscured by the baseline incidence rate until suspicion is triggered by a noticeable increase, a sentinel event (e.g., pediatric cases), or related *M. tuberculosis* isolates.

- **Source-Case Investigation:** A source-case investigation seeks the source of recent *M. tuberculosis* infection, perhaps newly diagnosed TB disease. A source case or patient is the original source of infection for secondary cases or contacts. The source case can be, but is not necessarily, the index patient.



For more information on source-case investigations, see the CDC's "Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis Cases" (*MMWR* 2005;54[No. RR-15]: 31) at <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf>

Time Frames for Contact Investigation

Use this topic to understand the time frames for key contact investigation activities. A suspected or confirmed case of tuberculosis (TB) becomes designated as an “index patient” when that person is the first patient to appear as an indicator of a potential public health problem. An investigation is launched because of an index patient and the investigation often starts with an interview of the index patient.

Information about the Index Patient and Transmission Sites

Comprehensive information about an index patient is the foundation of a contact investigation. This information includes the disease characteristics, the onset date of the illness, names of contacts, exposure locations, and current medical factors, such as initiation of effective treatment and drug susceptibility results.

The infectiousness of the index patient determines the recommended time frames for pursuing the investigation. Indications of infectiousness include symptoms (such as cough, fever, weight loss, and night sweats), a positive acid-fast bacilli (AFB) sputum smear, a positive nucleic acid amplification (NAA) test, cavitory disease, or an abnormal chest radiograph consistent with TB.

Refer to Table 2: Time Frames for Investigating the Index Patient and the Sites of Transmission for the recommended time frames for index patient interviews and visits to the residence or other transmission sites, or see the CDC’s “Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis” at <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf>.



Some readers confuse prioritizing an investigation with prioritizing follow-up of individual contacts within an investigation. The following explains the difference between the two:

- The time priority for investigating the index patient and transmission sites is determined by the infectiousness of the index patient. Indications of infectiousness include positive AFB sputum smear results as well as symptoms, positive NAA test results, and chest radiographs showing cavitory disease or abnormalities consistent with TB.
- Ranking contacts by priority for follow-up within an investigation is based upon the characteristics of the index patient as well as the duration and circumstances of the exposure, and the vulnerability/susceptibility of the contacts to progression from TB infection to development of TB disease (such as contacts under 5 years of age or with HIV infection, immunosuppression, underlying disease processes).

TABLE 2: TIME FRAMES FOR INVESTIGATING THE INDEX PATIENT AND THE SITES OF TRANSMISSION¹⁷

| Activity | Suspects Expected to Be Cases of Tuberculosis (TB) | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
| | Suspects with Indications of Infectiousness | Suspects Without Indications of Infectiousness |
| First Index Patient Interview Number of days following notification within which the index patient should be interviewed in person (i.e., not by telephone) | ≤1 Business Day of Reporting | ≤3 Business Days of Reporting |
| Residence Visit Number of days following the first index patient interview within which the place of residence of the index patient should be visited | ≤3 Business Days After First Interview | 3 Business Days After First Interview |
| Field Investigation Number of days following initiation of the contact investigation within which all potential settings for transmission should be visited | 5 Business Days After the Start of the Investigation | 5 Business Days After the Start of the Investigation |
| Index Patient Reinterviews Length of time after the first interview within which the index patient should be reinterviewed one or more times for clarification and additional information | 1 or 2 Weeks After First Interview | 1 or 2 Weeks After First Interview |
| Reassessment of Index Patient Information about the index patient should be reassessed at least weekly until drug-susceptibility results are available for the <i>Mycobacterium tuberculosis</i> isolate or for 2 months following notification, whichever is longer. | | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7–8.

Contact Evaluation and Treatment

In addition to the investigation of the index patient and transmission sites, a contact investigation also involves contact follow-up. Refer to Table 3: Time Frames for Contact Evaluation and Treatment to monitor the progress of the investigation and determine whether additional resources are needed for finding, evaluating, and treating the high- and medium-priority contacts.




Priority-ranking contacts for investigation are based upon the likelihood of infection and the potential hazard to the individual contact if infected.¹⁸ For information on how to determine which contacts are high-, medium-, or low-priority, see the [Tuberculosis Contact Investigation Form](#), and [Tuberculosis Contact Investigation Form Instructions](#).



CDC recommends that IGRA testing may be used in all circumstances in which the tuberculin skin test (TST) is currently used, including contact investigation.¹⁹

TABLE 3: TIME FRAMES FOR CONTACT EVALUATION AND TREATMENT²⁰

| Type of Contact | Business Days from Listing of a Contact to Initial Encounter* | Business Days from Initial Encounter to Completion of Medical Evaluation† | Business Days from Completion of Medical Evaluation to Start of Treatment |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| High-Priority Contact Index patient with positive acid-fast bacilli (AFB) sputum smear results or cavitary disease on chest radiograph | 3 Business Days After Being Listed in the Investigation²¹ | 5 Business Days | 10 Business Days |
| | | 5 Business Days  Children and high-risk contacts can develop complicated tuberculosis (TB) within a few weeks of infection. | |
| High-Priority Contact Index patient with negative AFB sputum smear results | 3 Business Days After Being Listed in the Investigation²² | 10 Business Days | 10 Business Days |
| Medium-Priority Contact Regardless of AFB sputum smear or culture result | 3 Business Days After Being Listed in the Investigation²³ | 10 Business Days | 10 Business Days |
| <p>* “Encounter” means a face-to-face meeting, which gives the public health worker a chance to determine whether the contact is generally healthy or ill. The initial encounter also provides opportunities to administer a tuberculin skin test (TST) and to schedule further evaluation.</p> <p>† The medical evaluation is complete when the contact’s status relative to <i>Mycobacterium tuberculosis</i> infection or TB disease has been determined. A normal exception to this schedule is the delay in waiting for final mycobacteriology results, but this applies to relatively few contacts.</p> | | | |

Source: Adapted from CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):9.

Ongoing Management Activities

Ongoing contact follow-up includes testing, medical evaluation, and treatment. Information from contact follow-up guides decisions about whether to expand a contact investigation. Refer to Table 4: Overview of Ongoing Management Activities and Maximum Time Frames to monitor the progress of ongoing contact follow-up and to determine if/when to expand the investigation.

TABLE 4: OVERVIEW OF ONGOING MANAGEMENT ACTIVITIES AND MAXIMUM TIME FRAMES²⁴

| Activity | Purpose | Maximum Time Interval |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Review all documentation | To ensure that contact list is complete | Ongoing |
| Review and assess completeness of each contact's medical follow-up and treatment plan | To ensure appropriate and complete medical follow-up | 5 business days after each contact's medical evaluation is completed* |
| Review and assess the timeliness of initiating the treatment plan | To avoid delays in treatment initiation, particularly in high-risk contacts | 10 business days after each contact's medical evaluation is completed* |
| Determine if transmission occurred | To decide whether to expand investigation | At completion of follow-up testing, or if secondary cases are identified |
| Obtain and review drug-susceptibility results | To determine if contacts are receiving appropriate treatment for latent tuberculosis infection (LTBI) | 1 to 2 months after the index patient's initial sputum collection date |
| Repeat tuberculin skin test (TST) or IGRA if contact is initially TST or IGRA -negative | To determine if contact has converted (TB Class I to TB Class II) | 8 to 10 weeks after each contact's initial TST or IGRA or last exposure to the index patient† |
| Reevaluate contacts who were initially TST- or IGRA negative and started on LTBI treatment (Window Period Treatment for a TB Class I Contact) | To determine if treatment for LTBI should be continued | 8 to 10 weeks after each contact's initial TST or IGRA or last exposure to the index patient before the end of the infectious period† |
| Assess contacts' adherence with medical follow-up and TB medication | To remove barriers and ensure timely and complete evaluation and follow-up | Monthly, at time of each visit |
| Ensure contacts are monitored for adverse reactions and toxicity of LTBI treatment regimens | To prevent development of adverse effects and toxicity from drug regimens | At least monthly while on LTBI treatment |

| Activity | Purpose | Maximum Time Interval |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Evaluate problems and concerns that arise and may delay or hamper contact investigation | To remove barriers and ensure timely and complete evaluation and follow-up | Whenever problems are identified |
| Collect and analyze data to evaluate the contact investigation and complete the "TB Contact Investigation Summary" form for the WA State TB Services | To provide epidemiologic analysis of investigations and to measure performance using indicators that reflect performance objectives ²⁵ | Ongoing |
| <p>* The medical evaluation is complete when the contact's status relative to <i>Mycobacterium tuberculosis</i> infection or TB disease has been determined. A normal exception to this schedule is the delay in waiting for final mycobacteriology results, but this applies to relatively few contacts.</p> <p>† Third TST/IGRA: In rare circumstances, an infectious index patient with advanced disease can stay infectious for several months. In these circumstances, the second TST/IGRA for negative contacts should be performed in the usual time frame (8 to 10 weeks). This will identify any contacts who have already converted so they can be evaluated for treatment. However, any household members who remain TST/IGRA negative and have continued exposure to the infectious index patient should have a third TST/IGRA 8 to 10 weeks after the index patient becomes noninfectious. This is especially true for contacts who are infants in a household where a resident is culture positive after 3 months or has multidrug-resistant TB. For example, a household member with continued exposure to an infectious index patient had a negative second TST/IGRA on 3/12/2007. The last date the index patient was infectious was 3/5/2007. The household member should have a third TST/IGRA 8 to 10 weeks from 3/5/2007</p> | | |

Source: Adapted from: California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). Contact investigation guidelines. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. November 12, 1998:18. Available at: http://www.ctca.org/fileLibrary/file_46.pdf

Infectious Period

Determine the infectious period to focus the investigation on those contacts most likely to be at risk for infection and to set the time frame for testing contacts.

The infectious period is the time frame in which potential exposure to others may have occurred while the patient was infectious or able to transmit tuberculosis (TB).²⁶ The exact start of the infectious period cannot be determined with any current methods, so a practical estimation is necessary. From expert opinion, an assigned start **3 months prior to TB diagnosis or onset of symptoms** is recommended for the more infectious patients. Some circumstances may indicate an even earlier start which should be used instead. The clearest example is when the patient or the patient's associates were aware of protracted illness, which can exceed one year in extreme examples.

Assemble information from the index patient interview and other sources to estimate the infectious period. Helpful details include the approximate dates that TB symptoms were noticed, bacteriology results, and the extent of disease, especially the presence of large lung cavities, which implies prolonged illness as well as increased infectiousness.

Use Table 5 to determine the start of the infectious period.

TABLE 5: GUIDE FOR ESTIMATING THE BEGINNING OF THE PERIOD OF INFECTIOUSNESS²⁷

| Index Patient Characteristics | | | | | | Recommended Beginning of Likely Period of Infectiousness |
|-------------------------------|----|-------------------------------------------------|----|---------------------------|----|---------------------------------------------------------------------------------------------------------------------------|
| Tuberculosis Symptoms | | Positive Acid-Fast Bacilli Sputum Smear Results | | Cavitary Chest Radiograph | | |
| Yes | No | Yes | No | Yes | No | |
| ✓ | | | ✓ | | ✓ | 3 months prior to symptom onset or first positive finding consistent with tuberculosis (TB) disease (whichever is longer) |
| ✓ | | ✓ | | ✓ | | 3 months prior to symptom onset or first positive finding consistent with TB disease (whichever is longer) |
| | ✓ | | ✓ | | ✓ | 4 weeks prior to date of suspected diagnosis |
| | ✓ | ✓ | | ✓ | | 3 months prior to first positive finding consistent with TB |

Source: California Department of Health Services Tuberculosis Control Branch; California Tuberculosis Controllers Association. Contact investigation guidelines. Berkeley, CA: California Department of Health Services; 1998; in CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7.

For purposes of contact investigation, the end of potential exposure to the infectious case determines the end of the infectious period. The potential for transmission is reduced by the initiation and duration of treatment, the index patient's response to treatment, and/or the application of effective infection control measures.

In general, **for the purposes of contact investigation**, the infectious period is closed when contacts are no longer exposed to the patient **OR** when **all three** of the following criteria are met:

1. The index patient is receiving effective treatment (as demonstrated by *Mycobacterium tuberculosis* susceptibility results) for at least two weeks.
2. The index patient has diminished symptoms.
3. The index patient exhibits mycobacteriologic response (e.g., decrease in grade of sputum smear positivity detected on sputum-smear microscopy).^{28,29}

Take careful note of the following exceptions:

- **Multidrug-resistant TB (MDR-TB):** MDR-TB can extend infectiousness if the treatment regimen is ineffective.
- **Signs of infectiousness:** Any index patient with signs of extended infectiousness should be continually reassessed for recent contacts.
- **Susceptible contacts:** Apply more stringent criteria for setting the end of the infectious period if particularly susceptible contacts are involved. (HIV infection, child under 5 years of age, immunosuppression, underlying disease processes)



A patient with pulmonary or laryngeal TB returning to a congregate living setting or to any setting in which susceptible persons might be exposed should meet **both** of the following two criteria for noninfectiousness:

1. Have had three consecutive AFB-negative sputum smear results from specimens collected 8 to 24 hours apart, with at least one being an early morning specimen, and
2. Have been on antituberculosis therapy for at least 2 weeks

Index Patient Interviews

Conduct index patient interviews to set the direction for the contact investigation, identify contacts, provide opportunities for the patient to learn about tuberculosis (TB) and its control, and help the public health worker learn how to provide treatment and care specific to that patient.

In index patient interviews, gather information about the index patient's medical history, treatment needs, residence, transmission sites, dates and times at specific transmission sites, and contacts at specific sites. Use the information from these interviews to decide whether to start a contact investigation, establish its priority relative to other investigations, and determine the scope of the investigation.

There should be an initial interview and one or two reinterviews before discharge from the hospital, or within one to two weeks if the initial interview occurs in the home, to obtain further information and answer additional questions.³⁰



TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker (New Jersey Medical School Global Tuberculosis Institute Web site; 2004) at <http://www.umdnj.edu/ntbcweb/products/tbinterviewing.htm> offers specific suggestions on how to prepare for and conduct the interviews.³¹



Record information regarding the index patient and contacts on the [Contact Investigation Form](#) (FORMS).

Preinterview Preparation

Gather information regarding the patient and the circumstances of the illness to prepare for the first interview.

Consult these sources:

- Current medical record
- Physician
- Laboratory, clinic or other reporting source
- Infection control nurse (if the patient is hospitalized)

General Guidelines for Interviewing an Index Patient

1. Discuss confidentiality and privacy in frank terms to help the patient decide how to share information, and revisit these topics several times during the interview to stress their importance. Emphasize confidentiality, but inform the patient that relevant information may need to be shared with other local health jurisdiction staff or other persons who may assist in congregate settings to most efficiently determine which contacts need to be evaluated. Inform the patient that it will be necessary for visits to be made at sites such as the home, workplace/school, or leisure establishments to assess the shared air environment and accurately structure the contact investigation.³²
2. Conduct the interviews in the patient's language, using a medical interpreter if the patient does not speak English.
3. Conduct the interviews in a culturally competent manner.



For more information on cultural sensitivity, refer to the *Participant's Workbook* for Session 4: "Working with Culturally Diverse Populations" in the *Directly Observed Therapy Training Curriculum for TB Control Programs* (Curry International Tuberculosis Center Web site; 2003) at <http://www.currytbcenter.ucsf.edu/catalogue/epub/index.cfm?tableName=DOTE>



For assistance with language issues, see the *Language Services Resource Guide for Health Care Providers* (The National Health Law Program Web site; 2006) at <http://www.healthlaw.org/images/pubs/ResourceGuideFinal.pdf>

Field Investigation

A field investigation includes visiting the patient's home or shelter, workplace or school (if any), and the other places where the patient said he or she spent time while infectious. The field investigation is important and should be done even if the patient interview has already been conducted. The purpose of the field investigation is to identify contacts and evaluate the environmental characteristics of the place or places in which exposure may have occurred. The field investigation may provide additional information for use in the risk assessment and for identifying additional contacts.³³

During field visits, the healthcare worker should do the following:

- **Observe environmental characteristics**, such as room size, crowding, and ventilation, to estimate the risk of tuberculosis (TB) transmission. Air volume, exhaust rate, and circulation assist in predicting the likelihood of transmission in an enclosed space. In large indoor settings, the degree of proximity between contacts and the index patient can influence the likelihood of transmission. The most practical system for grading exposure settings is to categorize them by size (e.g., “1” being the size of a vehicle or car, “2” the size of a bedroom, “3” the size of a house, and “4” a size larger than a house). The volume of air shared between an infectious TB patient and contacts dilutes the infectious particles. Local circulation and overall room ventilation also dilute infectious particles, but both factors have to be considered because they can redirect exposure into spaces that were not visited by the index patient.³⁴
- **Identify additional contacts** (especially children) and their locating information, such as phone numbers and addresses.
- **Look for evidence of other contacts** who may not be present at the time of the visit (for example, pictures of others who may live in or visit the house, shoes of others who may live in the house, or toys left by children).
- **Interview and apply skin tests (TST's) or draw blood for IGRA testing on high- and medium-priority contacts** who are present and arrange for reading of the Tuberculin Skin Test (TST) results.
- **Educate the contacts** about the purpose of the contact investigation, the basics of transmission, the risk of transmitting *Mycobacterium tuberculosis* to others, and the importance of testing, treatment, and follow-up for TB infection and disease.
- **Refer contacts who have TB symptoms** to the local health jurisdiction or a community based healthcare provider for a medical evaluation, including radiography and sputum collection.³⁵

Healthcare workers should remember to follow infection control precautions while visiting a potentially infectious TB patient at home or in any other location. These precautions may include wearing a personal respirator.³⁶



For more information on infection control, “Guidelines for Isolation Precaution” at <http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html> and “Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis” at <http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf>

Another critical consideration during field investigations is safety. Healthcare workers should become familiar with policies and recommendations of local law enforcement agencies and local health jurisdiction administration policies regarding personal safety. Current information regarding local high-risk areas for crime can be very valuable in planning and conducting safe field visits.

General safety precautions that are recommended for the healthcare worker include the following:

- Wearing an identification badge with a current photo
- Working in pairs when visiting a potentially dangerous area
- Informing your supervisor or other coworkers of your itinerary and expected time of return, especially if you anticipate problems³⁷

Contact Priorities

Assign priorities to contacts, using the registry of contacts compiled from the index patient interviews, site visits, interviews with contacts, and information from other persons involved in the investigation. The Centers for Disease Control and Prevention (CDC) defines the three levels of contact priorities as follows:

- High-priority contacts
- Medium-priority contacts
- Low-priority contacts

Contact priorities are determined by the likelihood of infection and the potential hazards to the individual contact if infected.³⁸ Priority-ranking contacts for investigation is based upon the characteristics of the index patient, the duration and circumstances of the exposure, and the vulnerability/susceptibility of the contacts to disease from *Mycobacterium tuberculosis* infection.³⁹

Use the assigned priorities to allocate resources to complete all investigative steps for the high- and medium-priority contacts.⁴⁰ Dividing contacts into these three levels provides a system for public health staff to reach high-priority contacts first, then medium- and low-priority contacts. The priority scheme directs resources to the following essential actions:

1. Find contacts who are secondary active tuberculosis (TB) cases.
2. Find contacts who have recently acquired *M. tuberculosis* infection—the most likely to benefit from treatment.
3. Select contacts who are most likely to progress to TB disease if they are infected (i.e., susceptible contacts) or who could suffer severe morbidity if they develop TB disease (i.e., vulnerable contacts).⁴¹ (These include contacts under 5 years of age or with HIV infection, immunosuppression, underlying disease processes.)



For more information see the CDC's "Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis" at <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf>

Index Patient with Positive Acid-Fast Bacilli Sputum Smear Results or Cavitary Tuberculosis

Use Table 6 to prioritize contacts to index cases with sputum smear-positive or cavitary disease.

TABLE 6: PRIORITIZATION OF CONTACTS TO SMEAR-POSITIVE OR CAVITARY CASES⁴²

| High-Priority Contacts | Medium-Priority Contacts | Low-Priority Contacts |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> Household contacts Contacts <5 years old Contacts with human immunodeficiency virus (HIV) infection or other immunocompromising condition Contacts with exposure during a medical procedure such as bronchoscopy, sputum induction, or autopsy Contacts with exposure in a congregate setting Contacts whose exposure occurs in poorly ventilated areas and for significant periods of time* | <ul style="list-style-type: none"> Contacts not in high-priority groups Contacts 5–15 years old Contacts whose exposure occurs in poorly ventilated areas and for significant periods of time* | <ul style="list-style-type: none"> Contacts not in high-priority groups Contacts not in medium-priority groups |
| <p>* Observe environmental characteristics, such as room size, crowding, and ventilation, to estimate the risk of tuberculosis (TB) transmission: air volume, exhaust rate, and circulation predict the likelihood of transmission in an enclosed space. In large indoor settings, the degree of proximity between contacts and the index patient can influence the likelihood of transmission. The most practical system for grading exposure settings is to categorize them by size (e.g., “1” being the size of a vehicle or car, “2” the size of a bedroom, “3” the size of a house, and “4” a size larger than a house). The volume of air shared between an infectious TB patient and contacts dilutes the infectious particles. Local circulation and overall room ventilation also dilute infectious particles, but both factors have to be considered because they can redirect exposure into spaces that were not visited by the index patient.⁴³</p> | | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):12.

Index Patient with Negative Acid-Fast Bacilli Sputum Smear Results

Use Table 7 to prioritize contacts to index cases with sputum smear-negative results

TABLE 7: PRIORITIZATION OF CONTACTS TO SMEAR-NEGATIVE CASES⁴⁴

| High-Priority Contacts | Medium-Priority Contacts | Low-Priority Contacts |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Contacts <5 years old • Contacts with human immunodeficiency virus (HIV) infection or other immunocompromising conditions • Contacts exposed during a medical procedure, such as bronchoscopy, sputum induction, or autopsy | <ul style="list-style-type: none"> • Contacts not in high-priority groups • Household contacts • Contacts exposed in a congregate setting • Contacts whose exposure occurs in poorly ventilated areas and for significant periods of time* | <ul style="list-style-type: none"> • Contacts not in high-priority groups • Contacts not in medium-priority groups |
| <p>* Observe environmental characteristics, such as room size, crowding, and ventilation, to estimate the risk of tuberculosis (TB) transmission: air volume, exhaust rate, and circulation predict the likelihood of transmission in an enclosed space. In large indoor settings, the degree of proximity between contacts and the index patient can influence the likelihood of transmission. The most practical system for grading exposure settings is to categorize them by size (e.g., “1” being the size of a vehicle or car, “2” the size of a bedroom, “3” the size of a house, and “4” a size larger than a house). The volume of air shared between an infectious TB patient and contacts dilutes the infectious particles. Local circulation and overall room ventilation also dilute infectious particles, but both factors have to be considered because they can redirect exposure into spaces that were not visited by the index patient.⁴⁵</p> | | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):13.

Index Patient with Negative Bacteriologic Results and Abnormal Chest Radiographs Not Consistent with Tuberculosis

Use Table 8 to prioritize contacts to a suspected case of pulmonary TB who is acid-fast bacilli (AFB) sputum smear negative, nucleic acid amplification (NAA) negative, and culture negative, and who has abnormal chest radiographs not consistent with TB disease.

TABLE 8: PRIORITIZATION OF CONTACTS TO CASES WITH NEGATIVE BACTERIOLOGIC RESULTS AND ABNORMAL CHEST RADIOGRAPHS NOT CONSISTENT WITH TUBERCULOSIS⁴⁶

| High-Priority Contacts | Medium-Priority Contacts | Low-Priority Contacts |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| | <ul style="list-style-type: none"> Household contacts Contacts <5 years old Contacts with human immunodeficiency virus (HIV) infection or other medical risk factor Contacts exposed during a medical procedure, such as bronchoscopy, sputum induction, or autopsy | <ul style="list-style-type: none"> Contacts not in medium-priority groups |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):14.

Contact Evaluation, Treatment, and Follow-up

Complete evaluation, treatment, and follow-up for high- and medium-priority contacts, as specified in your contact investigation plan. The Centers for Disease Control and Prevention (CDC) recommends the following:

- Provide each high- and medium-priority contact an initial assessment that includes a face-to-face encounter in which an impression of each contact's general health is formed and a tuberculin skin test (TST) is administered or blood is drawn for interferon gamma release assay (IGRA).
- Medically evaluate each high- and medium-priority contact to determine whether tuberculosis (TB) disease or latent tuberculosis infection (LTBI) are present or absent.
- Timely initiation of treatment is especially important for high-priority contacts and for contacts likely to progress to TB disease if they are infected (i.e., susceptible contacts) or contacts who could suffer severe morbidity if they had TB disease (i.e., vulnerable contacts, including those under 5 years of age or with HIV infection, immunosuppression, or underlying disease processes).
- Use the same diagnostic methods for all contacts, except when they have medical or constitutional conditions making TB more likely or more difficult to diagnose. A contact's country of origin and bacille Calmette-Guérin (BCG) vaccination (*See note below*) are not included in algorithms for diagnosis or treatment. Interpret a positive TST in a foreign-born or BCG-vaccinated person as evidence of recent *Mycobacterium tuberculosis* infection in contacts of persons with infectious cases. Evaluate these contacts for TB disease and offer them a course of treatment for LTBI.⁴⁷



IGRA testing results are not affected by BCG vaccination, so its use is especially encouraged when tuberculin skin test (TST) results may be in question.

Forms



- [Contact Investigation Form](#)
- [Form Instructions](#)

Immunocompromised Contacts and Children under 5

Use Table 9 to select evaluation, treatment, and follow-up activities for contacts who are immunocompromised and/or under 5 years old.

Evaluate contacts who are immunocompromised or under 5 years of age with medical history, physical examination, chest radiograph, and tuberculin skin test (TST) or IGRA. Based upon the results of these evaluations, follow the action steps outlined in Table 9.

TABLE 9: EVALUATION, TREATMENT, AND FOLLOW-UP OF IMMUNOCOMPROMISED CONTACTS AND CHILDREN UNDER 5 YEARS OLD⁴⁸

| If evaluation or test results show that a contact has | | Then take this action or these actions |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symptoms consistent with TB disease and/or Abnormal chest radiograph | | Fully evaluate for TB disease |
| No symptoms consistent with TB disease and normal chest radiographs | 1st TST* ≥ 5 mm or IGRA positive | Complete a full course of treatment for LTBI |
| | 1st TST < 5 mm or IGRA negative and ≥ 8 weeks since last exposure | <ul style="list-style-type: none"> • If not HIV-infected, no further evaluation required • If HIV-infected, no further evaluation required; consider a full course of treatment for LTBI |
| | 1st TST < 5 mm or IGRA negative and < 8 weeks since last exposure | Begin treatment for LTBI and retest 8–10 weeks post exposure |
| | 2nd TST ≥ 5 mm or IGRA positive | Complete a full course of treatment for LTBI |
| | 2nd TST < 5 mm or IGRA negative | <ul style="list-style-type: none"> • If not HIV-infected, no further evaluation required • If HIV-infected, no further evaluation required; consider a full course of treatment for LTBI |
| Definitions of abbreviations: HIV = human immunodeficiency virus; IGRA=Interferon Gamma Release Assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test. * Note: An IGRA test may be used in place of a TST. | | |

*Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):15–16.

Immunocompetent Adults and Children 5 and Older (High- and Medium-Priority Contacts)

Use Table 10 to select evaluation, treatment, and follow-up activities for high- and medium-priority contacts who are immunocompetent and/or 5 years of age or older. Evaluate these contacts with medical history, exposure history, and TST or IGRA. Based upon the results of these evaluations, follow the action steps outlined in Table 10.

TABLE 10: EVALUATION, TREATMENT, AND FOLLOW-UP OF IMMUNOCOMPETENT ADULTS AND CHILDREN 5 YEARS AND OLDER (HIGH-AND MEDIUM-PRIORITY CONTACTS)⁴⁹

| If evaluation or test results show that a contact has | | Then take this action or these actions |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symptoms consistent with TB disease | | Fully evaluate for TB disease |
| No symptoms consistent with TB disease | 1st TST* ≥ 5 mm or IGRA negative | Evaluate with a physical examination and CXR: <ul style="list-style-type: none"> • If CXR abnormal, fully evaluate for TB disease • If CXR normal, complete a full course of treatment for LTBI |
| No symptoms consistent with TB disease | 1st TST < 5 mm or IGRA negative and ≥ 8 –10 weeks since last exposure | No further evaluation or treatment required |
| No symptoms consistent with TB disease | 1st TST < 5 mm or IGRA negative and < 8 weeks since last exposure | Retest 8–10 weeks post exposure |
| No symptoms consistent with TB disease | 2nd TST ≥ 5 mm or IGRA positive | Evaluate with a physical examination and CXR: <ul style="list-style-type: none"> • If CXR abnormal, fully evaluate for TB disease • If CXR normal, complete a full course of treatment for LTBI |
| No symptoms consistent with TB disease | 2nd TST < 5 mm or IGRA negative | No further evaluation or treatment required |
| Definitions of abbreviations: CXR = chest radiograph; IGRA=Interferon Gamma Release Assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test. * Note: An IGRA test may be used in place of a TST. | | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):17.

Contacts with Prior Positive Tuberculin Skin Tests

Use Table 11 to select evaluation, treatment, and follow-up activities for contacts who have prior positive TSTs or IGRAs. Evaluate contacts with medical and exposure history. Based upon the results of these evaluations, follow the action steps outlined in Table 11.

TABLE 11: EVALUATION, TREATMENT, AND FOLLOW-UP OF CONTACTS WITH PRIOR POSITIVE TUBERCULIN SKIN TESTS⁵⁰

| If evaluation or test results show that a contact has | | Then take this action or these actions |
|----------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symptoms consistent with TB disease | | Fully evaluate for TB disease |
| No symptoms consistent with TB disease | Immunocompromised or ≤5 years old | Evaluate with a physical examination and CXR: <ul style="list-style-type: none"> • If CXR or physical examination is indicative of TB disease, fully evaluate for TB disease • If results are not indicative of TB disease: <ul style="list-style-type: none"> • If contact previously completed treatment, consider retreatment • If treatment not completed previously, complete a full course of LTBI treatment |
| No symptoms consistent with TB disease | Immunocompetent and ≥5 years old | <ul style="list-style-type: none"> • If contact previously completed treatment for LTBI, no further evaluation or treatment required • If contact has not completed treatment for LTBI, consider treatment for LTBI |
| Definitions of abbreviations: CXR = chest radiograph; LTBI = latent tuberculosis infection; TB = tuberculosis. | | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):19.

When to Expand a Contact Investigation

Guidelines for Expanding an Investigation

Determine when to expand a contact investigation using the following guidelines:

1. Do not include lower-priority contacts unless objectives for high- and medium-priority contacts are being met.
2. Consider the extent of recent transmission.
3. Consider expanding the scope (e.g., number of contacts) of an investigation if any one or more of the following criteria are met:
 - a. Unexpectedly large rate of tuberculosis (TB) infection or disease in high-priority contacts, which is defined as 10% or at least twice the rate of a similar population without recent exposure, whichever is greater



Since the background prevalence of tuberculosis infection in adult foreign-born populations from high-incidence countries often exceeds 30%, it is important to stratify the infection rates by country of birth and/or length of residence and by age. For example, in a community with a population comprised of large numbers of individuals born outside of the United States, the infection rate may exceed 30% in a contact investigation. In this case, separate U.S.-born individuals from foreign-born and determine the infection rate using the U.S.-born results.

- b. Evidence of second-generation transmission (i.e., from TB patients who were infected after exposure to the source patient)
 - c. TB disease in any contacts who had been assigned low priority
 - d. Infection in any contacts younger than 5 years old
 - e. Contacts with a change in TST or IGRA status from negative to positive
4. When results from an investigation indicate that it should be expanded, but resources are insufficient, seek assistance from the next higher public health administrative level.

In general, without evidence of recent transmission, do not expand an investigation to lower-priority contacts. When program evaluation objectives have not been met, expand a contact investigation only in exceptional circumstances, generally involving highly infectious cases with high rates of infection among contacts or evidence for secondary cases and secondary transmission. Derive the strategy for expanding an investigation from the data obtained from the investigation to that point in time. Without data from the initial contact investigation to support evidence of transmission, there is little support to expand to lower-priority contacts. As in the initial investigation, review the incoming results of the expanded investigation at least weekly to reassess the strategy.

Low-Priority Contacts

Use Table 12 to select evaluation, treatment, and follow-up activities for low-priority contacts. Evaluate these contacts with medical and exposure history. Based upon the results of these evaluations, follow the action steps outlined in Table 12.

TABLE 12: EVALUATION, TREATMENT, AND FOLLOW-UP OF LOW-PRIORITY CONTACTS⁵¹

| If evaluation or test results show that a contact has | | Then take this action or these actions: |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symptoms consistent with TB disease | | Fully evaluate for TB disease |
| No symptoms consistent with TB disease | 8–10 weeks since last exposure | Evaluate with a TST or IGRA test |
| No symptoms consistent with TB disease | <8 weeks since last exposure | Wait 8–10 weeks after last exposure, and then evaluate with a TST or IGRA test |
| No symptoms consistent with TB disease | 1st TST* ≥5 mm or IGRA positive | Evaluate with physical examination and CXR: <ul style="list-style-type: none"> • If CXR is abnormal, fully evaluate for TB disease • If CXR is normal, consider treatment for LTBI |
| No symptoms consistent with TB disease | 1st TST <5 mm or IGRA negative | No further evaluation or treatment required |
| Definitions of abbreviations: CXR = chest radiograph; IGRA=Interferon Gamma Release Assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test. * Note: An IGRA may be used in place of a TST. | | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):22.

Data Management and Evaluation of Contact Investigations

Data collection related to contact investigation has three broad purposes:

1. Management of care and follow-up of individual index patients and contacts
2. Epidemiological analysis of an investigation in progress as well as overall results of previous investigations
3. Program evaluation via performance indicators that reflect performance objectives

Reasons Contact Investigation Data Are Needed

Comprehensive Care

For each index patient and the associated contacts, a broad amount of demographic, epidemiological, historical, and medical information is needed for providing comprehensive care. The care for these individuals can extend to longer than a year in some instances, so the information builds stepwise and has numerous longitudinal elements (e.g., clinic visits attended, treatment doses administered and bacteriological response to treatment).

Timeline Objectives

Many of these data elements also contribute to the other reasons for collecting data. Data on some process steps are necessary for monitoring whether the contact investigation is keeping to the timeline objectives (e.g., how soon after listing is the TST or IGRA test obtained on a contact).

Completion of Investigation

When aggregated, the data from an investigation provides timeliness measures of initiation of investigation and evaluation of contacts. The analysis of data also contributes to reassessments of the strategy used in the investigation (e.g., was the infection rate greater for contacts believed to have more exposure?).

Reassessment of Strategy

The data from a completed investigation and all investigations in a fixed period (e.g., six months) show achievements in meeting program objectives, such as observance of timelines and completion of therapy for infected contacts. These core measurements for program evaluation, however, cannot directly show why objectives were not met. If the data are structured and stored in formats allowing detailed retrospective review, barriers may be identified and interventions recommended for future practice.



To assess the overall activities of contact investigation, see CDC's "Framework of Program Evaluation in Public Health" (*MMWR* 1999;48[No. RR-11]), at <ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4811.pdf>.

Approach

Follow a systematic, consistent approach to data collection, organization, analysis, and dissemination.

1. Collect specific data elements on index patients and their contacts. The data elements should permit calculation of program performance indices.
2. Collect data on standardized (paper or electronic) forms.
3. Supply data definitions and formats for use by persons who collect, use, and interpret contact investigation data.
4. Whenever feasible, use data definitions and formats that are standard among jurisdictions.
5. Store data electronically for quick analysis of interim results.
6. Implement policies for data management that enable quick analysis of interim results.
7. Implement policies for data management and storage that specify the assignment of responsibilities.
8. Implement training and policies for data accuracy, completeness, and security.
9. Periodically summarize and review data during a particular contact investigation and for overall contact investigations.
10. Evaluate programs for contact investigation activities at least annually. Evaluation is an integral part of TB program responsibility.
11. Beyond standard data elements shown in these guidelines, collection and analysis of specific additional elements can contribute to local program management.

Index Patient and Contact Data

For data required on each index patient and contact, see Table 13 and Table 14.

TABLE 13: DATA ABOUT THE INDEX PATIENT⁵²

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identifiers/Demographic Information | <ul style="list-style-type: none"> • Case manager • Name and aliases • For minors and dependents: guardian information • Date of birth • Social security number • Current locating information and emergency contacts • Residences during infectious period if unstably housed • Sex • Race • Ethnicity • Country of birth • Time in United States, if foreign born • Primary language and preferred language • Methods of translation or interpretation |
| Transmission Settings and Associated Time Frames | <ul style="list-style-type: none"> • Living situation(s) • Employment or school • Social/recreational activities • Congregate settings (e.g., jail, homeless shelter) • Substance abuse with social implications (e.g., crack cocaine) |
| Tuberculosis Information | <ul style="list-style-type: none"> • Healthcare provider for TB (e.g., public health, private, both, other) • Anatomic site of disease • Symptoms and their dates • CXR results, presence of cavitary disease • Previous treatment with TB medications with start and stop dates and adherence • Bacteriologic results (sputum smear, culture, drug susceptibility) with dates • Previous history of TB disease and treatment • Infectious period (updated as new information arrives) • HIV infection status • HIV/AIDS registry number |
| Contact Investigation | <ul style="list-style-type: none"> • Date of initial interview with index patient • Dates of follow-up interviews with index patient |
| Definitions of abbreviations: AIDS = acquired immunodeficiency syndrome; CXR = chest radiograph; HIV = human immunodeficiency virus; RVCT = <i>Reports of Verified Cases of Tuberculosis</i> ; TB = tuberculosis. | |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.

TABLE 14: DATA ABOUT EACH CONTACT⁵³

| | |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigator and Dates | <ul style="list-style-type: none"> • Contact manager or investigator • Date listed • How or why contact was listed (e.g., named by index patient) • Dates of interviews • Start and end dates for exposure (updated as new information arrives) |
| Identifiers | <ul style="list-style-type: none"> • Name and aliases • For minors and dependents: guardian information • Social security number • Date of birth • Locating information and emergency contacts • Sex • Race • Ethnicity • Country of birth • Time in United States, if foreign born • Primary language and preferred language • Methods of translation or interpretation |
| Exposure | <ul style="list-style-type: none"> • Relationship/connection to index patient • Social affiliations (e.g., work, school, church, clubs, activities) • Environmental information about exposure settings (e.g., room size, ventilation) • Frequency, duration, and time frame of interactions |
| Medical History and Risk Factors | <ul style="list-style-type: none"> • Prior history of TB disease or LTBI, and documentation • BCG vaccination and date • Medical risk factors for progression of infection to TB disease[†] • Population risk factors for prevalent <i>M. tuberculosis</i> infection[†] |
| Evaluation for Tuberculosis Disease and Latent Tuberculosis Infection | <ul style="list-style-type: none"> • Healthcare provider for TB (e.g., public health, private, both, other) • Symptoms suggesting TB disease • TSTs, with dates, reagents and lot numbers, reaction measurement and/or IGRA results with dates and results • CXR results with dates • Bacteriologic results with dates • HIV infection status • Final diagnostic classifications for LTBI or TB disease |

| | |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Treatment Information for Contacts with Latent Tuberculosis Infection | <ul style="list-style-type: none"> • Dates of treatment • Treatment regimen (medications, dosing schedule, any changes to these) • Methods of supervising treatment (DOT, etc.) • Adverse reactions (specify each) • Interruptions in regimen and dates • Outcome of treatment (completion, etc.) • If treatment not completed, reason† |
| | <p>Definitions of abbreviations: BCG = Bacille Calmette-Guérin; CXR = chest radiograph; DOT = directly observed therapy; HIV = human immunodeficiency virus; IGRA=Interferon Gamma Release Assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test.</p> |

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.

Evaluation of a Contact Investigation

Summarize the results of a contact investigation to report by priority the total number of contacts who were identified, tested, started therapy, and completed therapy.



For more information regarding use of this evaluation framework, see the CDC Program Evaluation Workgroup's Web site at <http://www.cdc.gov/eval/framework.htm>.

Outbreak Investigation

If data from a contact investigation or surveillance indicate a potential outbreak, conduct an outbreak investigation. A tuberculosis (TB) outbreak warns of potential extensive transmission. An outbreak implies that (1) a TB patient was contagious, (2) contacts were exposed significantly, and (3) the interval since exposure has been sufficient for infection to progress to disease. An outbreak investigation involves several overlapping contact investigations, with a surge in the need for public health resources. More emphasis on active case finding is recommended, which sometimes means that more contacts than usual should have chest radiographs and specimen collection for mycobacteriology.

Definition of a Tuberculosis Outbreak

Definitions for a *TB outbreak* are relative to the local context. Outbreak cases can be distinguished from other cases only when certain associations in time, location, patient characteristics, or *Mycobacterium tuberculosis* attributes (e.g., drug resistance or genotype) become apparent. In low-incidence jurisdictions, any temporal cluster is suspicious for an outbreak. A working definition of a potential *TB outbreak* is helpful for planning and response, and may include any of the following six criteria (based on surveillance and epidemiology):

1. An increase in TB cases has occurred which is above the expected number of TB cases
2. During and because of a contact investigation, two or more contacts are identified as having TB disease, regardless of their assigned priority (i.e., high, medium, or low priority)
3. Any two or more cases occurring within one year of each other are discovered to be linked, and the linkage is established outside of a contact investigation (e.g., two patients who received a diagnosis of TB disease outside a contact investigation are found to work in the same office and only one or neither of the persons was listed as a contact to the other)
4. A genotype cluster leads to discovery of one or more verified transmission links that were missed during a contact investigation within the prior two years

Criteria based on program resources:

5. Transmission is continuing despite adequate control efforts by the TB control program
6. Contact investigation associated with increased cases requires additional outside help



View an example of a [Health Advisory](#).

Deoxyribonucleic Acid Genotyping (DNA)

Deoxyribonucleic acid (DNA) genotyping is a laboratory technique used by public health agencies to distinguish between different strains of *M. tuberculosis*. Characterization of *M. tuberculosis* with DNA genotyping is a powerful tool which is useful for the following activities;

1. Surveillance of potential outbreaks
2. Confirming TB cases linked by traditional epidemiologic methods
3. Identifying clusters of patients infected with genetically related or identical strains of *M. tuberculosis* and determining common sources of infection
4. Guiding contact investigations and the appropriate use of preventive therapy
5. Identifying laboratory cross-contamination as the cause of misdiagnosis

When used to track the transmission of a specific strain, DNA genotyping can help assess the effectiveness of TB control programs, a particularly useful methodology for use in areas with low TB incidence.

The use of genotyping results can confirm linkages between cases. An outbreak increases the urgency of investigations and will put greater demands on the local health jurisdiction.

Therefore, corroboration of a suspected linkage between cases by genotyping results is a valuable tool to use in the decision to intensify an investigation. An epidemiologic investigation is required for determining probable transmission linkages even if genotypes match.

Any secondary case that is unexpectedly linked to a known index patient represents a potential failure in the contact investigation; in such cases, reassess the original investigation to determine whether the strategy for finding contacts was optimal and whether the priorities were valid. If a secondary case occurred because treatment for a known contact with latent tuberculosis infection (LTBI) was not started or completed, review the strategies for treatment and completion.



For more information regarding Deoxyribonucleic Acid Genotyping, refer to National TB Controllers Association/CDC Advisory Group on Tuberculosis Genotyping. *Guide to the Application of Genotyping to Tuberculosis Prevention and Control*. Atlanta, GA: US Department of Health and Human Services, CDC; June 2004. Available at:

http://www.cdc.gov/tb/programs/genotyping/images/TBGenotypingGuide_June2004.pdf



For information on Restriction Fragment Length Polymorphism (RFLP) see:

http://www.cdc.gov/tb/programs/genotyping/Chap5/5_Developing_3c_RFLP.htm

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Resources

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