

Contact Investigation

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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

- 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 (younger than 5 years of age or immunocompromised); and
 - 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 Alaska guidelines to do 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 Alaska 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 to achieve the goal of reduction of TB morbidity and mortality is prompt identification of contacts of 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 in protecting 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 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.⁶ A study showed that improvements in contact investigations might have prevented 17 (10%) of 165 pediatric TB cases in California in 1994.⁷

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 pleural disease with either

- pulmonary cavities;
- respiratory specimens that have acid-fast bacilli (AFB) on microscopy; or
- especially both.⁸

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



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction **1.18**.

Program Standards

Contact and source case investigations

Public health nurses are responsible for doing contact and source case investigations. Contacts of tuberculosis cases and suspects should be investigated according to the protocol in this section. The public health nurse should begin this investigation as soon as possible after being notified of a suspected or confirmed case of tuberculosis disease.

A source-case investigation seeks the source of recent *M. tuberculosis* infection, perhaps newly diagnosed TB disease. Associates of children <5 years of age diagnosed with tuberculosis should be evaluated in an effort to identify the source of infection. In addition, source-case investigations may be done for children <2years of age who are diagnosed with LTBI.

Forms



For each investigation, complete the *Contact Investigation Form* in the Forms section (**18.1**). Also see the Required Reports from Local Public Health Agencies to the Alaska TB Program” topic in the Surveillance section **2.10**.

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

Reporting and recordkeeping requirements: Initial and final results of contact or source case investigations must be forwarded to the Alaska TB Program. Staff from the Alaska TB Program will work with public health nurses to assess the completeness of the contact investigation. The results of the follow-up skin tests should also be documented and forwarded to the Alaska TB Program. See Table 4: **Overview of Ongoing Management Activities and Maximum Time Frames (11.17)** for timelines.

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 for contacts
8. Decision about whether to expand testing
9. Evaluation of contact investigation activities^{9,10}

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.¹¹

Contact Investigation Plan

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



For more information on timelines, see Table 2: **Time Frames for Investigating the Index Patient and the Sites of Transmission (11.13)** and Table 3: **Time Frames for Contact Evaluation and Treatment (11.15)** in this section's topic "Time Frames for Contact Investigation."

The plan is a work in progress which is subject to revision if additional information indicates a need to expand a contact investigation. It is part of the permanent record of the overall investigation for later review and program evaluation.¹²

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, public health officials 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 on 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.¹³

Table 1. **INDEX PATIENT FACTORS INCREASING TRANSMISSION RISK**¹⁴

Characteristics of the Index Patient	Behaviors of the Index Patient
Pulmonary, laryngeal, or pleural tuberculosis (TB)	Frequent coughing
Positive acid-fast bacilli sputum smear results	Sneezing
Cavitation on chest radiograph	Singing
Adolescent or adult patient	Close social network
Lack of treatment or ineffective treatment of TB disease	

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 their infection. For contact investigations, 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.¹⁵ 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 of age 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 needs to be done 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.¹⁶ 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.¹⁷ Regardless of known HIV status, HIV counseling should always be recommended for all patients as a part of the screening process.¹⁸

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 sputa and by observing infection rates in household contacts. However, the exact rate of decrease cannot be predicted for individual patients, and an arbitrary determination is required for each.

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.



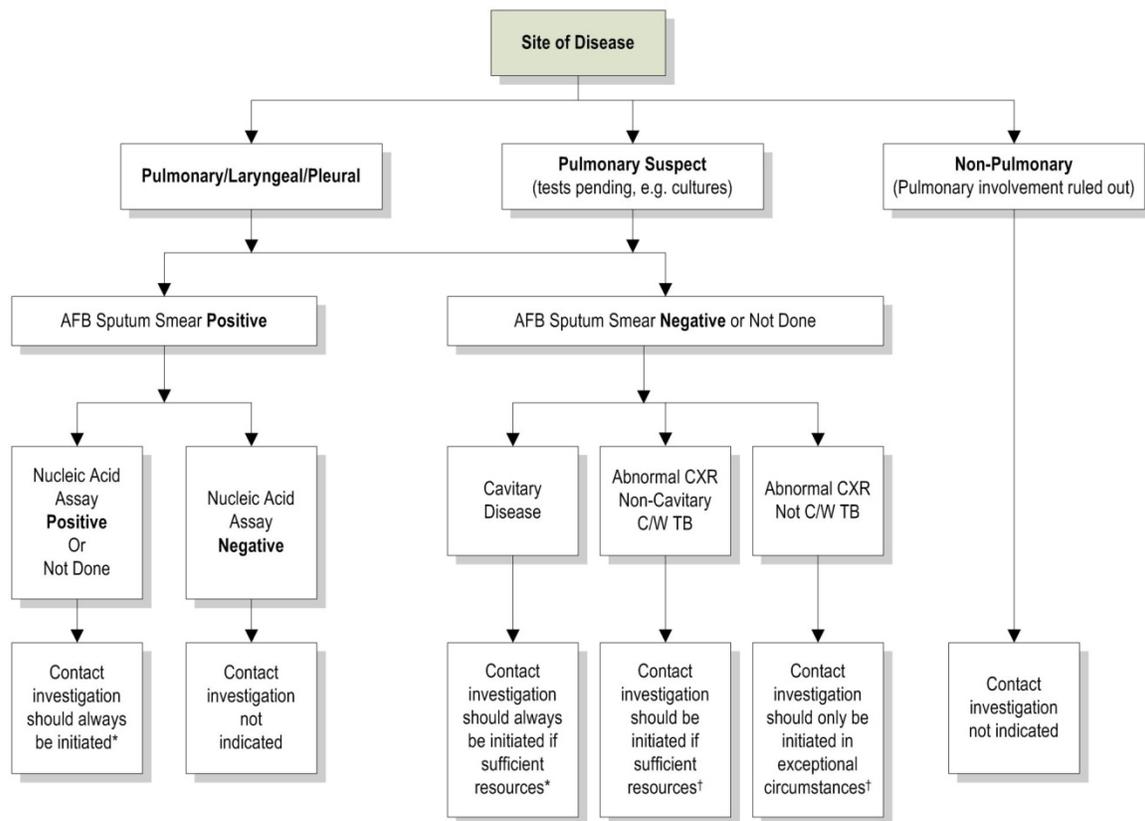
For more information on drug-resistant tuberculosis see the Treatment of Tuberculosis section **6.22**.

Resistance to only isoniazid (INH) leaves the option of four months of daily rifampin (RIF), but additional resistance to RIF constitutes multidrug-resistant TB (MDR-TB). If this is the case, all the potential regimens are poorly tolerated to some extent, while none of these regimens have been tested fully for efficacy

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 INVESTIGATION**¹⁹



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 TB suspect. Although sputum smear-positive pulmonary, laryngeal or pleural TB suspects may turn out to have nontuberculous mycobacteria (NTM) instead of *M. tuberculosis*, opportunities for appropriate contact investigation may be delayed, or even lost, if the PHN waits 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 “cavitory disease”.

For patients whose samples were reported smear or culture positive at other laboratories, providers and PHN case managers should collect and submit sputum specimens on TB suspects to the Alaska State Public Health Laboratory (ASPHL). Doing so facilitates more rapid completion of testing and provides an isolate to be sent for universal genotyping.

When sputum samples have not been collected, either because of an oversight or the patient's inability to expectorate, 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.

A contact investigation can 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.



For more information on outbreak investigations, see the “Outbreak Investigation” topic in this section **11.47**.

- **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. Source case investigations should always be done when children under the age of 5 are suspected or are diagnosed with TB. Source case investigations may also be done when children under the age of 2 are diagnosed with LTBI.



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 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, 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 (11.13)** for the recommended time frames for index patient interviews and visits to the residence transmission sites.



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 on the characteristics of the index patient as well as the duration and circumstances of the exposure, and the vulnerability/susceptibility of the contacts to disease from *Mycobacterium tuberculosis* infection (such as contacts < 5 years of age or HIV infection, immunosuppression or underlying disease processes).



For information on how to determine which contacts are high, medium, and low priority, see the “Contact Priorities” topic in this section **11.27**.

Table 2: **TIME FRAMES FOR INTERVIEWING THE INDEX PATIENT**²⁰

Activity	Suspects with Indications of Infectiousness	Suspects Without Indications of Infectiousness
<p>First Index Patient Interview Number of days following notification within which the index patient should be interviewed in person (i.e., not by telephone)</p>	<p>≤1 Business Day of Reporting</p>	<p>≤3 Business Days of Reporting</p>
<p>Residence Visit Number of days following the first index patient interview within which the place of residence of the index patient should be visited</p>	<p>≤3 Business Days After First Interview</p>	<p>3 Business Days After First Interview</p>
<p>Field Investigation Number of days following initiation of the contact investigation within which all potential settings for transmission should be visited</p>	<p>5 Business Days After the Start of the Investigation</p>	<p>5 Business Days After the Start of the Investigation</p>
<p>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</p>	<p>1 or 2 Weeks After First Interview</p>	<p>1 or 2 Weeks After First Interview</p>
<p>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.</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):7–8.



Circumstances unique to Alaska may prevent meeting the contact investigation timelines in CDC’s national standards. Interviews and contact investigation activities should be initiated as soon as possible for persons with suspected or confirmed TB disease.



When patients are hospitalized or reside outside of their home community at the time of diagnosis, consult the Alaska TB Program at 907-269-8000 regarding options for timely initiation of contact investigation.

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 is based on the likelihood of infection and the potential hazard to the individual contact if infected.²¹ For information on how to determine which contacts are high-, medium-, or low-priority, see the “Contact Priorities” topic in this section **11.27**.

Table 3: **TIME FRAMES FOR CONTACT EVALUATION AND TREATMENT**²²

Type of Contact	Business Days from Listing of a Contact to Initial Encounter*	Business Days from Initial Encounter to Completion of Medical Evaluation†
High-Priority Contact Index patient with positive acid-fast bacilli (AFB) sputum smear results or cavitory disease on chest radiograph	3 Business Days After Being Listed in the Investigation ²³	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 Investigation ²⁴	10 Business Days
Medium-Priority Contact Regardless of AFB sputum smear or culture result	3 Business Days After Being Listed in the Investigation ²⁵	10 Business Days
* “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. † 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.		

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.



Circumstances unique to Alaska may prevent meeting the contact investigation timelines in CDC’s national standards. Interviews and contact investigation activities should be initiated as soon as possible for persons with suspected or confirmed TB disease.



CDC recommendations include the use of interferon gamma release assays (IGRA) in all instances, including contact investigation, where tuberculin skin test (TST) would be used. For children under the age of 5 years, TST is the preferred method of screening.²⁶

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 when to decide whether to expand the investigation.

Table 4: **OVERVIEW OF ONGOING MANAGEMENT ACTIVITIES AND RECOMMENDED TIME FRAMES**²⁷

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*
Document all initial contact investigation activities and submit forms to the Alaska TB Program	To ensure that contacts documented, appropriate and complete medical follow-up has occurred, and high-risk contacts identified and treated	10 business days after index case reported to PHN case manager
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) if contact is initially TST-negative	To determine if contact has converted	8 to 10 weeks after each contact's initial TST or last exposure to the index patient†

Activity	Purpose	Maximum Time Interval
Reevaluate contacts who were initially TST-negative and started on LTBI treatment (Consider Window Period Treatment for select high priority contacts)	To determine if treatment for LTBI should be continued	8 to 10 weeks after each contact's initial TST or last exposure to the index patient before the end of the infectious period†
Document all repeat TSTs and follow-up and submit forms to the Alaska TB Program.	To ensure that contact list complete, appropriate and complete medical follow-up has occurred, and high-risk contacts identified and treated	Submit documentation of follow-up within 10 business days.
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
Identify/evaluate issues that 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	To provide epidemiologic analysis of investigations and to measure performance using indicators that reflect performance objectives ^{28,29}	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: In rare circumstances, an infectious index patient with advanced disease can stay infectious for several months. In these circumstances, the second TST 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 negative and have continued exposure to the infectious index patient should have a third TST 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 on 3/12/2007. The last date the index patient was infectious was 3/5/2007. The household member should have a third TST 8 to 10 weeks from 3/5/2007. For consultation regarding the appropriateness of a third TST, call the Alaska TB Control at 907-269-8000.</p>		

Source: Adapted from: California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). Guidelines for the Investigation of Contacts of Persons with infectious Tuberculosis. *CDHS/CTCA Joint Addenda* [CTCA Web site]. 2011. Available at: http://ctca.org/filelibrary/ctcaciguideines117_.pdf. Accessed January 9, 2017.

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).³⁰ The start of the infectious period cannot be determined with any current methods, so a practical estimation is necessary. From expert opinion, an assigned start three months prior to TB diagnosis 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 are the approximate dates that TB symptoms were noticed, bacteriology results, and the extent of disease—especially the presence of large lung cavities, which imply prolonged illness as well as infectiousness.

Use Table 5: **Guide for Estimating the Beginning of the Period of Infectiousness** to determine the start of the infectious period.

Table 5: **GUIDE FOR ESTIMATING THE BEGINNING OF THE PERIOD OF INFECTIOUSNESS**³¹

Characteristics			
TB symptoms	AFB* sputum smear positive	Cavity chest radiograph	Recommended minimum beginning of likely period of infectiousness
Yes	No	No	3 months before symptoms onset or first positive finding (e.g., abnormal chest radiograph) consistent with TB disease, whichever is longer
Yes	Yes	Yes	3 months before symptoms onset or first positive finding consistent with TB disease, whichever is longer
No	No	No	4 weeks before date of suspected diagnosis
No	Yes	Yes	3 months before 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 the 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 exposure to contacts has ended **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 has three (3) sputum-smears that are (-) for acid fast bacilli.^{32,33}

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).



Please consult the Alaska TB Program at 907-269-8000 when clearing patients for travel or return to group settings.

- Generally, a patient may be cleared to travel on a commercial conveyance, return to a congregate living setting or to any setting in which susceptible persons might be exposed **all three** of the following criteria for noninfectiousness have been met:³⁴
 1. Has been on antituberculosis therapy for at least two weeks;
 2. Exhibits clinical improvement; and
 3. Has at least three consecutive negative AFB sputum smear results from sputum collected more than eight hours apart (with one specimen collected during the early morning).

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 specific care for the 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 is at home, to obtain further information and answer additional questions.³⁵



TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker (Rutgers Global Tuberculosis Institute; 2015) at <http://globaltb.njms.rutgers.edu/downloads/tbinterviewing.pdf> offers specific suggestions on how to prepare for and conduct the interviews.³⁶



Record information on the index patient and contacts on *Contact Investigation Form* available in the Forms section of this manual **18.1**.

Preinterview Preparation

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

Consult these sources:

- Current medical record
- Physician who reported the case
- Infection control nurse (if the patient is hospitalized)

The Privacy Rule in the Health Insurance Portability and Accountability Act (HIPAA) permits disclosure of medical record information to public health authorities.³⁷

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 health department staff or other persons who may assist in congregate settings to most efficiently ascertain 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 to accurately structure the contact investigation.³⁸
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; 2003) at:
<http://www.currytbcenter.ucsf.edu/node/165>



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/component/jfsfsubmit/showAttachment?tmpl=raw&id=00Pd00000077hZVEAY>

Field Investigation

A field investigation includes visiting the patient's home or shelter, workplace (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 in which exposure occurred. The field investigation may provide additional information for the risk assessment and identify additional contacts.³⁹

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 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.⁴⁰
- **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, screen and skin test high- and medium-priority contacts** who are present and arrange for reading of the results.
- **For contacts who are (+) TST**, symptom screening and collection of 3 sputa are advised.
- **Educate the contacts** about the purpose of a 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 for a medical evaluation, including sputum collection.⁴¹



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.⁴²



For more information on infection control, see the Infection Control section **17.1**.

Another critical consideration during field investigations is safety. Healthcare workers should become familiar with policies and recommendations of local law enforcement agencies and health department administration regarding personal safety. Current information on 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 identity badge with a current photo
- Working in pairs when visiting a potentially dangerous area
- Informing someone of your itinerary and expected time of return, especially if you anticipate problems⁴³

Contact Priorities

Assign priorities to contacts, using the list 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.⁴⁴ Priority-ranking contacts for investigation is based on 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.⁴⁵

Use the assigned priorities to allocate resources to complete all investigative steps for the high- and medium-priority contacts.⁴⁶ Dividing contacts into these three levels provides a system for public health staff to reach high-priority contacts first, and then medium-priority contacts, and then 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 recent *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 had TB disease (i.e., vulnerable contacts).⁴⁷



Timely initiation of treatment is especially important for susceptible and vulnerable contacts. Refer to Table 3: **Time Frames for Contact Evaluation and Treatment (11.15)** in the “Time Frames for Contact Investigation” topic.

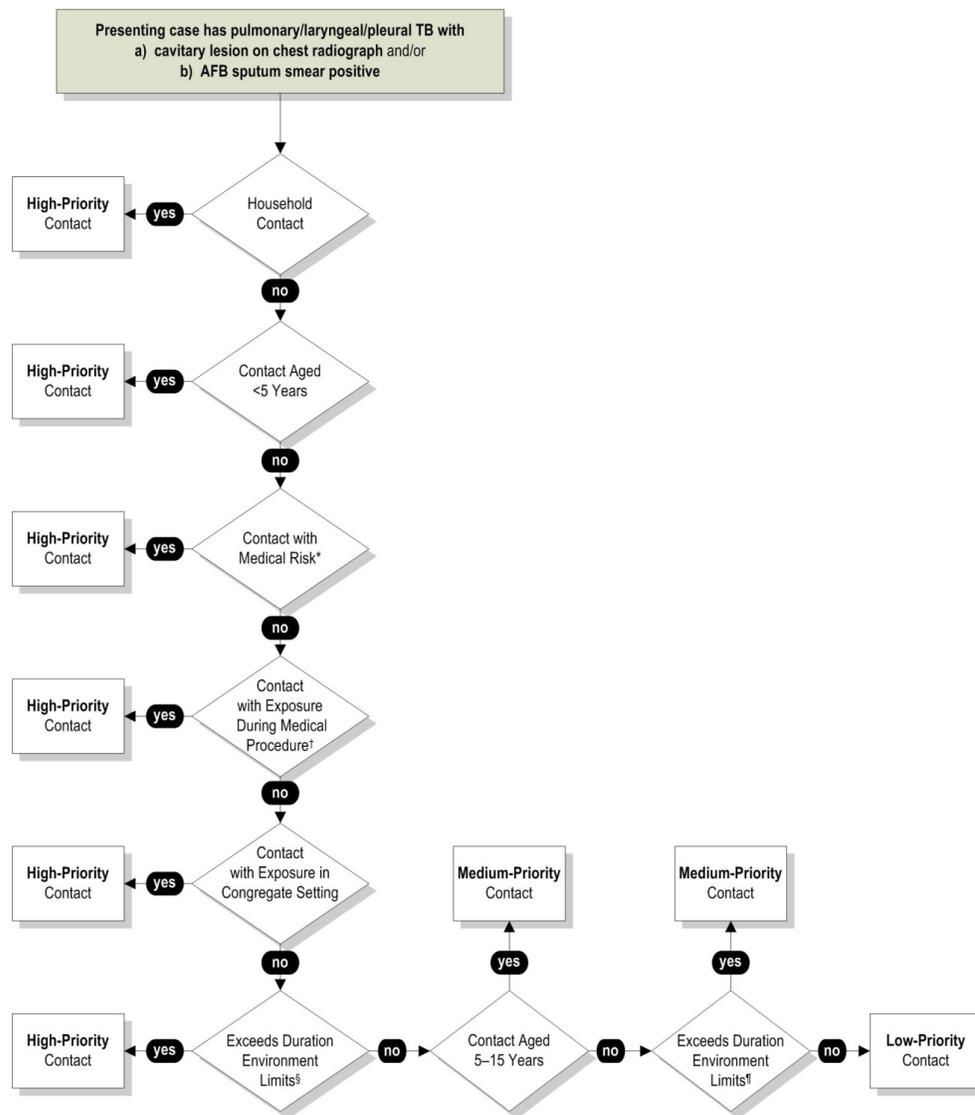
Use the tables on the following pages to assign priorities to contacts to the following:

- Figure 2: **Prioritization of Contacts to Smear-Positive or Cavitory Cases (11.28)**
- Figure 3: **Prioritization of Contacts to Smear-Negative Cases (11.30)**
- Table 6: **Prioritization of Contacts to Cases with Negative Bacteriologic Results and Abnormal Chest Radiographs Not Consistent with Tuberculosis (11.31)**

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

Use Figure 2 to prioritize contacts to smear-positive or cavitory index patients.

Figure 2: **PRIORITIZATION OF CONTACTS TO SMEAR-POSITIVE OR CAVITARY CASES**⁴⁸



Definition of abbreviations: AFB = acid-fast bacilli; HIV = human immunodeficiency virus.

* HIV or other medical risk factor.

† Bronchoscopy, sputum induction, or autopsy.

§ Exposure exceeds duration/environment limits per unit time established by the health department for high-priority contacts.

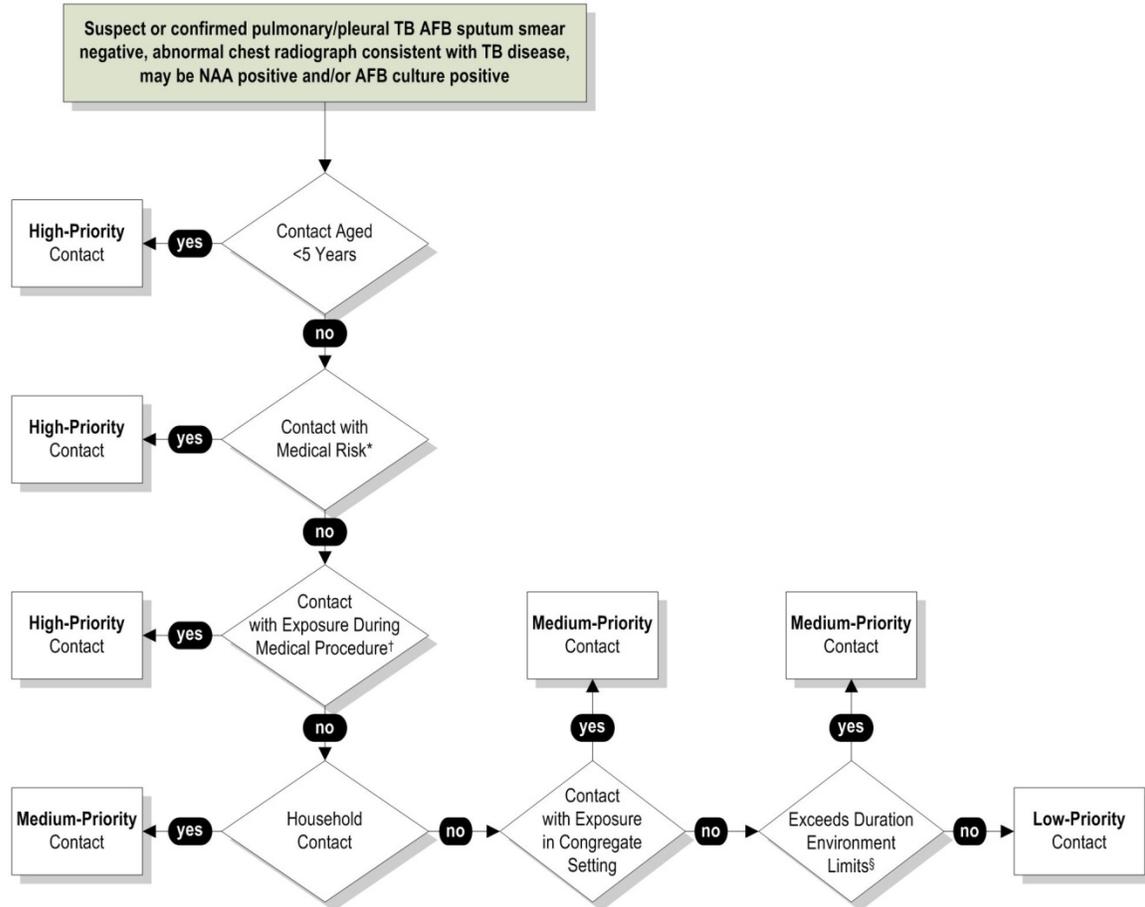
¶ Exposure exceeds duration/environment limits per unit time established by the health department for medium-priority contacts.

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 Figure 3 to prioritize contacts to smear-negative index patients.

Figure 3: **PRIORITIZATION OF CONTACTS TO SMEAR-NEGATIVE CASES**⁴⁹



Definition of abbreviations: AFB = acid-fast bacilli; HIV = human immunodeficiency virus; NAA = nucleic acid assay.

* HIV or other medical risk factor.

† Bronchoscopy, sputum induction, or autopsy.

§ Exposure exceeds duration/environment limits per unit time established by the local TB control program for medium-priority contacts.

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

Table 6: **PRIORITIZATION OF CONTACTS TO CASES WITH NEGATIVE BACTERIOLOGIC RESULTS AND ABNORMAL CHEST RADIOGRAPHS NOT CONSISTENT WITH TUBERCULOSIS**⁵⁰

High-Priority Contacts	Medium-Priority Contacts	Low-Priority Contacts
	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	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 usually administered.
- IGRAs can be used in place of (but not in addition to) TST in all situations in which CDC recommends TST as an aid in diagnosing *M. tuberculosis* infection, with preferences and special considerations noted below. This includes contact investigations, testing during pregnancy, and screening of health care workers and others undergoing serial evaluation for *M. tuberculosis* infection. Despite the indication of a preference, use of the alternative test (FDA-approved IGRA or TST) is acceptable medical and public health practice. Caution in interpretation should be used when testing certain populations because of limited data on the use of IGRAs ([see Updated Guidelines for Using Interferon Gamma Release Assays to Detect Mycobacterium tuberculosis Infection, United States](#))
- Populations in which IGRAs are preferred for testing:
 - Persons who have received BCG (either as a vaccine or for cancer therapy); and
 - Persons from groups that historically have poor rates of return for TST reading.
- TST is preferred over IGRAs for testing children less than 5 years of age.
- Medically evaluate each high- and medium-priority contact to determine whether tuberculosis (TB) disease or latent tuberculosis infection (LTBI) is 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). For recommended time frames, refer to Table 3: **Time Frames for Contact Evaluation and Treatment (11.15)** in the “Time Frames for Contact Investigation” topic.
- 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 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.⁵¹

Use the figures on the following pages to determine the evaluation activities for contacts in these different risk groups and priority rankings:

- Figure 4: **Immunocompromised Contacts and Children Younger than 5 (11.33)**
- Figure 5: **Immunocompetent Adults and Children 5 and Older (High- and Medium-Priority Contacts) (11.35)**
- Figure 6: **Contacts with Prior Positive Tuberculin Skin Tests**



During contact evaluation, treatments, and follow-up, use the *Contact Investigation Form* available in the Forms section of this manual **18.1**.



For time frames, see the “Time Frames for Contact Investigation” topic in this section. To arrange follow-up with public health officials in other jurisdictions for out-of-area contacts, see the Transfer Notifications section **15.1**.⁵²

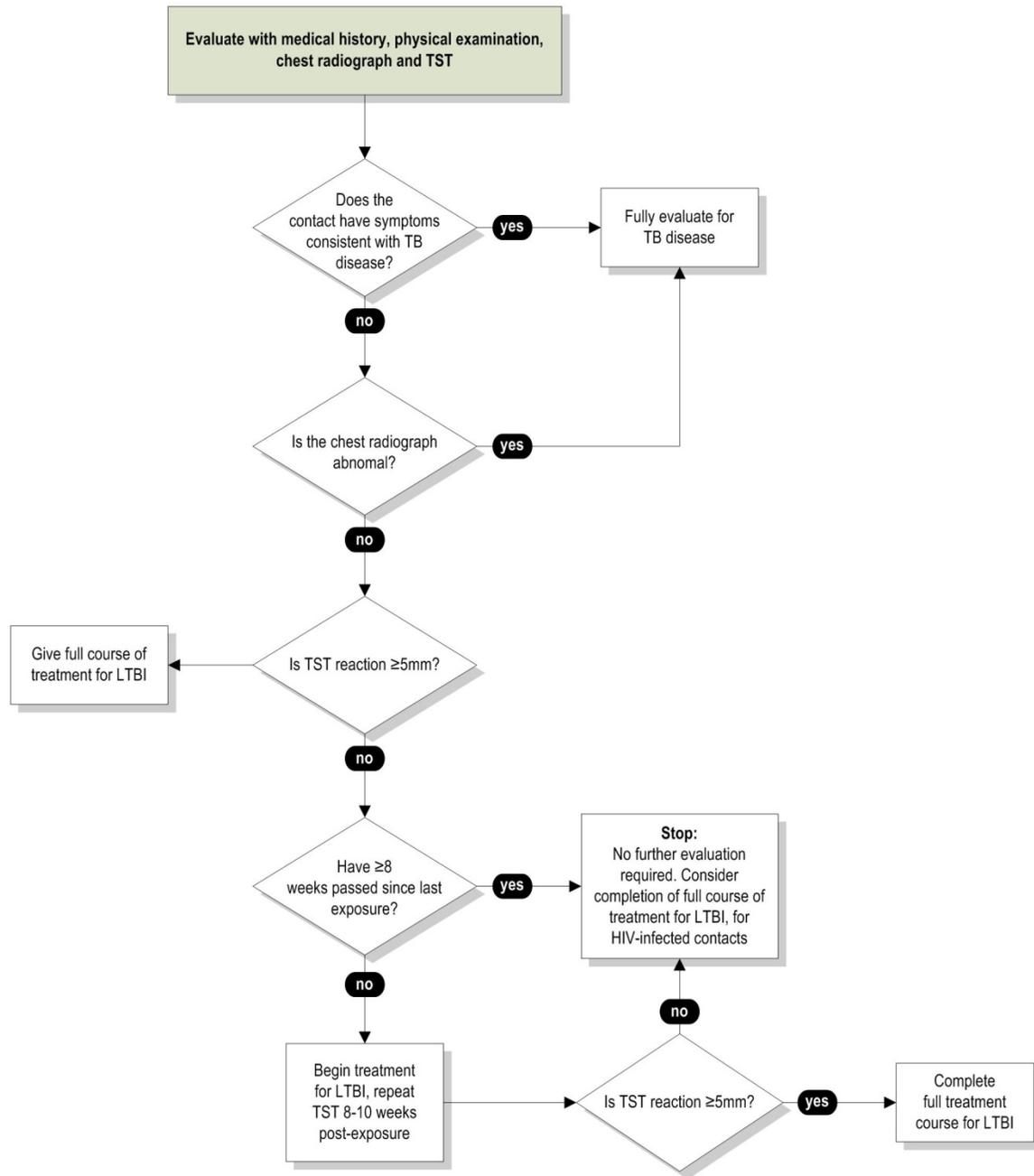


IGRAs may be used instead of TSTs in contact investigations EXCEPT in children under 5 years of age where TST is preferred. Unfortunately the Alaska TB Program and PHNs are unable to provide or pay for IGRA testing at this time.

Immunocompromised Contacts and Children under 5

Use Figure 4 to select evaluation, treatment, and follow-up activities for contacts who are immunocompromised and/or under 5 years old.

FIGURE 4: EVALUATION, TREATMENT, AND FOLLOW-UP OF IMMUNOCOMPROMISED CONTACTS AND CHILDREN UNDER 5 YEARS OLD⁵³



Definition of abbreviations: HIV = human immunodeficiency virus; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; 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):15.

Evaluate contacts who are immunocompromised or under 5 years of age with medical history, physical examination, chest radiograph, and tuberculin skin test (TST) or interferon gamma release assay (IGRA). Based on the results of these evaluations, take the actions in Figure 4.



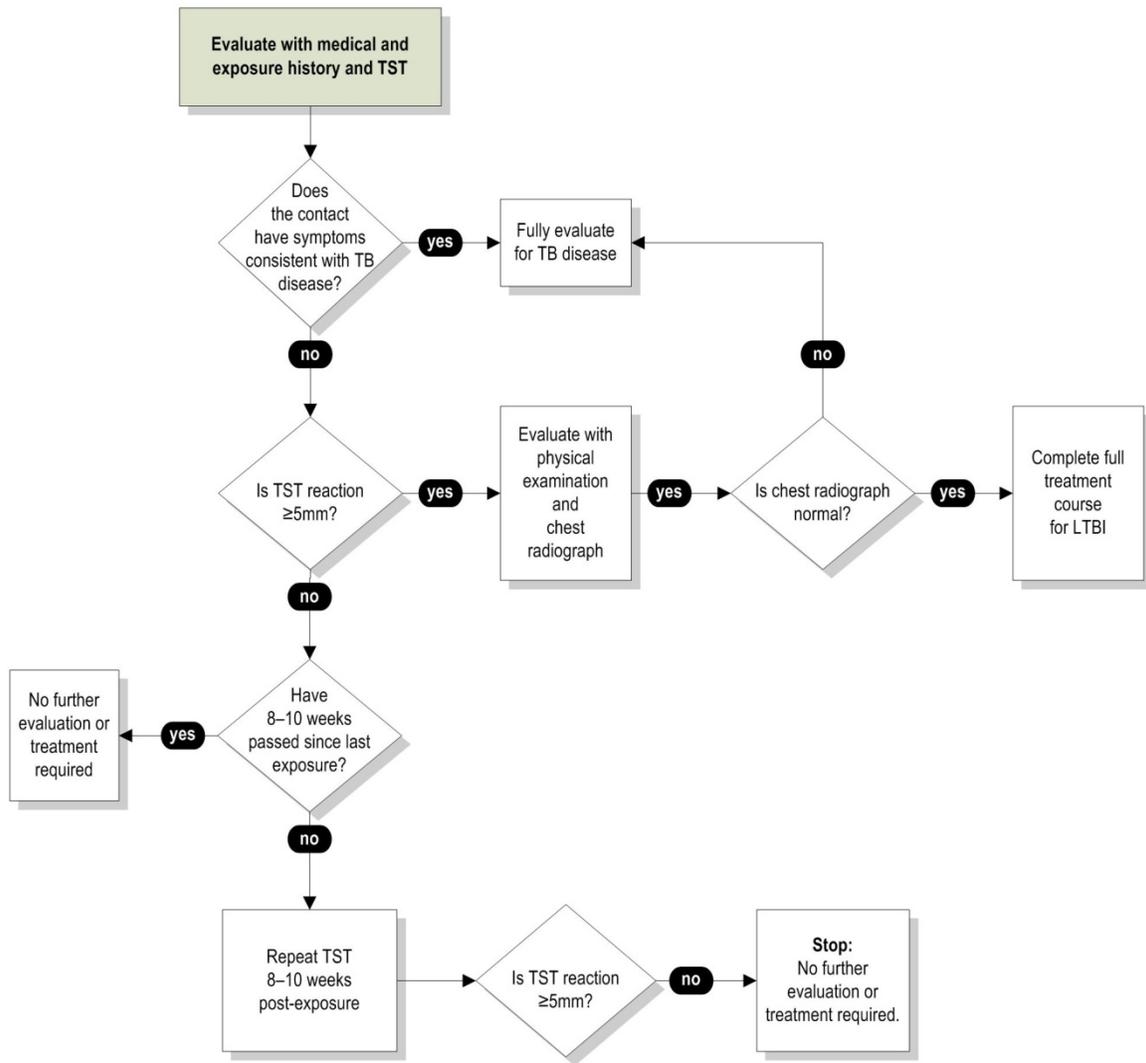
Timely initiation of treatment is especially important for these contacts. Refer to Table 3: **Time Frames for Contact Evaluation and Treatment** in the “Time Frames for Contact Investigation” topic.

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

Use Figure 5 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 high- and medium-priority contacts who are immunocompetent and/or 5 years of age or older, with medical history, exposure history, and tuberculin skin test (TST) or interferon gamma release assay (IGRA). Based on the results of these evaluations, take the actions in Figure 5.

Figure 5: **EVALUATION, TREATMENT, AND FOLLOW-UP OF IMMUNOCOMPETENT ADULTS AND CHILDREN FIVE YEARS OR OLDER (HIGH- AND MEDIUM-PRIORITY CONTACTS)**⁵⁴



Definition of abbreviations: IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; 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):17.

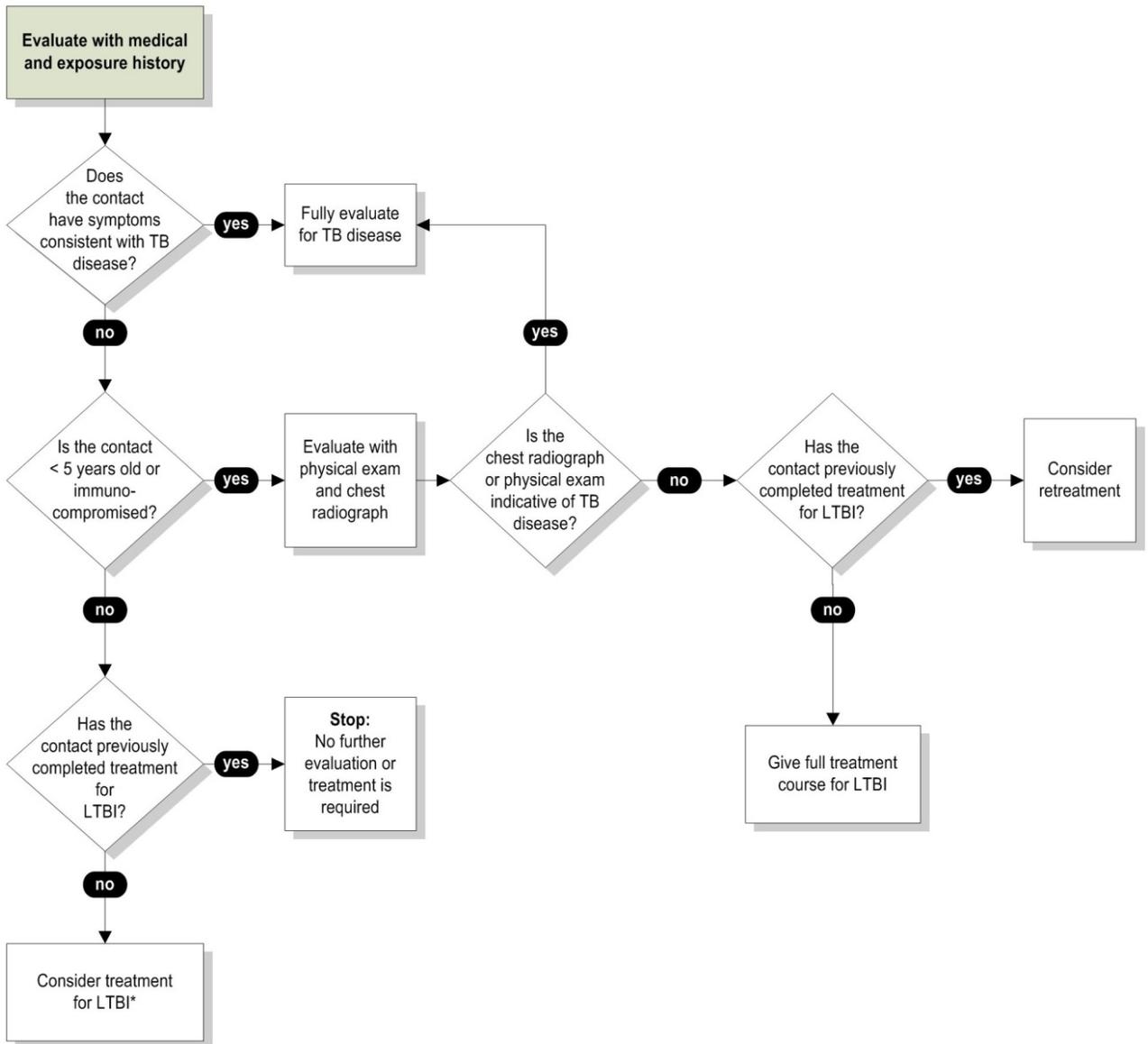
Contacts with Prior Positive Tuberculin Skin Tests

Use Figure 6 to select evaluation, treatment, and follow-up activities for contacts who have prior positive TSTs. For contacts with prior positive TSTs, evaluate them with medical and exposure history. Based on these histories, take the actions in Figure 6.



In Alaska, many contacts to TB suspects and cases have prior positive TSTs and must have their exposure and medical history assessed per Figure 6. Symptom screening and sputa collection (if the contact is able to cough and produce specimens) is recommended to “clear “ the contact and rule out active TB. Sometimes, contacts deny having a productive cough yet can produce adequate sputa specimens. Fully evaluating symptomatic contacts for TB disease in remote villages is challenging if not impossible due to the lack of skilled providers and x-ray capability in many small communities. Sputa collection, which would be included in a complete medical evaluation, can be done even in the most remote locations as long as specimens are sent to ASPHL as soon as possible after collection.

Figure 6: **EVALUATION, TREATMENT, AND FOLLOW-UP OF CONTACTS WITH PRIOR POSITIVE TUBERCULIN SKIN TESTS**⁵⁵



Definition of abbreviations: HIV = human immunodeficiency virus; LTBI = latent tuberculosis infection.

* Before initiation of treatment, contacts should be evaluated fully for TB disease. A full course treatment is recommended for HIV-infected contacts in this category.

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: 20% 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, household contacts with a positive tuberculin skin test (TST) results are more likely to be infected recently (or as a result of exposure to the index patient) if the contacts are U.S.-born children rather than adults born in high-incidence countries.

- 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 change in TST status from negative to positive

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.

Sometimes the result from an investigation indicates a need for expansion, but resources do not permit this. In these situations, seek consultation and assistance from the next higher level in public health administration (e.g., the county health department consults with the state health department). Consultation offers an objective review of

strategy and results, additional expertise, and the potential for personnel or funds for meeting needs.



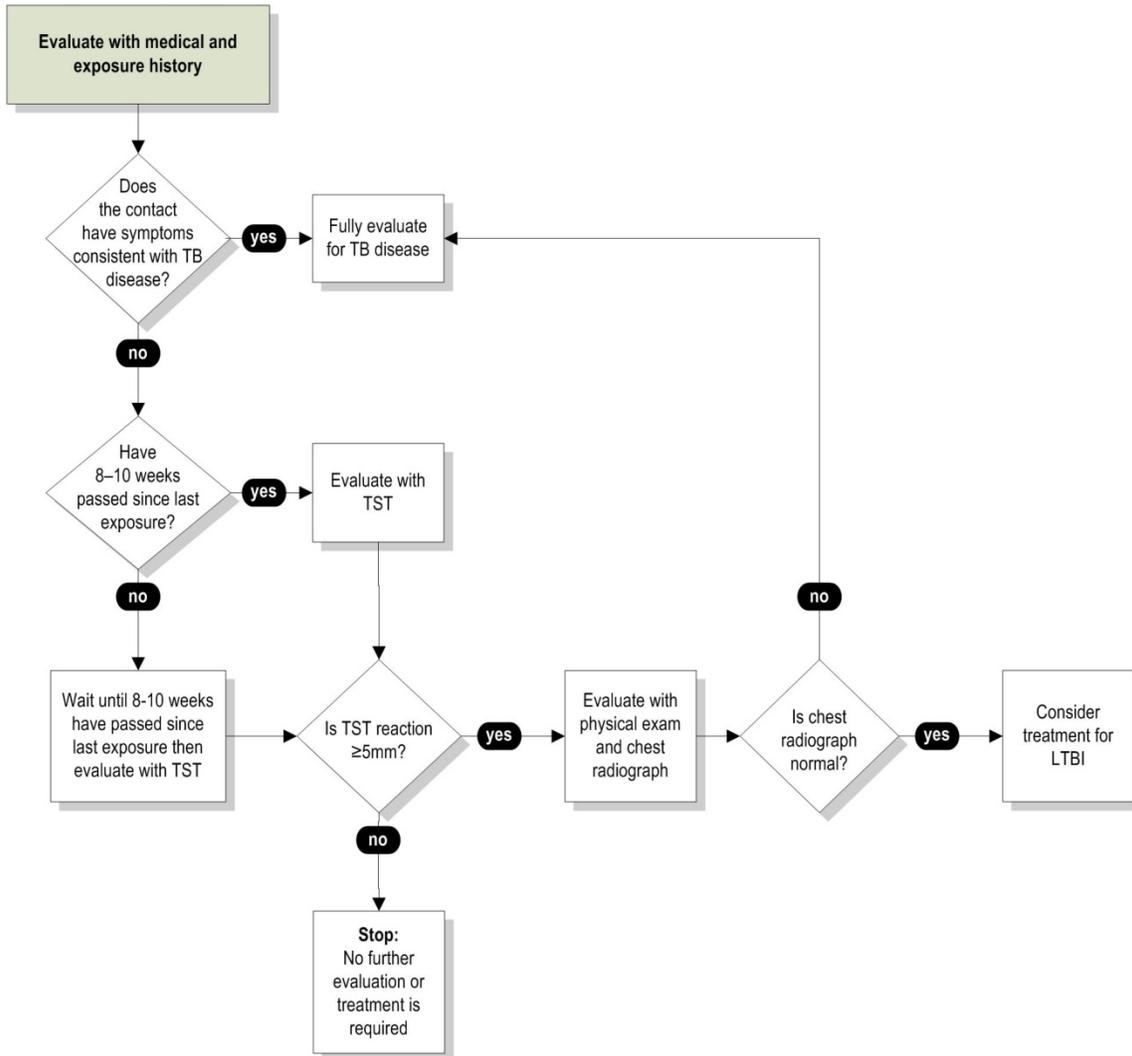
Contact the Alaska TB Program at 907-269-8000 to consult about expanding a contact investigation.

Low-Priority Contacts

Use Figure 7 to select evaluation, treatment, and follow-up activities for low-priority contacts.

Evaluate low-priority contacts with medical and exposure history. Based on these histories, take the actions in the Figure 7.

Figure 7: **EVALUATION, TREATMENT, AND FOLLOW-UP OF LOW-PRIORITY CONTACTS**⁵⁶



Definition of abbreviations: CXR = chest radiograph; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; 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):18.

Data Management and Evaluation of Contact Investigations

Data collection related to contact investigations 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 and overall 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 are 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 tuberculin skin test (TST) administered to a contact).

Completion of Investigation

When aggregated, the data from an investigation inform public health officials as to whether the investigation is on time and complete. 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 the 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, then the reasons for problems can be studied.



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> , is recommended for assessing the overall activities of contact investigations.

Index Patient and Contact Data



Use the *TB Case Management Form* to collect the data on each index patient and the *Contact Investigation Form* to collect the data on individual contacts. Both are available in the Forms section of this manual **18.1**.

Table 7: **DATA ABOUT THE INDEX PATIENT**⁵⁷

Identifiers/Demographic Information	<ul style="list-style-type: none"> Case manager Name and aliases For minors and dependents: guardian information Date of birth 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) Alcohol and 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 cavity TB medications with start and stop dates Bacteriologic results (sputum smear, NAA, 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
<p>Definitions of abbreviations: AIDS = acquired immunodeficiency syndrome; CXR = chest radiograph; HIV = human immunodeficiency virus; <i>RVCT</i> = <i>Reports of Verified Cases of Tuberculosis</i>; TB = tuberculosis.</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.

Table 8: **DATA ABOUT EACH CONTACT**⁵⁸

Investigator and Dates	Dates of interviews Start and end dates for exposure (updated as new information arrives)
Identifiers	Name and aliases For minors and dependents: guardian information Date of birth Sex Race Ethnicity Country of birth Time in United States, if foreign born Primary language and preferred language Methods of translation or interpretation
Exposure	Relationship/connection to index patient Social affiliations (e.g., work, school, church, clubs, activities) Environmental information about exposure settings (e.g., size, ventilation) Frequency, duration, and time frame of interactions
Medical History and Risk Factors	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	Healthcare provider for TB (e.g., public health, private, both, other) Symptoms suggesting TB disease TSTs, with dates, reagents and lot numbers, reaction measurement 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	Dates of treatment Treatment regimen (medications, dosing schedule, any changes to these) Adverse reactions (specify each) Interruptions in regimen and dates Outcome of treatment (completion, etc., consistent with ARPE [†]) If treatment not completed, reason [†]
<p>Definitions of abbreviations: ARPE = <i>Aggregate Report for Program Evaluation</i>; 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> <p>[†] As defined by CDC ARPE for contact investigations.</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, were tested, started therapy, and completed therapy.



Record your summary on the *Contact Investigation Form* available in the Forms section of this manual **18.1**.

In addition, the CDC's Framework for Program Evaluation in Public Health is recommended for assessing the overall activities of contact investigations.⁵⁹

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 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:

Criteria based on surveillance and epidemiology:

1. An increase has occurred 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 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:

Transmission is continuing despite adequate control efforts by the TB control program

Contact investigation associated with increased cases requires additional outside help

Deoxyribonucleic Acid Genotyping

Deoxyribonucleic acid (DNA) genotyping is routinely done on all Alaska TB isolates at a regional genotyping laboratory. It is also a laboratory technique used by public health officials to distinguish between different strains of *M. tuberculosis* and to help assess the

likelihood of TB transmission. Characterization of *M. tuberculosis* with DNA genotyping is a powerful tool for the following:

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 infections
4. Identifying laboratory cross-contamination as the cause of misdiagnosis

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

https://www.cdc.gov/tb/programs/genotyping/images/tbgenotypingguide_june2004.pdf

Resources and References

Resources

- California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). “Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis” (*CDHS/CTCA Joint Guidelines*; 2005). Available at: http://www.ctca.org/filelibrary/file_363.pdf
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