COUNTY OF LOS ANGELES
Public Health

Chapter Six:
Contact Investigation

Revised 2013

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Contact Investigation

Contact investigations (CI) have been a key component of tuberculosis (TB) control programs in the U.S. for over 30 years and are considered an essential prevention activity. After the early diagnosis and treatment of active TB cases, prompt detection and effective treatment of contacts to infectious cases is the second basic principle of TB Control in the United States[i]. On average, as of 2011, 18 contacts are identified for each person with infectious TB in the U.S. In addition, 20%–30% of all contacts have LTBI and 1% of contacts have TB disease. Of the contacts that ultimately develop TB disease, approximately one-half develop disease in the first year after exposure[ii]. When contacts with active TB are diagnosed early and are promptly started on effective treatment, TB transmission can be prevented. The ideal goal would be to distinguish all recently infected contacts from those who are not infected and prevent progression to TB disease by treating those with infection. In practice, existing technology and methods cannot achieve this goal. For this reason, limited public health resources must be focused on contacts most likely to have been infected.

The Los Angeles County TB Control Program (LAC TBCP) is responsible for the oversight of contact investigation within Los Angeles County. As part of this responsibility the Program has provided guidelines for conducting contact investigations in the LAC TBCP Manual. The last major revision of the Los Angeles County TB Control Program (LAC TBCP) Manual was in 2003 and since that time both the CDC Division of Tuberculosis Elimination and the California Department of Public Health (CDPH)/California TB Controllers Association (CTCA) have provided updated guidelines for contact investigations. In developing the Los Angeles County Contact Investigation guidelines, the LAC TBCP referenced the State and Federal guidelines to develop a CI framework by compiling tools for the various steps of the CI process. Recently approved Los Angeles County (LAC) Nucleic Acid Amplification Test (NAAT) guidelines are also referenced in this document.

The objectives of this chapter are to:

1) provide a detailed and updated framework for performing contact investigations in LAC
2) emphasize the importance of a multi-disciplinary team effort
3) ensure effective communication between public health center staff and the LAC TBCP
4) focus attention on recent changes and emphasize guidance offered in previous LAC DPH TBCP CI guidelines

What's New

Overall

- **Joint CHS/TBCP CI team, led by the AMD, to plan and implement CI activities.**
- **CIs should be conducted using a social network approach.**
- **The term "industry" will no longer be used and will be replaced with "exposure site."**
- **Each exposure site can be further subdivided into separate areas of exposure called "exposure settings."**

- **An exposure period should be determined for each exposure setting.**
- **<u>All contacts identified</u> during index or proxy interviews should be listed on the contact roster regardless of whether they are tested.**
- **TBCP will move from a two-tiered (high and low) to a three-tiered prioritization of contacts (high, medium and low).**

Contact Diagnosis, Evaluation and Treatment

- **CI steps have been separated into three phases (CI-assessment, CI-continuation, CI-completion).**
- **Interferon Gamma Release Assays (IGRA) are preferred (if available) for evaluation of TB infection in persons who have received BCG (either as a vaccine or for cancer therapy); and persons from groups that have poor rates of return for TST reading.**
- **The two-step skin test procedure, to boost sensitivity, is no longer recommended to evaluate contacts.**
- **High and medium priority contacts that have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation.**
- **A <u>≥</u>5 mm TST induration is considered positive in all contacts (high, medium and low priority).**
- **Chest x-rays are <u>not</u> recommended for <u>all</u> high priority contacts with negative TST or IGRAs. However, immunosuppressed contacts (e.g., HIV-infected or taking immunosuppressive medications: see tables 2a and 2b #2), contacts with TB symptoms, and contacts who are <5 years old should continue to have a chest x-ray as part of their initial evaluation.**
- **Initial testing of low priority contacts should be performed 8–10 weeks after last known exposure. The CI team decision of whether to test low priority contacts will depend on the results of the testing of high and medium priority contacts.**
- **Window period prophylaxis should be limited to those contacts who are immunosuppressed (see tables 2a and 2b #2), and children <5 years old.**
- **Contacts that have a documented previous positive TST and are HIV positive should complete a full course of LTBI treatment regardless of previous LTBI treatment.**
- **Source case finding should <u>not</u> be done for a child of any age diagnosed with LTBI.**

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Contents

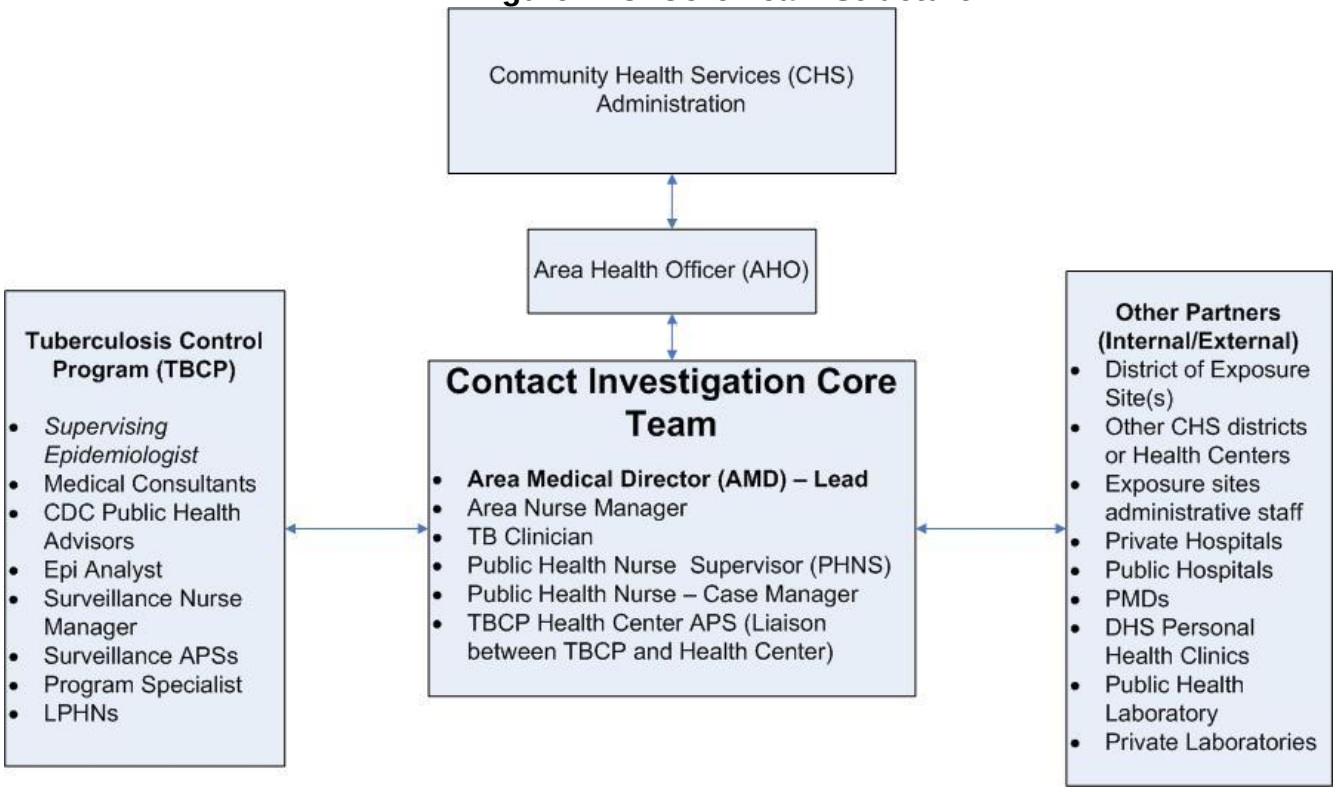
I. Contact Investigation: A Multi-Disciplinary Team Effort

In Los Angeles County, a public health nurse (PHN) is assigned as a case manager to each reported patient with suspected or confirmed TB disease. Part of the PHN's overall case management activities should include the assessment of the need for a CI. Since "CIs are complicated undertakings that typically require hundreds of interdependent decisions, the majority of which are made on the basis of incomplete data and dozens of time consuming interventions"[iii], *TBCP and Community Health Services (CHS) recommend that a joint CHS/TBCP CI Core Team be established to assist the PHN in completing the various activities of a CI.*

As the PHN collects information about the index patient and his/her contacts, the CI Core Team's objectives should include: determining the scope of the investigation, assisting with the prioritization of exposure sites and contacts, identifying strategies to focus resources on contacts at highest risk of exposure, determining the need to expand an investigation, and evaluating the outcomes of the CI. Information should be organized and presented by the PHN in a consistent format to facilitate review.

The suggested CI Core Team structure is illustrated in Figure 1:

Figure 1: CI Core Team Structure



The CI Core Team, under the leadership of the AMD, will need to work with TBCP and various internal and external partners in order to conduct a contact investigation. The health center APS is a member of the CI Core Team and will work closely with all members of TBCP, especially with its'

medical consultants, to provide recommendations and guidance. In order to meet the CI Core Team's objectives (listed above) it is critical that the Team shares and discusses CI information and planning on a regular basis throughout the investigation.

II. Framework for Contact Investigations

This chapter is designed to aid CHS staff members who conduct CI activities. The CI steps described within this section correlate with the LAC DPH TBCP CI Guidelines. Revised LAC DPH TBCP CI Guidelines have been placed in Appendix L which provides detailed information on contact investigations (CI). Each section within this chapter includes a short summary of the major CI concept or activity and tools to assist the CI team to make necessary decisions. Use of these tools by CHS in collecting the necessary information to be reviewed by the CI Core Team is strongly encouraged. Although the CI steps are listed in numerical order, the steps do not necessarily need to be carried in the exact order presented, and may be conducted in parallel. Also included within each section is a reference to the specific section in the LAC DPH TBCP CI Guidelines.

Structure of this Chapter section

1. **Decision to initiate a contact investigation**
2. **Investigating the index patient**
3. **Site evaluation**
4. **Assigning priorities to contacts**
5. **Diagnosis and evaluation of contacts**
6. **Treatment of contacts**
7. **When to expand a contact investigation**
8. **Communicating through the media**
9. **Data management and evaluation of contact investigation**
10. **Congregate settings (e.g., schools, health care facilities)**
11. **Source case finding**

Used together, the tools included in this section and the LAC DPH TBCP Guidelines will help focus CI activities on those contacts at greatest risk of being infected and on those at greatest risk of progression to TB disease.

Although these recommendations have attempted to cover most major scenarios, they do not address every circumstance that may arise. It is recommended that TBCP be consulted when situations not addressed in these recommendations arise.

1. Decision to Initiate a Contact Investigation

CI should be considered for all pulmonary, laryngeal, and pleuro-pulmonary TB suspects and cases. The possibility of pulmonary TB should always be considered in cases with an extra-pulmonary site of TB disease and pulmonary TB disease should be excluded by symptom screening, chest X-ray

(CXR) and sputum for acid fast bacilli (AFB) smear and culture if indicated. For a pleural TB suspect or case, pulmonary involvement should always be excluded with chest X-ray and sputum for AFB smear and culture.

Occasionally, in exclusively extra-pulmonary TB disease, aerosolization of infected droplets may occur, such as during an autopsy, electrical cauterization of infected tissue or water-jet irrigation of a TB abscess or wound. In these situations a CI should be initiated.

The decision to initiate a CI should be based on the estimated degree of contagiousness of the patient (based upon the site of disease, clinical and/or radiographic findings, sputum AFB smear and molecular diagnostic results). Relative infectiousness has been associated with positive sputum culture results and is highest when the sputum AFB smear results are also positive[iv,v,vi,vii]. The significance of results from respiratory specimens, other than sputum, (e.g., bronchial washing or broncho-alveolar lavage fluid) is undetermined. Experts recommend that these specimens be regarded as equivalent to sputum[viii].

Once a decision has been made to initiate a CI, investigation activities are separated into three phases: assessment, continuation, and completion. Activities associated with each phase are outlined in Table 1.

TABLE 1: Contact investigation phases and related activities

CI Phases	CI Activities
Assessment	• DPHN completes PHN TB assessment, interviews index patient or proxy to elicit contact names and locating information, identifies exposure sites and creates a preliminary CI plan (prioritizing sites, setting and contacts) • DPHN has the flexibility to begin testing of household contacts (unless the index patient resides in a congregate residential facility) • DPHN presents all initial information gathered on the index and preliminary CI plan to CI Core Team for review
Continuation	• AMD or designee contacts administration of exposure site(s) • DPHN, in consultation with the CI Core Team, conducts site visit(s), identifies contacts, prioritizes contacts (high, medium, low), begins initial testing (TST/IGRA) of high and medium priority contacts, schedules CXR, refers for window period prophylaxis/LTBI treatment as necessary • If the DPHN identifies contacts outside of the district of residence (DOR) of the index patient then the DPHN refers them to the appropriate public health center or public health jurisdiction • Interpretation of data should be carried out at a minimum by the CI Core Team after initial testing, after second round testing and at final review. Additional reviews may be necessary throughout the investigation. • CI Core Team determines the need for expansion on an on-going basis • DPHN monitors initiation of treatment for those contacts diagnosed with LTBI
Completion	• DPHN completes testing of contacts (as needed) • DPHN monitors completion of treatment for those contacts diagnosed with LTBI • CI Core Team conducts a comprehensive analysis of the CI (see section 9) at the completion of the investigation

NOTE: Prioritization of multiple contact investigations is a decision that should be made by the CI team based on factors such as the likelihood of transmission and on the contacts risk for progression to disease.

Tool –Sputum smear positive, Sputum smear negative
Reference - pages 10–16 of the LAC DPH TBCP CI Guidelines, Los Angeles County Nucleic Acid Amplification Test (NAAT) Guideline

2. Investigating the Index Patient

Gathering information about the index patient is the foundation of a contact investigation. Multiple interviews with the index patient and/or proxy are usually required to understand a patient's complex social network. The initial interview should be done in person, not by phone. Over the course of any one CI, a large amount of information will be collected about the patient through interview(s) and from patient medical records. Information required for medical review of the index case includes the following: site of disease, date of onset and type of symptoms, chest radiograph result, chest CT result if available, TB medicines and start date, sputum AFB smear, culture, and susceptibility results, name of lab where specimen was sent, other medical conditions, previous TB and TB treatment history, employment history / work site information and living situation / social factors.

An infectious period should be calculated to identify the period during which exposure is most likely to have occurred, in order to focus the CI on individuals at highest risk for infection. The calculation of the infectious period depends upon the patient's clinical characteristics.

For MDR cases regardless of sputum AFB smear status, cavitation on chest x-ray or TB symptoms the determination of the end of the infectious period will differ. MDR cases will require additional criteria of at least 3 consecutive negative sputum cultures without a subsequent positive culture and 14 days of TB treatment on DOT.

For patients with a very lengthy estimated infectious period (e.g. >1 year) it may not be feasible to evaluate all high priority contacts. In this situation, an investigation may be initiated using an abbreviated infectious period (e.g., 6 months). If there is not strong evidence of TB transmission in this abbreviated infectious period, it may not be necessary to expand the timeframe. If however, there is evidence of transmission during the abbreviated infectious period, the investigation timeframe should be expanded.

Information regarding transmission settings that the patient frequented during the infectious period is needed for identifying contacts and assigning priorities. Topics to discuss include where the patient spent nights, met with friends, worked, ate, visited, and sought health care. The interviewer should ask specifically regarding congregate settings (e.g., high school, university, correctional facility, homeless shelter, or nursing home). The interviewer also should inquire regarding routine and non-routine travel. Contacts not previously identified might have been exposed during the patient's infectious period while the patient was traveling. Routine travel modes (e.g., carpool) could also be settings in which contacts were exposed. This information is collected in a systematic fashion while still stressing patient confidentiality.

For all potentially infectious TB cases, a contact investigation plan should be created in order to document all sites of exposure during the patient's infectious period. *The plan should include the name and location of each site where the index patient spent time during his/her infectious period, the last day the patient was at each site, as well as documenting an estimated exposure period for each location.*

Maintain confidentiality at all times unless doing so endangers the public health. The Public Health Nurse should discuss with the patient how best to disclose the potential exposure to family/friends, worksite, social and other settings. Unless permission is given, the index patient should be informed that contacts will not be given information on the identity of the index patient. In certain situations where work, school, or other large groups are involved, it may be necessary for a few persons (e.g., employee health or work supervisor) to know the name of the index patient to ensure that all contacts are identified and to determine their level of risk. Confidentiality may be breached to protect the health of contacts and to protect the public.

Screening low priority contacts or persons not exposed simply to protect the identity of the index case is not recommended. This practice is contrary to the cardinal principle of prioritizing the evaluation of TB contacts (i.e. testing high and medium priority contacts first, and then proceeding to low priority contacts if indications exist), and may result in harm to individuals tested unnecessarily. When the CI Core Team encounters sensitive situations regarding protecting the identity of the index patient, they should consult with TBCP.

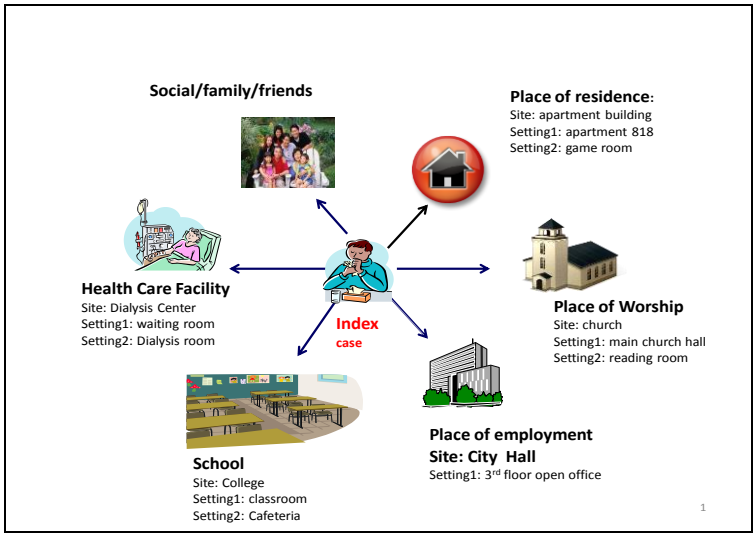
Tool –Interview checklist, Preliminary list of open-ended questions, Estimating infectious period table, List of possible exposure site(s)
Reference - pages 16-22 of the LAC DPH TBCP CI Guidelines

3. Site Evaluation

Factors to consider for assessing the risk of transmission at a site include: infectiousness of the index case, cumulative time of exposure, proximity of contact(s) to index, and environment (area and ventilation). The risk of transmission will often vary at each site/setting. A tool (see Exposure site assessment tool) has been provided to help assess the area and ventilation at a site or setting. To supplement this information, pictures, floor plans, video clips, diagrams or other graphical representations of the area can help the CI Core Team understand the space were exposure took place.

Reviewing the entire social network of the index patient (e.g., friends, family, work, school) will inform decision making for prioritization of sites, settings and contacts. For each site (e.g., school), the investigating team should further subdivide the site into settings (e.g., classroom, lunch area, gym, etc.). This process of more strictly dividing sites into settings is essential when performing a contact investigation in any large site, and will help prioritize contacts by duration and intensity of exposure. An example of a contact investigation with multiple sites and settings is illustrated in Figure 2.

Figure 2: Social Network: Potential exposure sites and associated settings



A home visit should be done for all pulmonary (including pleuro-pulmonary) and laryngeal TB suspects/cases to verify the information that is gathered through the index/proxy interview and from medical record review(s). While the home is an important site to investigate, all sites where the case spent time while contagious should be carefully considered for estimating the risk of transmission.

Prioritization of site visits should be done by the CI Core Team for all sites of exposure based on the estimated risk of transmission at each site and the contacts' risk for progression to disease if infected. During the CI Core Team review of the social network of a potentially highly infectious index case (e.g. multiple smear AFB positive) certain sites/settings should take precedence for investigation (e.g. congregate settings, sites where the index patient spent significant time, sites where vulnerable or susceptible contacts are identified, sites with intense exposure (e.g., close proximity within a poorly ventilated space) over a short duration). Conversely the CI Core Team can delay an investigation at, or decide to not investigate sites/settings where it can be verified that the index case spent an insignificant amount time during the infectious period.

The reason(s) to delay, not investigate or not visit an exposure site(s) should be discussed by the CI Core Team and documented.

Contacts should be prioritized as high, medium or low priority at each site/setting. High and medium priority contacts must be screened at each site/setting regardless of TB screening results at other sites/settings. Lack of evidence of transmission at one site/setting (including the home) does not preclude the possibility of transmission at another site/setting.

Tool –Exposure site assessment
Reference - pages 22-25 of the LAC DPH TBCP CI Guidelines, CI Monitoring and Communication Standards Attachment D

4. Assigning Priorities to Contacts

Although a relatively brief exposure can lead to *M. tuberculosis* infection and disease[ix], certain contacts are not infected even after long periods of intensive exposure. However, increasing the intensity and duration of exposure usually increases the likelihood of recent *M. tuberculosis* infection in contacts. In practice, public health officials must focus their resources on finding exposed persons who are more likely to be infected or to become ill with TB disease.

All contacts are not at equal risk to become infected, or of developing TB disease once infected. They are assigned a priority on a case-by-case basis depending upon the index patient's ability to transmit TB, the duration of exposure, the environment where possible transmission took place, and the susceptibility and vulnerability of the contact. *LAC DPH TBCP has moved from a two-tiered (high and low) to a three-tiered prioritization of contacts (high, medium and low*). Although additional time may be needed to prioritize contacts into these three categories, this will help to maximize limited resources on the highest-priority contacts. To aid in determining exposure duration and environmental exposure, refer to the Exposure Site Assessment tool.

Contacts of a more infectious index patient (e.g., one with sputum AFB smear positive TB) should be assigned a higher priority than those of a less infectious one because contacts of the more infectious patient are more likely to have recent infection or TB disease[x,xi,xii,xiii,xiv,xv].

HIV-infected persons, immunosuppressed patients (see tables 2a and 2b, #2), or children under five years old should be identified as high priority. If infected, they are more likely to progress to TB disease and are also more likely to develop severe or disseminated forms of TB disease.

A contact's risk for progression to TB disease should be determined through a medical assessment or self-reporting. For high and medium priority contacts, a medical assessment should determine risk factors for progression. For contacts initially categorized as low priority, self-reporting can be utilized, to identify immunosuppressed contacts or contacts at increased risk of progression once infected in order to elevate these individuals to high priority. In large scale investigations, TBCP recommends that an on-site educational session, along with a TB exposure letter, be provided to all potentially exposed persons, highlighting the need for medical evaluation for any person with TB signs and symptoms or persons that have been diagnosed with medical conditions that increase the risk for progression to active TB disease. Another strategy would be to work closely with facility administration or an onsite health care provider to identify and focus initial screening and testing on persons at increased risk for progression to TB disease.

It is critical that after index and contact characteristics have been taken into account, that prioritization of contacts for a particular site should be based on site/setting data that is as accurate as possible (intensity of exposure, duration of exposure, ventilation characteristics, and area of exposure) because it informs decisions on who to test, when to test and the extent of follow-up of contacts. In certain situations changing a contact(s) priority may be necessary as the CI Core Team receives new data while progressing through the investigation.

Regardless of a contact's priority, if a contact has signs or symptoms of TB disease they should be referred immediately for further evaluation to rule out TB disease.

The index patient's characteristics that inform contact prioritization can be divided into two general categories (Table 2a and 2b):

Table 2a: Exposure to a TB 3 or TB 5 case of pulmonary, laryngeal, and/or pleuro-pulmonary TB with

- ***Positive sputum AFB smear or***
- ***Cavitary lesion on chest radiograph***

High Priority Contacts	Medium Priority Contacts	Low Priority Contacts
1. Children under 5 years of age **2. Immunosuppressed contacts:** a. Infected with HIV b. Immunosuppressive medical treatment, for example: - ≥ I5mg day of prednisone or its equivalent for one month or more - Cancer chemotherapy agents - Antirejection drugs for organ transplantation - Tumor necrosis factor alpha (TNF-α) antagonists (e.g. for autoimmune diseases like rheumatoid arthritis, Crohn's disease) **3. Other conditions that increase risk of progression from latent TB infection to active disease once infected:** a. Chronic kidney disease / end-stage renal failure b. Diabetes mellitus c. Silicosis d. Head or neck cancer e. Hematological and reticuloendothelial disease (e.g. leukemias and lymphomas) f. Intestinal bypass or gastrectomy g. Chronic malabsorption syndrome h. Low body weight (>10% below ideal body weight) i. Chronic alcoholism j. Increased risk for HIV infection (including intravenous drug-use) **4. Exposure during an aerosol-inducing medical procedure** (e.g. autopsy, bronchoscopy or sputum induction) **5. Significant exposure based on intensity AND ≥8 hours of exposure during any one week of the infectious period***	**1**. Persons five years and older, not already classified as high priority with **significant exposure based on intensity OR ≥8 hours of exposure during any one week of the infectious period*** **2. Any contact who does not meet the above criteria but deemed to be medium priority by the CI Core Team**	Any contacts, who are not already classified as high or medium priority, and who have limited exposure to the index case

* Examples of intense exposure include: Carpooling with the index case, sharing the same house or living space as the index case, and sharing air with the index case in small, enclosed spaces with little natural ventilation or mechanical ventilation with re-circulated air

Table 2b. Exposure to a TB 3 or TB 5 case of pulmonary, laryngeal and/or pleuro-pulmonary TB with:

- ***Negative sputum AFB smear, and***
- ***Abnormal, non-cavitary chest radiography consistent with TB disease***
- ***Started on TB treatment***

High Priority Contacts	Medium Priority Contacts	Low Priority Contacts
1. Children under 5 years of age **2. Immunosuppressed contacts:** a. Infected with HIV b. Immunosuppressive medical treatment, for example: - ≥ l5mg day of prednisone or its equivalent for one month or more - Cancer chemotherapy agents - Antirejection drugs for organ transplantation - Tumor necrosis factor alpha (TNF-α) antagonists (e.g. for autoimmune diseases like rheumatoid arthritis, Crohn's disease) **3. Other conditions that increase risk of progression from latent TB infection to active disease once infected:** a. Chronic kidney disease / end-stage renal failure b. Diabetes mellitus c. Silicosis d. Head or neck cancer e. Hematological and reticuloendothelial disease (e.g. leukemias and lymphomas) f. Intestinal bypass or gastrectomy g. Chronic malabsorption syndrome h. Low body weight (>10% below ideal body weight) i. Chronic alcoholism j. Increased risk for HIV infection (including intravenous drug-use) **4. Exposure during an aerosol-inducing medical procedure** (e.g. autopsy, bronchoscopy or sputum induction)	**1**. Persons five years and older, not already classified as high priority with **significant exposure based on intensity** **AND** **≥8 hours of exposure during at least one week of the infectious period*** **2. Any contact who does not meet the above criteria but deemed to be medium priority by the CI Core Team**	Any contacts, who are not already classified as high or medium priority, and who have limited exposure to the index case

* Examples of intense exposure include: Carpooling with the index case, sharing the same house or living space as the index case and sharing air with the index case in small, enclosed spaces with little natural ventilation or mechanical ventilation with re-circulated air

Tool – Prioritization of contacts, Contact exposure letter (CHS template letter)
Reference - pages 25-30 of the LAC DPH TBCP CI Guidelines

5. Diagnosis and Evaluation of Contacts

Once contacts have been prioritized, resources should initially be allocated to complete all investigative steps for high and medium priority contacts. Exposure sites may not have all three levels of priority contacts (smaller settings or investigations may only have one or two priority levels). In practice, screening and testing of high and medium priority contacts often happens simultaneously. TBCP recommends that the CI Core Team consider on-site screening and testing of contacts whenever possible. On-site testing is strongly recommended in order to expeditiously and comprehensively screen and test (TST/IGRA) high and medium priority contacts. After screening and initial testing, contacts that are converters, TST/IGRA positive and those contacts needing window period prophylaxis should be promptly referred to their district of residence public health center for follow up evaluation and treatment.

When on-site testing can be done by the facility where the exposure occurred (e.g., facilities covered by ATD Standard or facilities that contract out their employee screening), CHS can assist in prioritizing contacts and document that evaluation is completed.

A medical history should include an assessment of TB risk factors, (see tables 2a and 2b). *High and medium priority contacts who have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation*.

IGRAs are preferred (if available) for evaluation of TB infection among persons who have received BCG (either as a vaccine or for cancer therapy); and persons from groups that have historical poor rates of return for TST reading.

When using a TST to test for infection, a TST result of ≥5 mm induration is considered positive in ***all contacts*** *(high, medium and low priority).*

If the initial TST is five (5) millimeters or greater, the contact is asymptomatic and has a normal chest x-ray, then the contact is diagnosed with LTBI. If after medical evaluation there is no contraindication to LTBI medications the contact should be strongly encouraged to complete LTBI treatment.

If the initial TST is less than five (5) millimeters, a repeat TST is indicated 8-10 weeks after the last exposure to the infectious index case or after smear conversion if exposure is continued. *Window period prophylaxis should only be offered for those contacts who are immunosuppressed or less than 5 years old.*

If the repeat TST is still less than five (5) millimeters, consider the possibility of anergy in immunosuppressed contacts (see tables 2a and 2b, #2). If it is unlikely that a negative TST is the result of anergy, window period prophylaxis should be discontinued. Contacts who are HIV-infected and were started on window period prophylaxis should complete a full course of LTBI treatment.

For contacts, a skin test conversion is defined as an increase of at least 5mm, from less than 5mm on the initial skin test to a reaction of greater than or equal to 5mm on the second test, 8 to 10 weeks after exposure.

LAC TBCP has provided table 3 below to aid in the definition of TST conversion in a contact investigation. Any prior documented TST >10mm should be considered a prior positive and evaluated (as outlined on page 6-43). Expert consultation should be obtained in interpreting TST results in a contact investigation if there continues to be uncertainty about whether individuals have had clinically significant TST changes.

Table 3. Guidance for Defining a Tuberculin Skin Test Converter in a CI[+]

scenario	Previous TST status	Initial post-exposure TST result	Repeat post-exposure TST result	TST converter?
1	No previous documented TST	<5 mm	Increase of at least 5 mm	Yes
		≥ 5 mm	Do not place TST	No (Reactor)
2	Documented previous TST within last 2 years was < 5 mm	<5 mm	Increase of at least 5 mm	Yes
		≥ 5 mm	Do not place TST	Yes
3	Documented previous TST within last 2 years was qualitatively "negative" but no quantitative measurement was noted	< 5 mm	Increase of at least 5 mm	Yes
		≥ 5 mm	Do not place	Yes

[+]Any person with a documented TST negative greater than 2 years prior to exposure who tests positive on the first post-exposure TST (>=5mm) is considered a reactor and not a converter.

In the context of a CI, it is difficult to interpret the results of a two-step TST done to detect boosting of sensitivity. (Note: Two-step testing is distinct from the practice of repeat testing 8–10 weeks after last exposure.) For this reason, CDC does not recommend the use of two-step testing in CI. *A contact whose second test result is positive (increase of at least 5mm) after an initial negative result (<5mm) should be classified as a converter*.

Low priority contacts should be tested at least 8–10 weeks from the time of last exposure. The CI team decision of whether to test low priority contacts will depend on the results of the testing of high and medium priority contacts (see Section 7: When to expand a CI).

At a site where only low priority contacts have been identified, testing outcomes from other sites (that have high and/or medium priority contacts) within the social network of the index patient can be used to decide whether to proceed with testing.

A chest x-ray is indicated at the initial screening of a contact, regardless of TST/IGRA results, for children less than 5 years old, and immunosuppressed contacts (i.e. contacts infected with HIV,

contacts on immunosuppressive medical treatment, such as: ≥ l5mg day of prednisone or its equivalent for one month or more, cancer chemotherapy agents, antirejection drugs for organ transplantation, tumor necrosis factor alpha (TNF-α) antagonists).

Any contact (high, medium or low priority) with signs and/or symptoms of active TB (e.g. chronic cough, unexplained weight loss, night sweats, fever) should be fully evaluated for TB disease.

Management of broken appointments differs between high, medium and low priority contacts. Contacts who fail to comply with an initial appointment for examination should be managed in the following manner:

- For high priority contacts, the DPHN should contact the patient immediately to reschedule an appointment within one week. With the second broken appointment, the high priority contact is referred to the PHNS and then to the SPHI. With the third broken appointment, the TB clinician should review the contact's exposure and risk factors and assess the need for a Legal Order of Examination within 72 hours.

- For medium priority contacts, the DPHN should reschedule an appointment within two weeks. With the second broken appointment, it is not necessary to make further attempts to reschedule the contact. The TB Clinician should disposition the contact.

- If a low priority contact breaks the initial appointment, the investigation of that contact may be closed at the discretion of the DPHN. It is not necessary to reschedule the contact for an appointment.

Principles of contact investigation for multidrug-resistant TB (MDR-TB) index cases are the same as those used for index cases who have drug-susceptible TB. While MDR-TB organisms are not considered more virulent than drug-susceptible organisms, a heightened effort should be made to identify and evaluate all contacts because of the increased complexities regarding LTBI treatment or treatment of TB disease that may arise. Consultation with TBCP for expert advice about MDR-LTBI treatment is required.

Tool – Timeframe for contact follow-up, Diagnosis and evaluation of contacts TBCP BA follow-up
Reference - pages 31-44 of the LAC DPH TBCP CI Guidelines

6. Treatment of Contacts

Once contacts have been identified and screened, appropriate treatment of contacts is essential.

In the absence of treatment for LTBI, 5% to 10% of immunologically competent adults develop TB disease during their lifetimes, and half of the risk occurs in the first 2 to 3 years after infection[xvi]. Infected children have a comparatively higher risk of progression to active disease: 43% of infants less than 1 year of age, 24% of children 1 to 5 years old, and 15% of those 11 to 15 years old

develop TB disease if not treated for LTBI[xvii]. Factors that increase the risk of progression to disease usually affect the immune system — HIV-infection is the most important risk factor that promotes progression to active TB in people with LTBI. Compared to a 5% to 10% lifetime risk for an immunologically competent adult, persons infected with HIV have a 5% to 15% annual risk of developing active TB disease[xviii].

All contacts that are examined and diagnosed with LTBI but refuse therapy should be counseled regarding their specific risk for developing TB disease. This includes contacts with a history of a previously positive TST/IGRA. The PHN and CHS chest clinician should discuss with patients and their families the reasons for refusing treatment and attempt to address concerns or misconceptions about TB infection and TB disease. Initiation and completion of treatment for LTBI is an essential component of CIs and every effort should be made to ensure high rates of initiation and completion. For certain high priority contacts who refuse treatment, such as persons living with HIV, other immunosuppressed individuals or children < 5 years of age, the CHS chest clinician may require that the contact return for periodic examinations to evaluate for active TB disease.

Contacts may choose to be followed by their own health care provider. In such cases, the PHN should contact the primary care physician and stress the need for TB testing and initiation and completion of LTBI treatment as indicated. Private providers should follow the guidelines for medical management of contacts as described in this chapter. The PHN case manager must obtain final TB evaluation results for those contacts that are evaluated by their primary care provider. If LTBI treatment was initiated, treatment start date and final treatment outcome should be obtained in a timely manner.

For contacts who initiate LTBI therapy, every effort must be made to help support completion of therapy. This is an opportunity to address barriers to LTBI treatment adherence. Completion of LTBI treatment is essential to interrupting the chain of transmission of TB and is one of the most important goals of all contact investigations.

Tool –Primary Care Provider follow-up letter, Primary Care Provider evaluation summary roster (CHS template letter)
Reference - pages 44-46 of the LAC DPH TBCP CI Guidelines, TB control manual chapter 2

7. When to Expand a Contact Investigation

The decision to expand a CI should be based on the outcome of screening of high and medium priority contacts. Generally the screening outcome for at least 70% of high and medium priority contacts within a large investigation should be completed prior to assessing the need for expansion. In addition, the identification of other TB cases or any TST/IGRA conversions among the contacts should trigger discussion of expanding the CI.

The CI Core Team should **consider** expanding the scope (i.e., number of contacts) of an investigation if any one or more of the following criteria are met:

- Unexpectedly high prevalence of LTBI in high or medium priority contacts. Two sources that can be used to estimate prevalence are:
  - The 1999-2000 National Health and Nutrition Examination Survey (NHANES) which indicates that the estimated prevalence of LTBI in US born individuals (based on TST screening) is 1.8% and in non-US born individuals living in the US is 18.7%[xix],
  - Los Angeles County TBCP School Mandate Data - contact TBCP **OR**
- TB disease in any contacts, **OR**
- TB infection in any contacts aged <5 years, **OR**
- Contacts with change in TST/IGRA status from negative to positive (see table 3)

At times, preliminary data may provide sufficient evidence to support recent transmission in the setting. Thus, a decision to expand the investigation may be made even if less than 70% of contacts have been evaluated. In these situations, derive the strategy for expanding an investigation from the data obtained to that point in time. Without data from the initial contact investigation to support evidence of transmission, there is no indication to expand a CI. Ensure that you have data from all of the identified contacts, including those who reside in other public health centers.

Tool – framework-when to expand a contact investigation, calculation of infection rate
Reference - pages 47-48 of the LAC DPH TBCP CI Guidelines

8. Communicating through the Media

As per Los Angeles County guidelines, all media inquiries should be routed through DPH External Relations and Communications Office. It is often helpful to anticipate media inquiries for high profile settings, such as schools or large workplaces. In these instances, consider contacting the External Relations and Communications Office prior to actually receiving a media inquiry.
Media line: (213) 240-8144
E-mail: media@ph.lacounty.gov

Tool – N/A
Reference - pages 48-50 of the LAC DPH TBCP CI Guidelines, LAC DPH Policy No. 400 Contact with News Media

9. Data Management and Evaluation of Contact Investigation

Data management related to contact investigations has three broad components: data collection, data summary, and data analysis.

Data collection should be done using standardized (paper or electronic) forms to allow for the systematic collection of data in an organized fashion. The collection and management of contact information in a large and/or more complicated investigations may be enhanced by using an

electronic contact list. Summarizing contact evaluations in an electronic format will make sorting, calculating and analyzing the results of the investigation easier for the CI Core Team. In these situations, it would be appropriate to notify TBCP that an electronic contact roster would be submitted in place of an H289.

Data collected should be summarized and presented in an easy to understand electronic format to enable the CI Core Team to routinely access standardized summary reports. CI Core Team decisions regarding which contacts to assign as high, medium and low priority must be documented so as to aid in assessing and evaluating outcomes.

Data analysis should be carried out by the CI Core Team periodically throughout the investigation in order to determine if transmission occured.

A comprehensive analysis should be done at the completion of the investigation. Ideally, as a result of this comprehensive analysis, a CI summary should be generated to identify lessons learned and best practices. Large complex investigations involving TBCP and CHS should be documented in a 'Post Event Evaluation'. TBCP and CHS should work together after such investigations to document a summary of the investigation, including: decisions made throughout the investigation (prioritization of sites, contacts included in testing and those not included), epidemiologic links identified between cases, probable/possible sites of exposure, resources allocated, assessment of the response, lessons learned, TBCP specific recommendations, CHS specific recommendations and if necessary, any corrective action measures. When possible, Post Event Evaluations should take place no later than three months after the screening and testing of contacts.

The purpose of the Contact Investigation Data Management Tool is to provide an overall assessment of the investigation and should be used to communicate information from CHS to TBCP. Additional information may be requested by TBCP during the investigation to aid in oversight and consultation. Data elements to be reported to TBCP are outlined in the below table 4.

Table 4 Minimum Data Elements Reported to TBCP

Outcome	Definition (contacts at each site/setting)	Suggested indicators for CI completeness
A. # of contacts identified	Includes all potentially exposed contacts (stratified by priority)	
B. # with initial evaluation	Includes all contacts for whom medical history and TB exposure history have been obtained	B/A (Goal=100%)
C. # fully evaluated	Includes all contacts for whom necessary testing to provide final diagnosis of LTBI, including TST/IGRA (if indicated) and CXR (if indicated) was obtained	C/B (Goal=100%)
D. # diagnosed with LTBI	Includes all reactors, documented prior positives, and documented converters	

i. # reactors	Includes all reactors (either on 1st or 2nd test), excluding converters	
ii. # prior positive TST/IGRA	Includes all documented prior TST/IGRA positives	
iii. # documented converters	Includes all converters (either on 1st or 2nd test)	
E. Infection rate (%)	(D - Dii) / (C – Dii)	
F. # started on LTBI treatment		F/D (Goal=100%)
G. # completed LTBI treatment		G/F (Goal=100%)
H. # children (< 5 years old) diagnosed with LTBI		
I. # suspects or additional confirmed cases	Excluding the index case	

Tool – Contact Investigation Data Management Tool
Reference - pages 50-56 of the LAC DPH TBCP CI Guidelines, LAC DPH Policy No. 400 Contact with News Media

10. Special Circumstances

In addition to the general challenges that a large scale TB contact investigation may present, a CI in a health care setting, school, homeless shelter or correctional facility poses several specific challenges that are important to consider in planning and carrying out activities. This section is based on lessons learned from CIs conducted in these particular settings.

The early identification of a TB exposure, within a health care setting, school, homeless shelter, or correctional facility, is critical and is usually determined during the initial patient interview. The CI Core Team should review all available information regarding the exposure and determine if a CI should be initiated. Once a decision to initiate a CI has been made, the CI Core Team should determine how and when to notify the facility. The public health department and facility administration should be in close communication and coordinate CI activities to ensure that the investigation proceeds as quickly and efficiently as possible. A written action plan outlining roles/responsibilities and agreed upon timelines may help to reduce duplicative tasks and focus limited resources.

Contact investigation within a homeless shelter or school will require management of a large number of contacts. For this reason, TBCP recommends that, when possible, the initial contact roster be obtained in electronic format from the facility administration. In addition to name, date of birth, country of birth, and contact information, administration should also be asked to include information on prior TB screening and known medical conditions.

The TBCP can be an important resource and partner for approaching contact investigations in special situations, including (but not limited to):

- Homeless persons
- Prolonged infectious periods (e.g., > 1 year)
- Congregate settings
- Drug resistance
- Any evidence of transmission (i.e., another case with the same genotype or likely connection)
- Sites involving immunosuppressed individuals
- Other situations that require a more complex approach

One should have a low threshold to inform TBCP of CIs meeting the above criteria, as unorthodox approaches or advanced epidemiologic methods may be necessary.

Contact investigations within health care settings

Post exposure follow up of Health Care Workers is an employer responsibility as outlined in Title 8 of the California Code of Regulations(CCR) General Industry Safety Orders § 5199, also known as the Aerosol Transmissible Disease (ATD) Standard[xx]. Covered workplaces include health care settings, such as hospitals, skilled nursing facilities, clinics, doctor's offices, other outpatient medical facilities, home health care operations, long-term health care facilities, hospices, medical transport, homeless shelters, correctional facilities, drug treatment programs, emergency response operations, and coroner facilities and laboratories. The Division of Occupational Safety and Health (DOSH) has drafted summary sheets to assist in understanding how proposed Section 5199 would apply in certain facilities (see California State Department of Industrial Relations).

Certain health care facilities are not covered by the standard if they meet specific conditions outlined in the standard. For example, outpatient dental clinics are not required to comply with the standard if they do not perform dental procedures on patients identified as having or suspected of having an ATD. They must have written procedures for screening patients for ATDs, they must implement these procedures before performing any dental procedure to determine if there is an exposure risk and staff must be trained on the screening procedures.

Likewise, certain specialty clinics are not required to comply with the standard if they do not perform aerosol generating procedures on cases or suspected cases of ATDs, have a screening process in place to identify patients with potential exposure risk and implement the screening procedure prior to treating the patients. Staff must also be trained on the established procedures.

At times, in smaller medical settings only low priority contacts are identified using duration and intensity criteria. In such cases an attempt should be made to determine whether children <5 years old and/or immunosuppressed individuals were at the setting during the exposure period. These contacts should be reclassified as high priority and undergo evaluation for TB infection. The decision to test low priority contacts at these sites can be made based on the review of testing outcomes of high and medium priority contacts at other exposure sites within the social network of the index patient.

The below summary of public health responsibilities are not intended to modify or replace the actual language of the standard, rather are listed to clarify responsibilities.

Public Health Responsibility

The Public Health Department's interaction with a health care facility after a TB exposure depends on the type of facility where the exposure took place. The table on page 6-49 identifies the lead department/program responsible for notifying and working with the major types of health care facilities

Community Health Services (CHS) staff responsibilities

- Notify the facility/agency of the potential exposure
- Assist with determining the infectious period
- Assist with determining the exposure period for the identified exposure setting(s)
- Assist with setting limits of the contact investigation (post exposure follow up)
- Recommend that the facility notify the primary provider of any patients who may need TB screening
- Offer assistance in locating and evaluating employee contacts who are no longer employed, employee contacts on long term leave, or patient contacts who do not have a primary provider.
- Request a summary of the post exposure follow up (# contacts identified, number screened and outcome of the screening).

Tuberculosis Control Program (TBCP) responsibilities

Upon reporting of an infectious TB suspect/case from a public/private hospital, TBCP will determine from the Infection Control Practitioner (ICP) if the patient was appropriately isolated upon entry to the hospital. If the patient was appropriately isolated, no CI will be needed at the facility. If the patient was not appropriately isolated, a CI is indicated at the facility. TBCP will notify the district of residence public health center on the GOTCH H-803 or H-1365 Hospital TB Reporting Forms.

CHS staff may contact surveillance nursing staff if they become aware of a potential health care facility exposure not previously identified. CHS staff should send an H-289 and a progress note which includes the patient demographic information, infectious period and hospital/clinic information and any pertinent information to the following email address: TBCPSurvNur@ph.lacounty.gov. Surveillance nursing will then notify the appropriate facility contact and request information regarding isolation and need for post exposure follow up of exposed contacts

TBCP surveillance nursing will offer health department assistance in locating and evaluating exposed contacts unable to be evaluated by the facility (i.e., patient contacts without a primary care provider, visitors, former employees, employees on long-term leave). The TBCP recognizes the employer responsibility to evaluate employee contacts under Title 8CCR, however, assistance will be offered to locate and evaluate employees when all employer attempts have failed. Any patient contact or employees unable to be located or screened will be referred by TBCP to the district of residence public health center for TB evaluation.

TBCP can assist with obtaining summary CI reports from public/private hospitals. These requests should be provided to the TBCP Surveillance APS or LPHN. Due to the nature of post exposure follow up testing and the potential for second round testing, results may take up to 3 months for completion. TBCP will provide CI summary reports from public/private hospitals to CHS at the request of the CI Core Team Lead or designee.

The California Codes and Regulations Title 22, indicates that there are additional requirements of health care facilities to provide information to the local health officer in the event of an unusual occurrence (e.g. TB exposure). The relevant Title 22 chapters and articles are as follows:

Skilled Nursing Facilities – chapter 3, article 5, §72541
Acute Psych Hospital – chapter 2, article 6, §71535
Intermediate Care Facilities – chapter 4, article 4, §73539
Primary Care Clinic – chapter 7, article 6, §75053

Tool – Health care facility notification and summary report (CHS template letters), California State Department of Industrial Relations - ATD fact sheets

Reference - ATD standards

Contact investigations surrounding patients who are homeless

Contact investigations involving homeless patients are challenging for many reasons including:

- Difficulty locating the patient and contacts if they are mobile
- Episodic incarceration
- Migration from one jurisdiction to another
- Psychiatric illnesses (including chemical dependency disorders) that hinder communication or participation

Due to a high prevalence of TB risk factors (e.g., substance abuse, HIV infection) and transmission in congregate settings, TB among homeless persons is a priority for TB control and prevention. A contact investigation among homeless persons, when conducted in a targeted and well-planned manner, has the potential to be a very high impact public health intervention.

Interview:

A TB CI interview with a homeless patient may be affected by his/her lifestyle, life circumstance, or the client's prior (positive or negative) encounters with other county agencies/departments. For this reason, greater time should be allocated for conducting an interview in order to first develop rapport and trust between the homeless patient and the interviewer. Careful consideration should be placed on where the interview should take place and who should be present.

A TB CI interview with a homeless patient should take place as soon as possible. If the patient is hospitalized at time of initial report, the interview should take place before discharge. The basic interview conducted for most patients with TB is often not sufficient for patients who are homeless. Interviews with homeless patients should include detailed information on shelters, social hangouts, location of meals, prior hospitalization(s), location and dates of incarceration, employment, and frequent use of public transportation.

It is not uncommon for homeless persons to express during an interview that they have few or no close contacts. When names or locations of specific contacts are unknown, interviews with the patient and potential contacts should focus on social networks and settings, including correctional facilities. Often it is possible that a homeless individual will spend a substantial amount of time with other people without realizing it. After carefully questioning and listening, it might become apparent that a homeless client has established a regular daily routine, visiting the same locations or meeting with friends (social hangouts). If the client indicates that he/she stays at a particular shelter, it is critical to conduct a site visit and speak with shelter staff (day time and night time staff) to identify close friends and contacts.

Establishing infectious periods:
As with non-homeless patients, establishing the patient's infectious period is an essential first step to conducting a contact investigation. However, this can be challenging if the patient cannot recall precise dates of symptom onset. Therefore, additional techniques should be used to verify symptom onset. Specifically, asking the patient about previous visits to medical care for TB related symptoms can help refine dates. Efforts should be made to contact medical providers or hospitals to determine the likelihood that the patient was contagious at that time. In addition, records of symptom screens performed at shelter entry can also be used to refine potential start dates for the infectious period.

Visiting sites of exposure:
Site visits and interviews are crucial, because the social communities of homeless persons are likely to vary by situation. A contact investigation presents an opportunity to review the screening and testing procedures established within a shelter and to offer assistance with these and other means of decreasing transmission of *M. tuberculosis* (e.g., administrative and environmental controls). However, transmission also could occur at sites besides shelters (e.g., jails, taverns, abandoned buildings, and cars).

Settings providing services to homeless persons are affected by policies, laws, and regulations according to their service population, location, and funding sources, and certain of these issues are relevant for the contact investigation. Access to visitation and occupancy rosters (or logs) and to other information regarding persons, vital for listing contacts and determining priorities should be discussed with homeless service providers in advance, so that requests for information become a routine collaboration with public health authorities.

Once sites of exposure have been identified, approaching the investigation will differ depending if the site is a congregate site or a non-congregate site. When conducting an investigation of exposures at a congregate site, such as a homeless shelter, one should:

- Contact shelter administration and shelter TB Liaison
- Contact TBCP early in the process to provide epidemiologic support and technical assistance
- Conduct a site visit and complete site environmental assessment worksheet
- Determine if index patient was part of any programs or obtained any services
- Obtain electronic rosters of clients, including room or bed location
- Review cough log
- Review employee TB screening results

- Review genotype data to identify other cases that may be related
- Set up educational sessions for staff and clients

Identifying exposed contacts:
One surrogate for degree of exposure at an overnight shelter is the bed/cot assignment. The proximity and duration of overlap should be estimated as closely as possible for selecting high and medium priority contacts. However, it is essential to not limit the investigation to individuals with bed assignments near the index case at the time of diagnosis; historical records should be examined for the duration of the infectious period to identify exposed persons who may no longer be at the facility at the time of investigation.

Homeless persons often seek health care from multiple volunteer providers, halfway houses, chemical dependency treatment programs, community clinics, urgent care centers, and hospital emergency departments. Consultation and assistance from health-care providers in these systems can be helpful. This also creates an opportunity for collaboration, contact ascertainment, and mutual education.

Identifying possible sites of exposure at non-congregate site, such as social hangouts or gathering places, are just as important in identifying potential contacts. When investigating exposures at non-congregate sites one should:

- Talk with the owner or manager about the investigation and need for an investigation
- Research the site and review the location using internet maps to get familiar with the area before a site visit
- Conduct multiple visits to the site (during similar times that the patient visited the site) to identify regular customers or clients
- Ask about regular customers and clients
- Encourage compliance for screening and testing in the field through the use of incentives and enablers

Contact investigations with schools
This category includes child care centers, preschools, primary through secondary schools, vocational schools that replace or immediately follow secondary school, and colleges or universities.

Early collaboration with school officials and community members is recommended when considering an investigation related to a school, even if preliminary information suggests that an investigation is unnecessary. TBCP recommends that when the CI Core Team decides that a CI is necessary in a school setting, the District Public Health Center work closely with the school administration. Determining whether the student attended classes or participated in extracurricular activities at school during his/her infectious period, should be validated with school district officials. The typical features of contact investigations in schools are the potentially substantial numbers of contacts and difficulties in assigning priorities to contacts who have undetermined durations and proximities of exposure. The potential is great for controversies among public health officials, school officials, and the guardians of the children.

The presence of TB in schools often generates publicity. Ideally, the health department should communicate with the school and parents (and guardians) before any media report a story. Public health officials should anticipate media coverage and plan a collaborative strategy.

Consent, agreement, and disclosure of information are more complex for non-emancipated minors than for adults. Each interaction with a minor is also a potential interaction with the family. The health department typically has limited alternatives for evaluating a minor if permission is not granted. Minors that are 12 years or older that have been exposed to an infectious index can consent to TB evaluation as outlined in CHS Policy 321.

Public health officials should visit the school to check indoor spaces, observe general conditions, and interview maintenance personnel regarding ventilation. Class assignment records help in listing contacts, estimating durations of exposure, and setting priorities. However, certain schools purge these files at the end of each school year, in which case interviews with students and personnel are necessary to list contacts.

Extracurricular activities add other exposure sites and contacts. Clubs, sports, and certain classes require additional information gained from interviewing the patient, the patient's guardians, and school personnel. For patients who ride school buses, a bus company might keep a roster of riders with addresses.

The strategy for contact investigations in child care centers, preschools, and primary schools depends on whether the index patient is a child (i.e., preadolescent) or an adult (e.g., a teacher or caregiver). The potential infectiousness of an adult in the school should be determined (see Decisions to Initiate a Contact Investigation and Investigating the Index Patient and Site Evaluation). “There are a number of reasons why children with TB disease may be less contagious than adults. First, children often have paucibacillary disease, leading to low rates of AFB-positive specimens. Second, young children are less likely to have cavitary lesions, in part due to less mature immune responses. Third, pre-pubertal children have a less forceful cough than adults and the cough is less likely to be productive, leading to decreased aerosolization. Fourth, childhood TB is more likely to be extra-pulmonary in nature than TB in immunocompetent adults. Finally, children may be less contagious, on a public health level, simply because they have more circumscribed social networks than adults.”[xxi]

In a source-case investigation of a child aged <5 years who has TB and who attends preschool or child care, all adults in these settings should be included if the source case has not been located in the family or household (see Source-Case Finding). Certain home-based child care centers include adults who do not provide child care but who still share airspace with the children. Source-case investigations should not be pursued in primary and higher-level schools unless other evidence points to the school as the focus.

In secondary and higher levels of education, students usually have adult-form TB, and infectiousness can be estimated by the standard criteria (see Decisions to Initiate a Contact Investigation and Investigating the Index Patient and Sites Evaluation). With advancing education, academic schedules and extracurricular social schedules become more complex, and the information reported by the index patient is more important for a thorough investigation than it is for younger children.

Though LA County no longer requires TB testing of students as a school entry requirement, most school districts have pre-employment requirements for TB clearance screening (e.g., a test for *M. tuberculosis* infection) and some school districts still require TB clearance for entering students. Certain colleges and universities also have these requirements. These baseline data are helpful for interpreting results from the investigation. Currently, children in daycare centers and pre-schools are required by CA State law to be assessed for risk factors of TB and then tested only if found to have a risk factor for TB. For children entering LA County schools, there is no explicit TB testing requirement, but children are supposed to be assessed for risk and tested if a risk factor is present during their State-mandated first grade school entry physical examination. Finally, school employees and volunteers are still required to be tested for TB upon entry into the school system and then every four years after that point.

School breaks, vacations, graduations, and transfers disrupt the contact investigation. In collaboration with school officials, the health department can notify, by mail, students and other contacts who will be unavailable at the school. These contacts should be referred for evaluation at the health department. Contacts choosing to be evaluated by their own providers, should receive written instructions identifying the patient as a contact and instructions on whom to provide final TB evaluation results.

Tool – N/A

Reference - pages 61-82 of the LAC DPH TBCP CI Guidelines, California TB Control Branch Contact Investigation in Schools Toolkit, California Tuberculosis Screening Guidelines for Child Care Centers and Schools

11. Source Case Finding

Source Case Finding (SCF) attempts to determine the source of TB disease in a child. Initiating a SCF may yield new cases and a high yield of infected individuals that stem from a common source of infection. Examination of the closest associates is usually all that is necessary, but the investigation may become larger if more infected persons are found and the source case is not immediately apparent. Source case findings can be considered for children under the age of five years old.

SCF includes interviewing and re-interviewing a proxy adult (usually parents or guardian) and similar interviewing and investigation principles described in earlier chapters apply. Additionally, inquiries such as child care, family visitors, travel, known family/friends with TB symptoms, and child's daily routine should be discussed.

Source case finding should not be done for a child of any age diagnosed with LTBI.
Reference - pages 82-84 of the LAC DPH TBCP CI Guidelines

III. Tool kit

Master List of Tools

CI Core Team Grid: Quick Reference for AMD and Nurse Managers

1. Decision to initiate CI
   Sputum smear positive,
   Sputum smear negative

2. Investigating Index Patient
   Interview checklist, preliminary list of open-ended questions,
   Estimating infectious period table,
   List of possible exposure site(s)

3. Site(s) evaluation
   Exposure site assessment

4. Assigning Priorities to Contacts
   Prioritization of contacts,

5. Diagnosis and Evaluation of Contacts
   Timeframe for contact follow-up,
   Diagnosis and evaluation of contacts,
   TBCP BA follow-up

6. Treatment of Contacts
   N/A

7. When to Expand CI
   Framework-when to expand a contact investigation,
   Calculation of infection rate

8. Communicating with the Media
   N/A

9. Data Management and Evaluation of Contacts
   Contact Investigation Data management Tool

10. Special Circumstances
    California State Department of Industrial Relations - ATD fact sheets

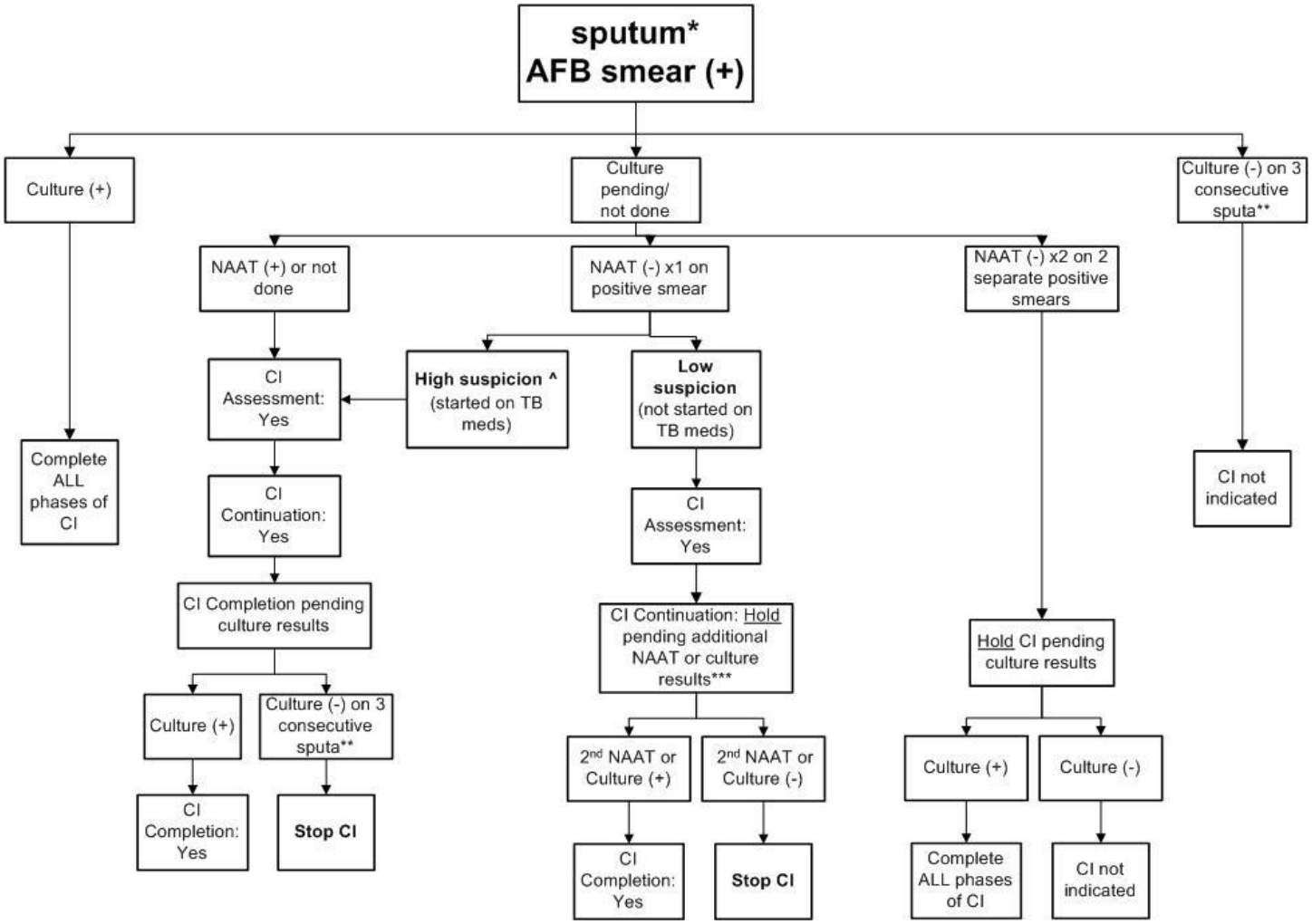
11. Source Case Findings
    N/A

(CHS template letters)

CI CORE TEAM GRID: QUICK REFERENCE GUIDE

OBJECTIVE	COMPONENTS	FACTORS/MEASURES	NOTES
1) Determining scope of the investigation	Estimate degree of contagiousness of the index case	• Anatomic site, • Sputum AFB smear status (+/-), • Radiological findings (CT/CXR), • NAAT/PCR results	
	Determine infectious period (IP)		
	Review social network of index	• Number of exposure sites and settings, • Types of sites/setting (e.g. congregate, high profile)	
2) Assisting with prioritization of exposure sites and contacts	Review types of sites/settings: estimate risk of transmission at each site/setting	• Type of space/area, • Ventilation: (natural, A/C), • Duration of exposure, • Site history: other recent cases at site	
	Establish plan to interact with site administration	• Determine which HC staff will establish primary communication with site administration	
	Determine exposure periods for each site/setting		
	Assess and prioritize contacts within each site/setting	• Infectiousness of index • Contacts' risk of progression to disease • Degree of exposure (intensity and duration)	
3) Identifying strategies to focus resources on contacts at highest risk	Abbreviate infectious period	• If IP > 1 yr, you can start by testing contacts exposed 3-6 months prior to diagnosis	
	Determine if certain sites can do their own testing	• e.g., SNF, other healthcare facilities	
	Delay testing of low priority wherever possible	• $\geq$ 8 weeks post exposure	
	Assess need to test low priority based on result of high and medium priority testing data	• Review data from testing of high/medium priority contacts	
	Assess resource availability and prioritize work	• CHS Administrative staff at HC takes into account current demands, other CI activities, etc.	
4) Determining need to expand	Determine if exposure occurred at site	• Identification of any new cases or conversions among groups initially tested. • Determine whether to expand to low priority contacts	
5) Evaluating outcomes	Documentation of key decisions Collection of data and data analysis	• e.g. event notes in CMAP/progress notes • Data forms	

Section I.
Criteria for Initiating a Contact Investigation (1)
TB 3 OR 5 SPUTUM* SMEAR (+)



* 'Sputum' refers to sputum, bronchial washing or bronchoalveolar lavage fluid

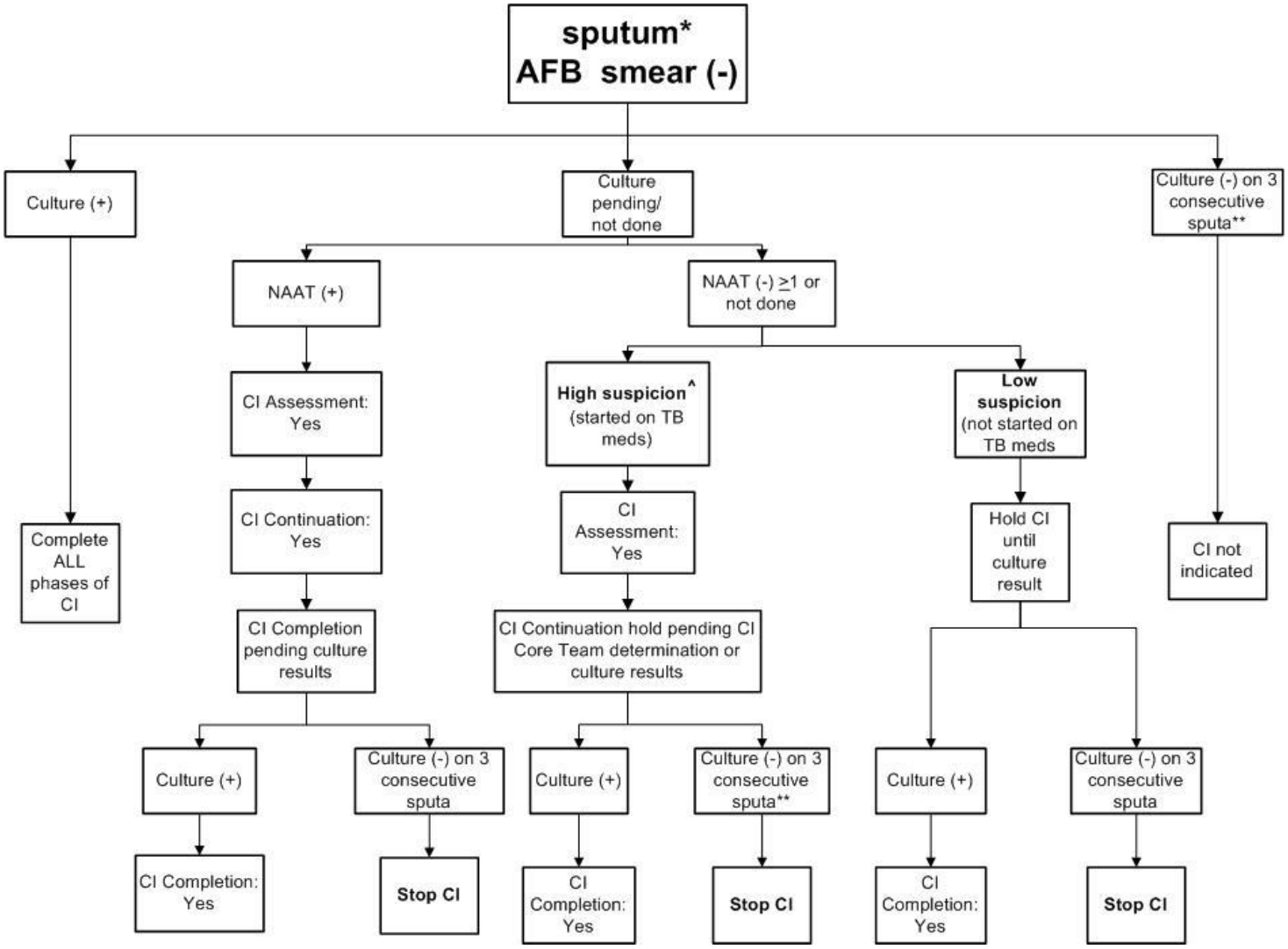
** If patient is unable to produce 3 sputum specimens, then all sputum specimens assessed should be culture negative for Mtb (document in chart, 'all cultures performed are negative for Mtb').

***Refer to 2012 LAC TBCP NAAT guidelines.

^ If meds are stopped (based on a change in diagnosis) then reassess need for CI.

Criteria for initiating a Contact Investigation (2)

TB 3 OR 5 SPUTUM* SMEAR (-)



* 'Sputum' refers to sputum, bronchial washing or bronchoalveolar lavage fluid

** If patient is unable to procedure 3 sputum specimens, then all sputum specimens assessed should be culture negative for Mtb (document in chart, 'all cultures performed are negative for Mtb').

***Refer to 2012 LAC TBCP NAAT guidelines.

^ If meds are stopped (based on a change in diagnosis) then reassess need for CI.

Section II
Investigating Index Patient

Click here to download a copy of:

TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker

TB Interview Checklist

Open-ended Questions (page 44-45)

TB Interview Guide

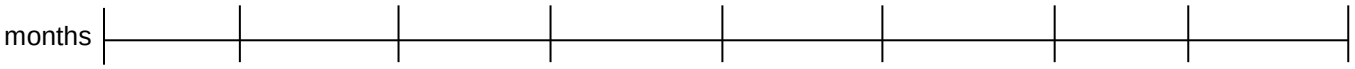
CDC Contact Investigation Patient Brochure

Establishing an Infectious Period

Patients with sputum smear positive for AFB OR cavitary chest x-ray OR with TB symptoms (e.g. cough, hoarseness)	**Patients with sputum smear negative for AFB, AND non-cavitary chest x-ray AND NO TB symptoms**
IP Beginning: 3 months prior to symptom onset or 1st positive finding consistent with TB disease (whichever is longer) Date of Symptom onset:_____ or Date of first positive finding: _____	**IP Beginning: 4 weeks** prior to date of suspected diagnosis (date of treatment started) Date treatment started:_____
IP Ending: All three of the following criteria need to be met: completion and tolerance of 14 days of appropriate TB treatment (preferably via DOT), 3 consecutive negative sputum AFB smears, and clinical improvement. The IP ending date is the latest date out of the 3 criteria. 1) 14 days of TB treatment:_____ 2) Date of 3rd consecutive AFB-negative smear _____ 3) Date of clinical improvement: _____	**IP Ending:** After at least 5 days of appropriate TB treatment is taken and tolerated. Completion of 5 days of TB treatment: _____

NOTE: For MDR cases regardless of sputum AFB smear status, cavitation on chest x-ray or TB symptoms the closure of the infectious period will differ. MDR cases will require additional criteria of at least 3 consecutive negative sputum cultures without a subsequent positive culture and 14 days of TB treatment.

Infectious period worksheet



Estimated Infectious Period: _____ to _____
Start End

List of Possible Exposure Site(s)

How to use this form:

Purpose: To document all sites identified where exposure occurred during the infectious period of a suspect/confirmed TB case.

Index Case:_____ **PF #:** _____-_____ -_____
NAME

Infectious Period: ____/____/____ - ____/____/____

Site Summary

Name of Site: _____ Last Day at Site: __/__/__

Address: _____ Exposure Period: __/__/__ - __/__/__

SPA: _____ District: _____ AMD: _____ PHNS: _____
NAME NAME

When was the District of Exposure notified? __/__/__ Facility Type:_____

Name of Site: _____ Last Day at Site: __/__/__

Address: _____ Exposure Period: __/__/__ - __/__/__

SPA: _____ District: _____ AMD: _____ PHNS: _____
NAME NAME

When was the District of Exposure notified? __/__/__ Facility Type:_____

Name of Site: _____ Last Day at Site: __/__/__

Address: _____Exposure Period: __/__/__ - __/__/__

SPA: _____ District: _____ AMD: _____ PHNS: _____
NAME NAME

When was the District of Exposure notified? __/__/__ Facility Type:_____

Name of Site: _____Last Day at Site: __/__/__

Address: _____Exposure Period: __/__/__ - __/__/__

SPA: _____ District: _____ AMD: _____ PHNS: _____
NAME NAME

When was the District of Exposure notified? __/__/__ Facility Type:_____

Name of Site: _____ Last Day at Site: __/__/__

Address: _____ Exposure Period: __/__/__ - __/__/__

SPA: _____ District: _____ AMD: _____ PHNS: _____
NAME NAME

When was the District of Exposure notified? __/__/__ Facility Type:_____

Section III
Exposure Site Assessment

Suspect/Case:_____ **Date of Assessment:** _____

Site #:_____ **Infectious period:** _____ **to** _____

Type of exposure site (e.g, other residence, workplace, school, shelter, jail, assisted living, SRO etc.):
_____

Name of exposure site: _____ **Contact Person:**_____

Phone number: _____

Last Date of exposure:_____

Exposure Period: ____/____/____ to ____/____/____

List exposure settings at site:	Size of exposure area: (car / bedroom / house / >house)	sq. ft (if available)	Cumulative hours of exposure during IP: (duration x frequency x timeframe of exposure)*
a.			X X =
b.			X X =
c.			X X =
d.			X X =

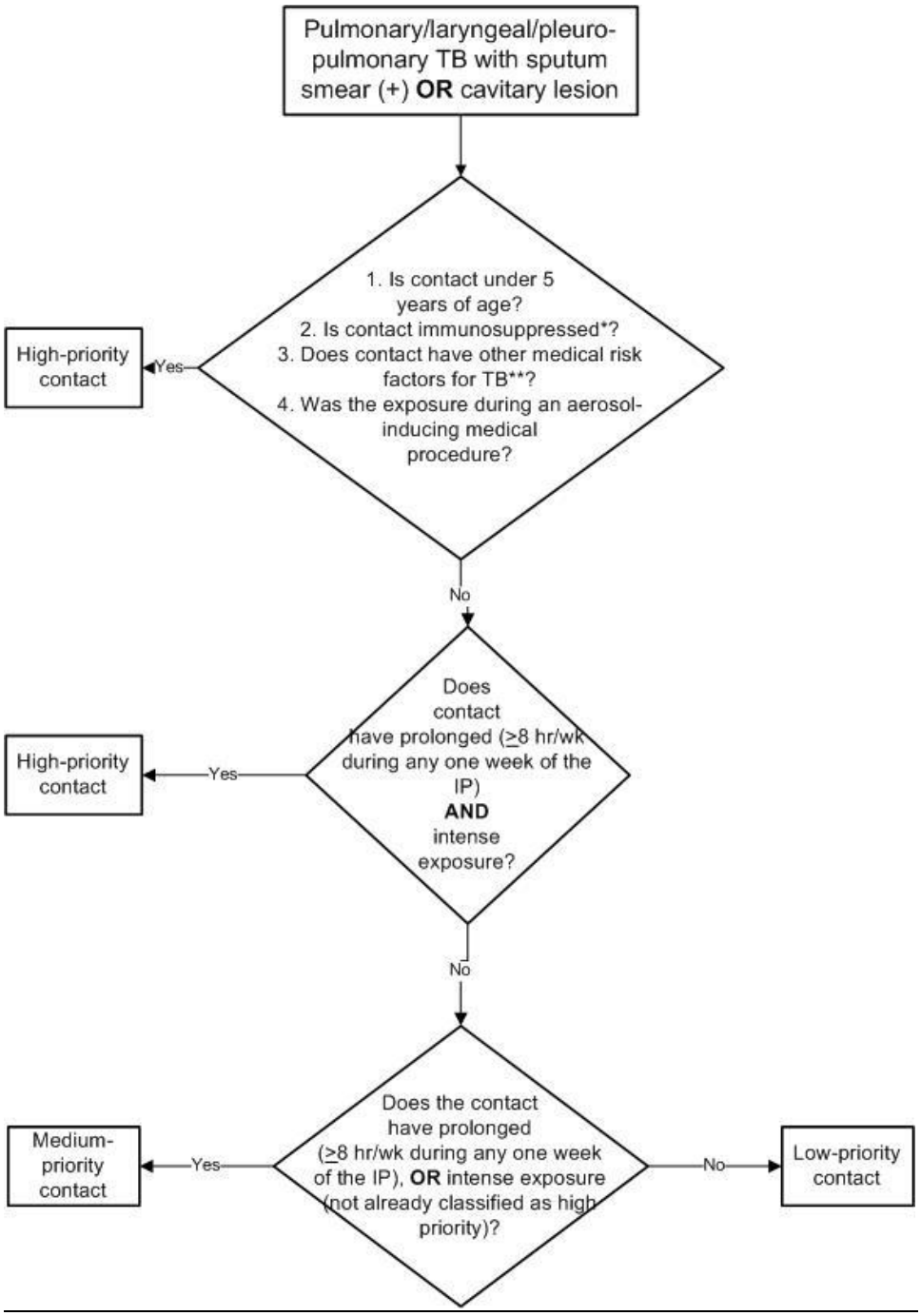
Use separate sheet to record information on additional sites

Type of natural ventilation: (record all that apply) Windows / doors / completely outside Routinely open / closed all the time	**Type of mechanical ventilation:** (record all that apply) wall AC/ central AC / fan / none / other Date of last maintenance (if available):		**Comments: How does it feel when you walk into area:** hot and stuffy / warm / cool
a.			
b.			
c.			
d.			

* Duration - minute or hours of exposure during each occurrence
Frequency - number of exposures per week
Timeframe of exposure- total weeks of exposure period

To supplement this information, pictures, floor plans, video clips, diagrams or other graphical representations of the area can help the CI Core Team understand the space were exposure took place.

Section IV
Prioritization of Contacts
Index: TB 3 or 5 smear (+) OR cavitary chest x-ray



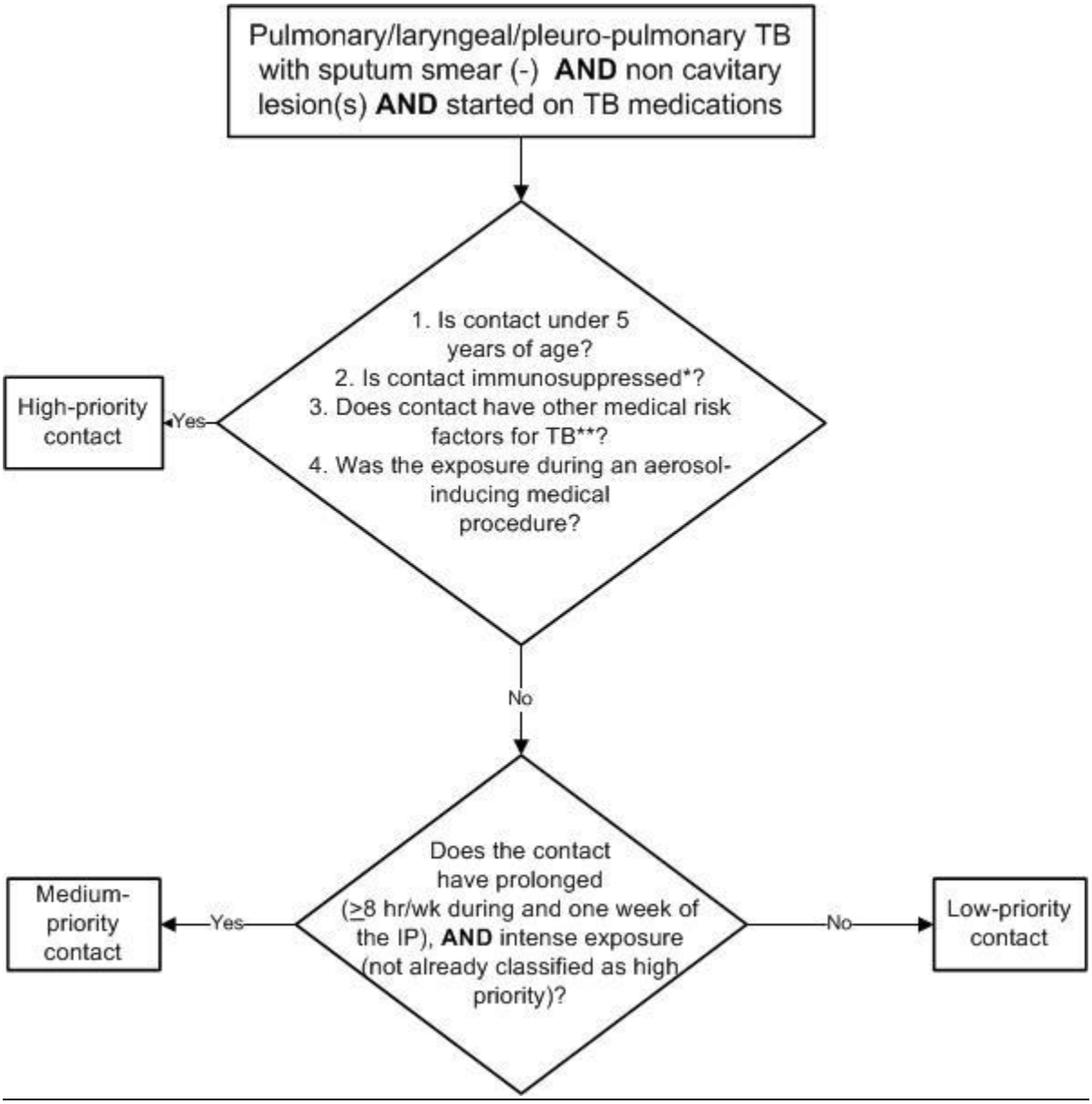
* Immunosuppressed contact: see tables 2a and 2b

**Other medical risk factors for TB: see tables 2a and 2b

Prioritization of Contacts (2)

Index TB 3 or 5:

Smear (-) AND non-cavitary AND started on TB treatment



* Immunosuppressed contact: see tables 2a and 2b

**Other medical risk factors for TB: see tables 2a and 2b

Section V

Timeframe for evaluation of contacts of persons exposed to tuberculosis*

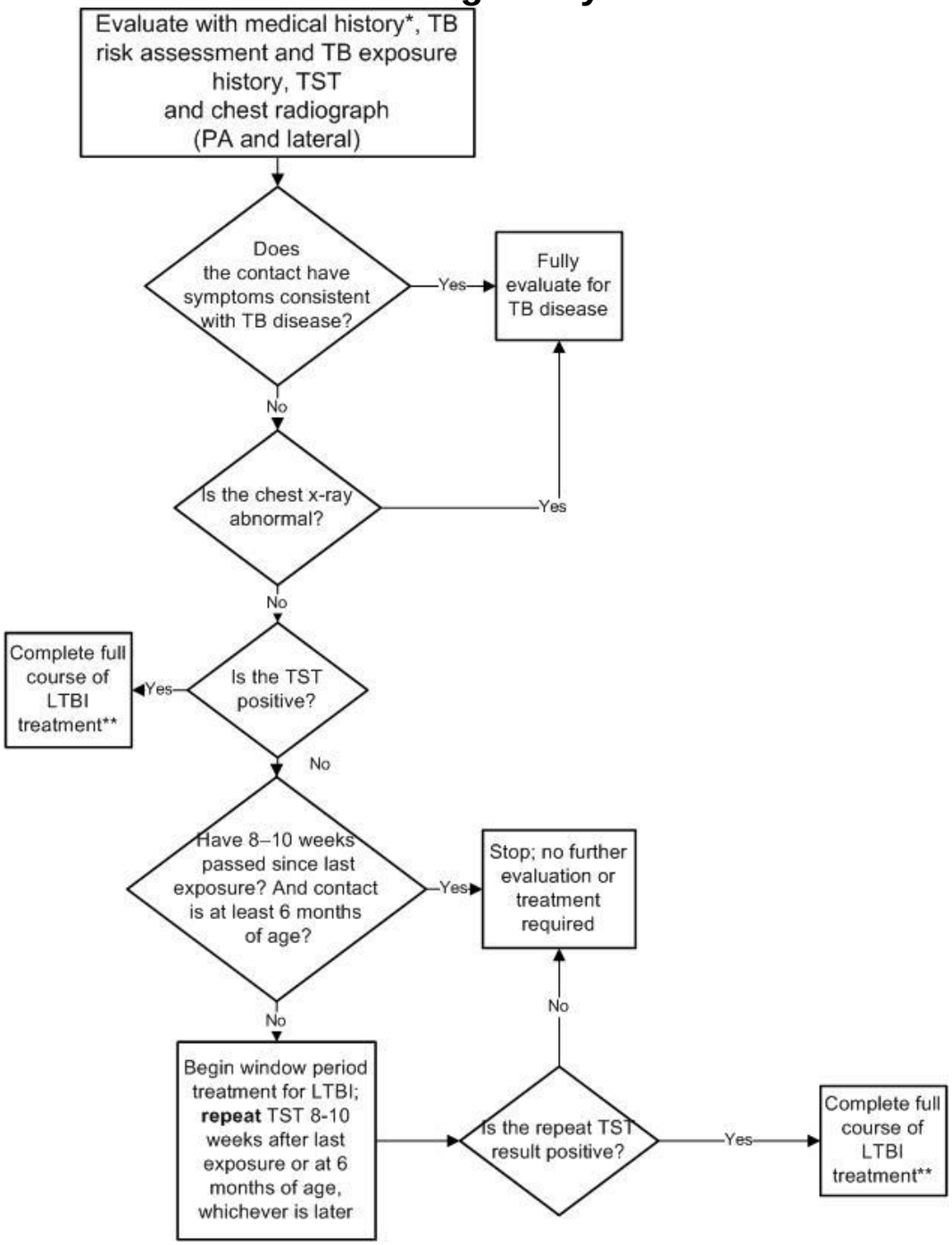
characteristics of index patient	contact priority	Time frame for follow-up	
TB 3 OR 5		From elicitation of contact to initial screening and testing** (calendar days)	From initial screening and testing to completion of medical evaluation (calendar days)
SPUTUM AFB SMEAR (+) **OR** CAVITARY CHEST X-RAY **OR** TB SYMPTOMS	high	5-7	7
	medium	14	10
	low	8-10 **weeks** after last known exposure	14 days from date of screening
SPUTUM AFB SMEAR (-) **AND** NON-CAVITARY CHEST X-RAY **AND** NO TB SYMPTOMS	high	7	10
	medium	14	10
	low	8-10 **weeks** after last known exposure	14 days from date of screening

*not including repeat testing 8-10 weeks after last exposure

** The time frame for follow-up are for those contacts at sites/settings where the CI Core Team has determined a true exposure has taken place.

Diagnosis and Evaluation of Contacts

Evaluation, treatment, and follow-up of contacts age < 5 years

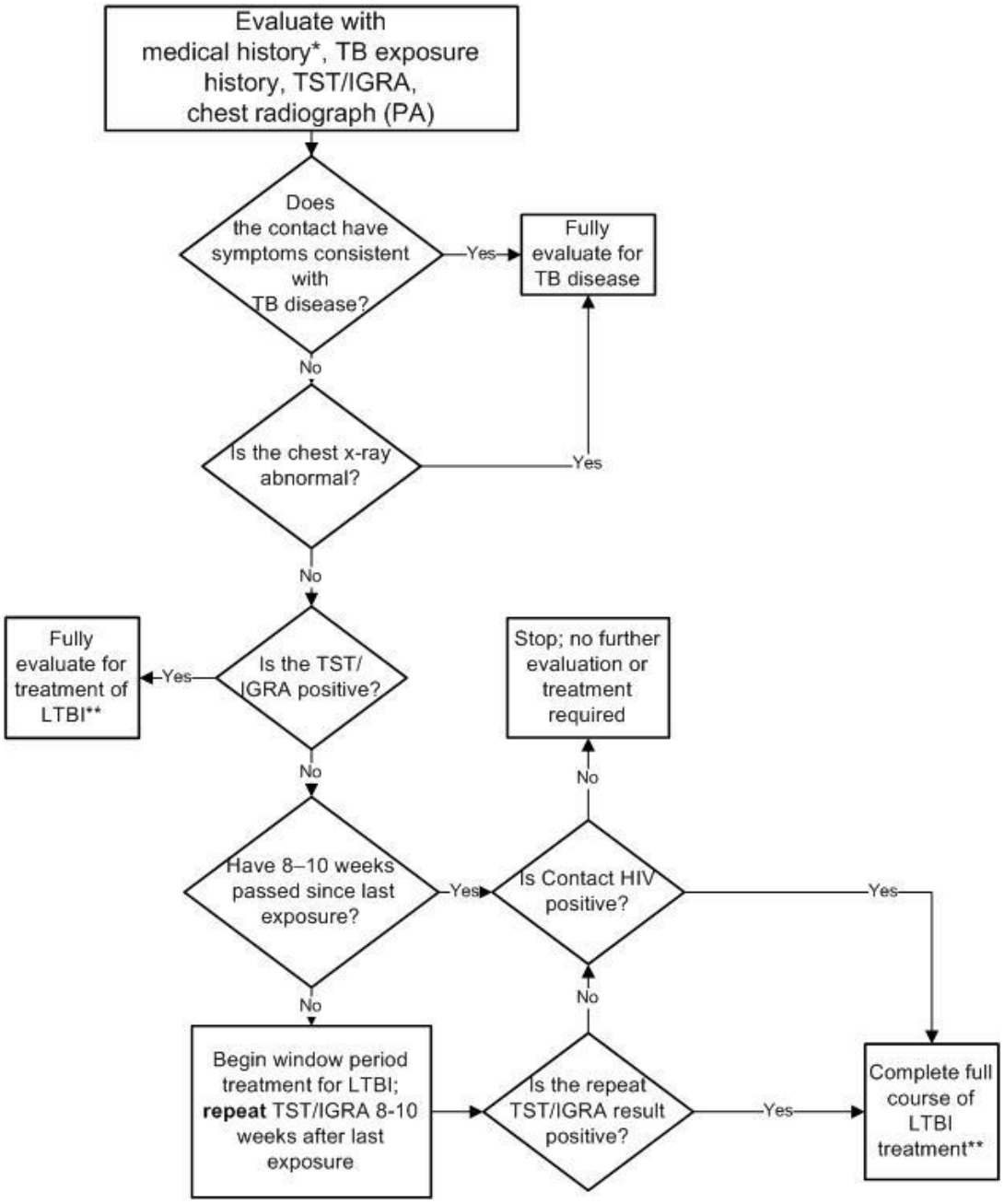


* A medical history should include an assessment of TB risk factors, including comorbid conditions that predispose the contact to an increase risk of progression to TB disease if infected. High and medium priority contacts who have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation.

**Special attention should be paid to immunosuppressed contacts to ensure that they do not have TB disease when starting therapy for LTBI. Careful physician evaluation should precede any decision to initiate LTBI treatment in an immunosuppressed contact.

Diagnosis and Evaluation of Contacts (2)

Evaluation, treatment, and follow-up of Immunosuppressed^ contacts ≥5 years old



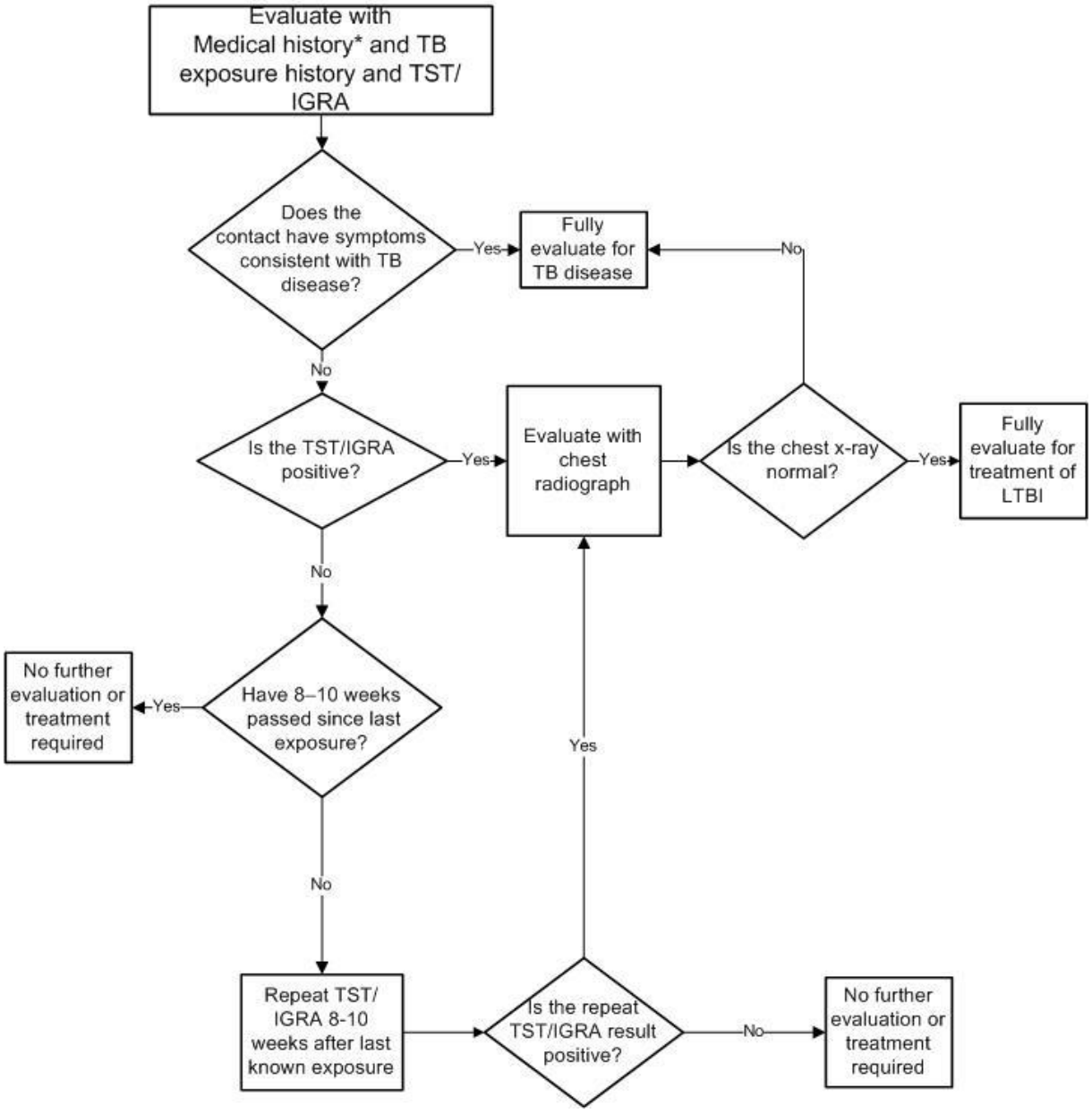
^See tables 2a and 2b, #2 for description of immunosuppressed contacts

* A medical history should include an assessment of TB risk factors, including comorbid conditions that predispose the contact to an increase risk of progression to TB disease if infected. High and medium priority contacts who have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation.

**Special attention should be paid to immunosuppressed contacts to ensure that they do not have TB disease when starting therapy for LTBI. Careful physician evaluation should precede any decision to initiate LTBI treatment in an immunosuppressed contact.

Diagnosis and Evaluation of Contacts (3)

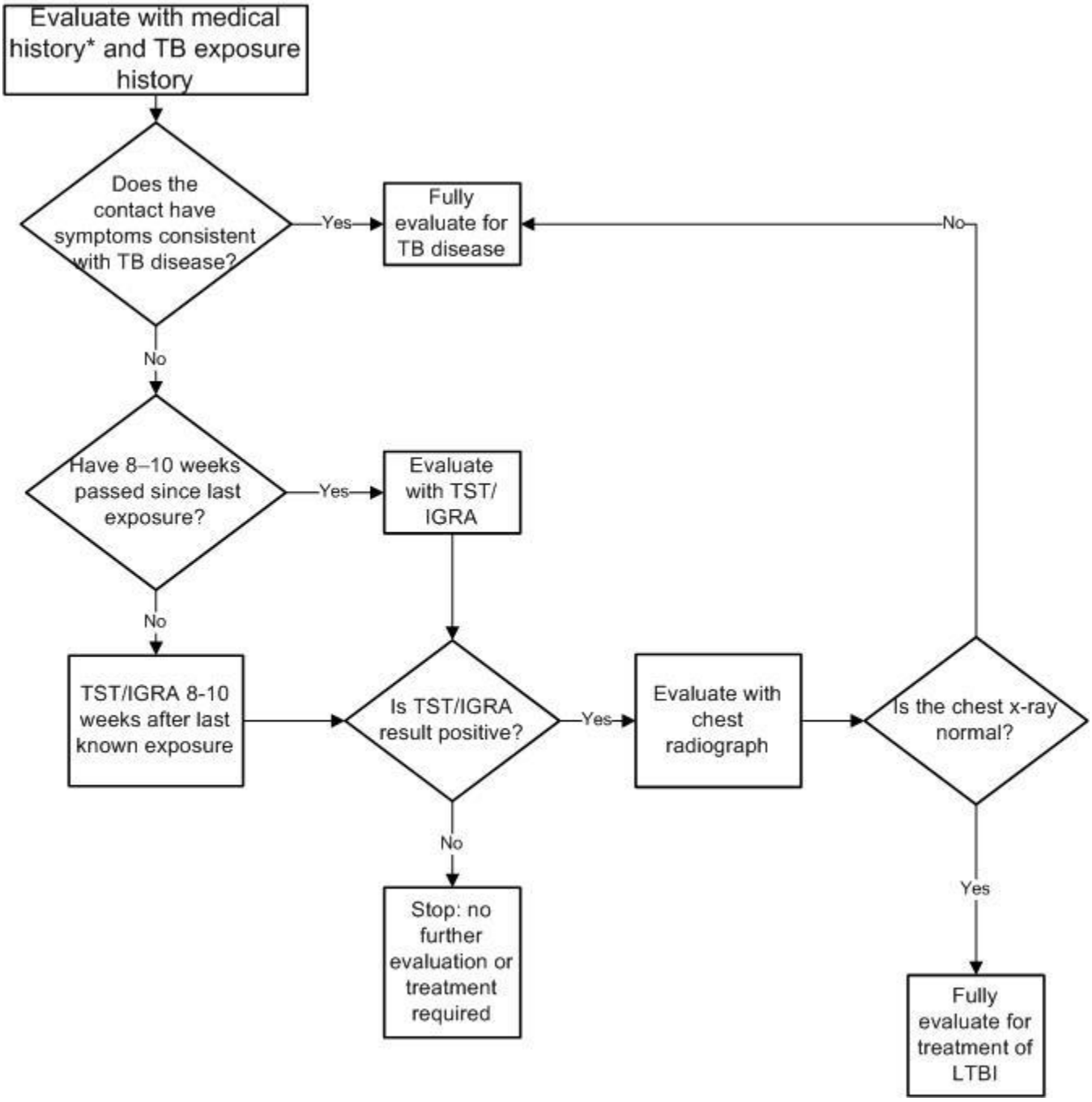
Evaluation, treatment, and follow-up of high and medium priority contacts, that are not immunosuppressed and children aged ≥5 years



* A medical history should include an assessment of TB risk factors, including comorbid conditions that predispose the contact to an increase risk of progression to TB disease if infected. High and medium priority contacts who have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation.

Diagnosis and Evaluation of Contacts (4)

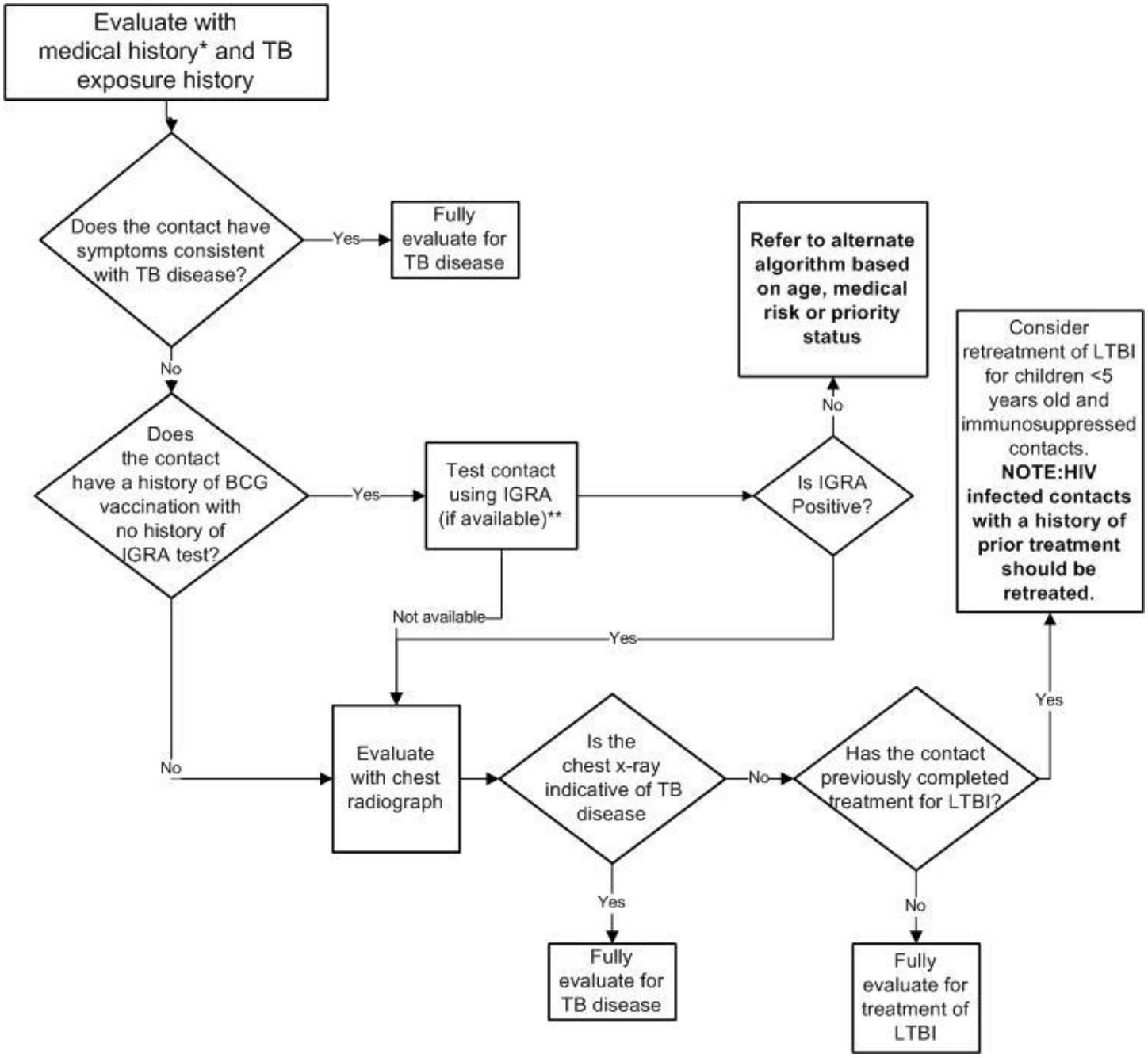
Evaluation, treatment, and follow-up of low priority contacts



* A medical history should include an assessment of TB risk factors, including comorbid conditions that predispose the contact to an increase risk of progression to TB disease if infected. High and medium priority contacts who have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation.

Diagnosis and Evaluation of Contacts (5)

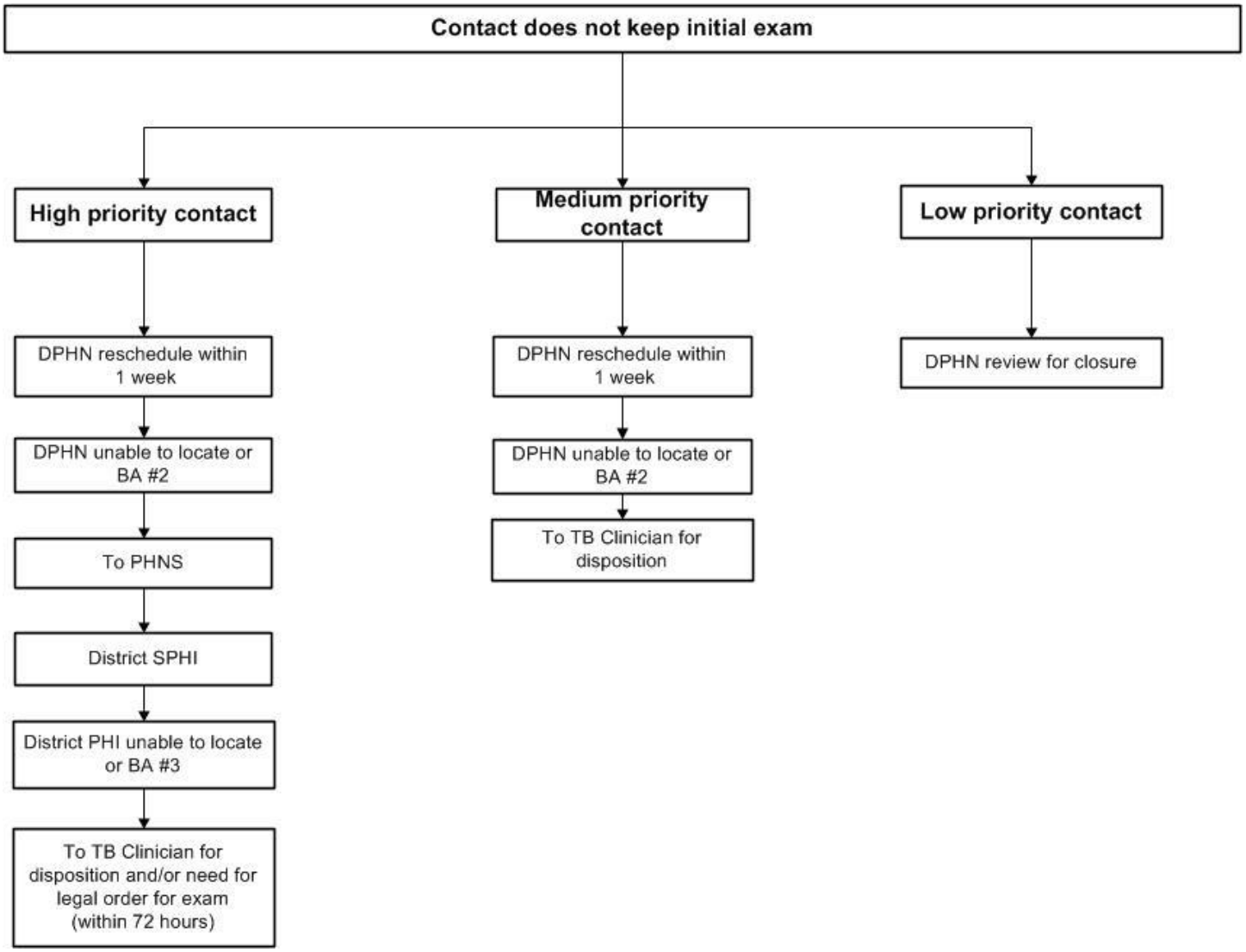
Evaluation, treatment, and follow-up of contacts with a documented previously positive tuberculin skin test OR IGRA



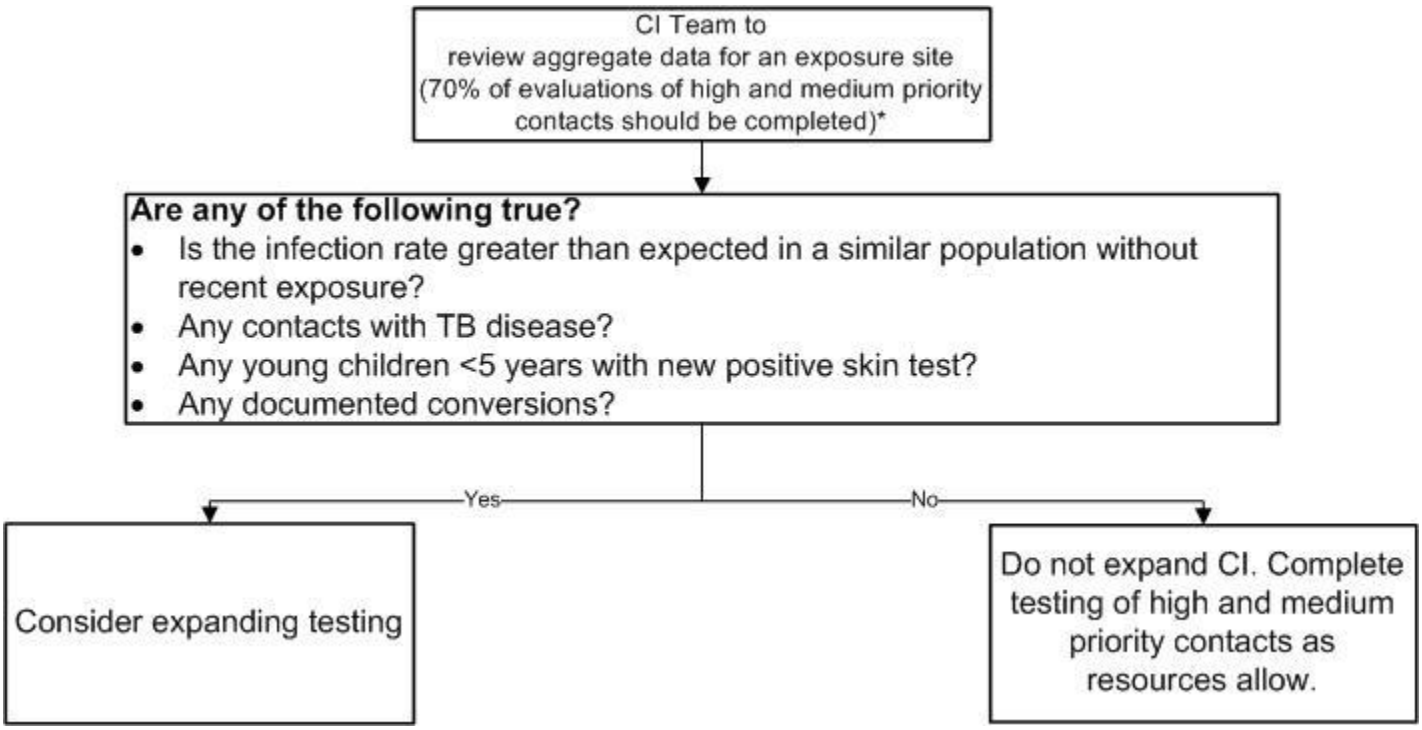
* A medical history should include an assessment of TB risk factors, including comorbid conditions that predispose the contact to an increase risk of progression to TB disease if infected. High and medium priority contacts who have not had an HIV test in the past year should be offered HIV testing as a routine part of their evaluation.

**If available, testing with an IGRA would be most useful in patients that have been previously BCG vaccinated.

TB Contact Investigation
Broken Appointment (BA) and Unable to Locate Follow-up



Section VII
When to Expand CI



*At times, preliminary data may provide sufficient evidence to support recent transmission in the setting. Thus, a decision to expand the investigation may be made even if less than 70% of contacts have been evaluated. In these situations formulate a strategy for expanding an investigation from the data obtained to that point in time.

Calculation of Infection Rate

The percentage of contacts with a similar amount of exposure who have a newly identified positive skin test reaction (5 or more millimeters of induration) or positive IGRA is called the **infection rate** for that group of contacts. (Contacts who had a previously documented positive TST or IGRA before being exposed to the TB patient should be excluded from this percentage.)
To calculate the infection rate among a given group of contacts, the health care worker should follow these steps:

1. Determine the number of contacts with newly identified positive skin tests/IGRA.
    - Subtract the number of contacts with a documented previous positive skin test/IGRA from the total number of contacts with a positive skin test/IGRA (new or previously documented)

2. Next, determine the total number of contacts without a documented previous positive skin test/IGRA.
    - Subtract the number of contacts with a documented previous positive skin test/IGRA from the total number contacts

3. Finally, determine the infection rate.
    - Divide the number of contacts with a new positive skin test/IGRA by the total number of contacts without a documented previous positive skin test/IGRA
    - Multiply by 100; the resulting percentage is the infection rate for the group of contacts

Example:

11 contacts were identified
1 contact had a documented previous positive skin test/IGRA
10 contacts had no documented previous skin test/IGRA
7 of the 10 contacts had a newly identified positive skin test/IGRA
3 of the 10 contacts had a newly identified negative skin test/IGRA

Step1:
8 contacts with positive skin tests/IGRA (new or previously documented)
-1 contact with a documented previous positive skin test/IGRA
7 contacts with newly identified positive skin tests/IGRA

Step 2:
11 total number of contacts identified
-1 contacts with a documented previous positive test/IGRA
10 contacts without a documented previous skin test/IGRA

Step 3:
7 contacts with a new positive skin test/IGRA
10 contacts without a documented previous positive skin test/IGRA X100 = **70 %**

Section IX
Contact Investigation Data Management Tool

Last Name	First Name	DOB	Sex ☐ M ☐ F	DP#	PF#

Symptoms:

Estimated Infectious Period:

Start Date _____ to End Date _____

CXR: ☐ Cavitary ☐ Abnl /Non-Cavitary ☐ Other: _____

Sputum AFB smear	Culture	NAAT\PCR
☐ POS ☐ NEG	☐ POS ☐ NEG	☐ POS ☐NEG
☐ ND ☐ UNK	☐ ND ☐ UNK	☐ ND ☐ UNK

CI Start Date: _____

Report Date: _____ ☐ **Check if Final Report**

Household (non-congregate)

Date of 1st Testing (TST/IGRA) _____

Date of 2nd Testing (TST/IGRA) _____

Outcomes	High Priority	Medium Priority
A. # of contacts identified at site		
B. # with initial evaluation		
C. # fully evaluated		
D. # diagnosed with LTBI*		
i. # reactors		
ii. # prior positive TST/IGRA		
iii. # documented converters**		
E. Infection rate (%) (D - Dii) / (C – Dii)		
F. # started on LTBI treatment		
G. # completed LTBI treatment		
H. # children (< 5 years old) diagnosed with LTBI		
I. # Suspects or additional confirmed cases		

***Diagnosed with LTBI**: includes all reactors, prior positive and documented converters

****TST conversion**: For contacts, a skin test conversion is defined as an increase of at least 5mm, from less than 5mm on the initial skin test to a reaction of greater than or equal to 5mm on the second test, 8 to 10 weeks after last exposure.

Last Name	First Name	DOB	Sex ☐ M ☐ F	PF#	DP#

CI Start Date: _____

Report Date: _____

☐ **Check if Final Report**

Outcomes

	Site Name: _____ Setting: _____ Exposure Period: _____ - _____ District: _____		Site Name: _____ Setting: _____ Exposure Period: _____ - _____ District: _____		Site Name: _____ Setting: _____ Exposure Period: _____ - _____ District: _____		Site Name: _____ Setting: _____ Exposure Period: _____ - _____ District: _____	
	High Priority	Medium Priority	High Priority	Medium Priority	High Priority	Medium Priority	High Priority	Medium Priority
A. # of contacts identified at site								
B. # with initial evaluation								
C. # fully evaluated								
D. # diagnosed with LTBI*								
i. # reactors								
ii. # prior positive TST/IGRA								
iii. # documented converters**								
E. Infection rate (%) (D - Dii) / (C – Dii)								
F. # started on LTBI treatment								
G. # completed LTBI treatment								
H. # children (< 5 years old) diagnosed with LTBI								
I. # Suspects or additional confirmed cases								

***Diagnosed with LTBI**: includes all reactors, prior positive and documented converters

****TST conversion**: For contacts, a skin test conversion is defined as an increase of at least 5mm, from less than 5mm on the initial skin test to a reaction of greater than or equal to 5mm on the second test, 8 to 10 weeks after last exposure.

Section X
Special Circumstances
CHS/TBCP post exposure TB follow-up for health care facilities

The interaction within a health care facility after a TB exposure depends on the type of facility where the exposure took place. The table below identifies the lead department/program responsible for notifying, working with and documenting the results of a CI within the major types of health care facilities

Interaction with health facility	County or private hospitals, hospital based clinic	DHS Comprehensive and Personal health clinics, SNF, Testing/treatment center (dialysis center/chemotherapy suite), Urgent care, and Hospice	PMD office, Community and Private medical clinics, Home health care operations	Homeless Shelter, SROs, drug treatment programs	Medical transport, Paramedic and emergency medical services	Correctional facilities	Coroner facilities and laboratories
Notify facility of exposure in writing	Yes-TBCP	Yes-CHS	Yes-CHS	Yes-CHS	Yes-CHS	Yes-TBCP	Yes-CHS
Offer assistance with determining the infectious period and exposure period for the identified exposure setting	Yes-TBCP	Yes-CHS	Yes-CHS	Yes-CHS	Yes-CHS	Yes-TBCP	Yes-CHS
Conduct site visit	No	Yes-CHS	Yes-CHS	Yes-CHS	N/A	N/A	Yes-CHS
Assist with prioritizing contacts (post exposure follow-up)	upon request	upon request	upon request	Yes-CHS	upon request	upon request	upon request
Assist with testing of employee contacts covered by ATD	No	No	No	No	No	No	No
Assist with testing of patient/client contacts with primary provider	No	No	upon request	Yes-CHS	No	No	No

Interaction with health facility	County or private hospitals, hospital based clinic	DHS Comprehensive and Personal health clinics, SNF, Testing/treatment center (dialysis center/chemotherapy suite), Urgent care, and Hospice	PMD office, Community and Private medical clinics, Home health care operations	Homeless Shelter, SROs, drug treatment programs	Medical transport, Paramedic and emergency medical services	Correctional facilities	Coroner facilities and laboratories
Offer assistance in locating and evaluating any of the following high priority contact: employee contacts who are no longer employed, contacts on long-term leave, or patient contacts who do not have a primary provider	Yes-TBCP (TBCP will obtain list and provide to CHS)	Yes-CHS	Yes-CHS	Yes-CHS	Yes-CHS	Yes-CHS	Yes-CHS
Recommend that the facility notify the primary provider of any patient contact who may need TB screening	Yes-TBCP	Yes-CHS	Yes-CHS	N/A	N/A	N/A	N/A
Request line list of at-risk patients/ employees/ clients/ visitors/etc.	No	No	No	Yes-CHS	No	No	No
Request facility complete form *'Summary Report of a TB Contact Investigation in a Health-Care Setting'*	Yes-TBCP	Yes-CHS	Yes-CHS	N/A	Yes-CHS	Yes-TBCP	Yes-CHS

IV. Definitions

- **Clinical high-suspicion –** TB suspect or case that has been started on appropriate TB meds
- **Clinical low-suspicion –** TB suspect or case that has not been started on TB meds
- **Contact –** an individual who has been exposed to *M. tuberculosis* infection by sharing air space with a person with infectious TB.
- **Conversion (TST conversion for contacts)** See Table 3.
- **Exposure -** the condition of being subjected to something (e.g., an infectious agent) that could have an effect. A person exposed to M. tuberculosis does not necessarily become infected. Much of the work in a TB contact investigation is dedicated to learning who was exposed and, of these, who became infected.
- **Exposure period -** the coincident period when a contact shared the same air space as a person with TB during the infectious period.
- **Exposure site:** locations where the index patient visited or spent time during the infectious period and include (but not limited to): 1) Congregate sites (e.g., jails/prisons, hospitals, shelters, skilled nursing facilities, factories, places of worship, alcohol and drug rehabilitation centers, etc.), 2) Contained environments in which air is shared (e.g., restaurants, universities, colleges, schools, classrooms, airplanes, etc.), and 3) Places where medical services are provided for immunosuppressed populations (e.g., hemodialysis centers, chemotherapy suites, medical clinics, etc.)
- **Exposure setting-** areas within an exposure site where the index patient shared air with others.
- **Household setting –** the primary residence of a TB suspect or case. The primary residence should not include congregate settings (e.g., shelters, skilled nursing facilities, SROs). Congregate settings should be considered exposure sites.
- **Infection rate –** the proportion of contacts with a similar degree of exposure who have a newly identified positive TST/IGRA test result
- **Infectious period -** The time during which a person with TB disease might have transmitted *M. tuberculosis* organisms to others. Within Los Angeles County, estimating the infectious period depends upon the characteristics of the index patient.

- **If the index patient is AFB sputum smear positive OR has a cavitary CXR OR is symptomatic** – The infectious period begins 3 months prior to symptoms onset or 1st positive findings consistent with TB disease (whichever is longer) and ends when all three of the following criteria are met: completion and tolerance of 14 days of appropriate TB treatment, 3 consecutive negative AFB sputum smears, and clinical improvement (ending date is the latest date out of the 3 criteria).

- **If the index patient is AFB sputum smear negative AND non cavitary AND has no TB symptoms** - The infectious period typically is defined as 4 weeks prior to the date of suspected diagnosis (date of treatment started) and ends after at least 5 days of appropriate TB treatment is taken and tolerated. TB diagnosis.

- **Immunosuppressed contacts** - contacts infected with HIV, contacts on immunosuppressive medical treatment, such as: ≥ l5mg day of prednisone or its equivalent for one month or more, cancer chemotherapy agents, antirejection drugs for organ transplantation, and tumor necrosis factor alpha (TNF-α) antagonists.

- **Outbreak -** a situation that is consistent with either of two sets of criteria:

  - during (and because of) a contact investigation, two or more contacts are identified as having active TB, regardless of their assigned priority; or

  - when any two or more cases occurring ≤1 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 outside of 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).

- **Pleuro-pulmonary TB –** refers to a patient with concomitant pleural and pulmonary TB. These cases do require a contact investigation. Cases with exclusive pleural disease are handled separately.

- **Secondary case - A case of TB disease discovered as a result of a contact investigation**

- **Social network – the description of a set of persons and places, and the connections among them.**

- **Window period –** the time period between the date of an initial TST/IGRA test with a negative result and the date of the follow-up TST/IGRA test that should take place 8 to 10 weeks after last exposure; a repeat TST/IGRA test should be administered to each contact who had an initial negative result.

Window period prophylaxis – the practice of providing treatment for latent TB infection to high priority contacts (including children < 5 years of age, persons living with HIV, and other

immunosuppressed persons) with an initial negative TST/IGRA test result less than 8–10 weeks after their exposure; if the contact has a negative TST/IGRA test reaction after the window period, treatment of latent TB infection is stopped in children. However, treatment is continued after the window period in persons living with HIV.

Key Abbreviations

AFB = Acid Fast Bacillus

AHO = Area Health Officer

AMD = Area Medical Director

ANM = Area Nurse Manager

ATD= Aerosol Transmissible Disease

CHS = Community Health Services

DPH = Department of Public Health

DPHN = District Public Health Nurse

DPHNS = District Public Health Nurse Supervisor

LAC = Los Angeles County

PHC = Public Health Center

PHL = Public Health Laboratory

SPHI = Supervising Public Health Investigator

TBCP = Tuberculosis Control Program

[i] MMWR 2005:54(No. RR-12):1-81.

[ii] CDC Guidelines for the investigation of contacts of personsperons with infectious tuberculosis; recommendations from the National TuberculosisTubercuosis Controllers Association and CDC, United States. MMWR 2005; 54 (No. RR-15):[1-47].

[iii] CDC Guidelines for the investigation of contacts of personsperons with infectious tuberculosis; recommendations from the National TuberculosisTubercuosis Controllers Association and CDC, United States. MMWR 2005; 54 (No. RR-15:[1-47]

[iv] Bailey WC, Gerald LB, Kimerling ME, et al. Predictive model to identify positive tuberculosis skin test results during contact investigations. JAMA 2002;287:996-1002.

[v] Marks SM, Taylor Z, Qualls NL, Shrestha-Kuwahara RJ, Wilce MA, Nguyen CH. Outcomes of contact investigations of infectious tuberculosis patients. Am J Respir Crit Care Med 2000;162:2033-8.

[vi] Loudon RG, Williamson J, Johnson JM. An analysis of 3,485 tuberculosis contacts in the city of Edinburgh during 1954-1955. Am Rev Tuberc 1958;77:623-43.

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[viii] Menzies D. Issues in the management of contacts of patients with active pulmonary tuberculosis. Can J Public Health 1997;88:197-201.

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[x] Liippo KK, Kulmala K, Tala EO. Focusing tuberculosis contact tracing by smear grading of index cases. Am Rev Respir Dis 1993;148:235–6.

[xi] Reichler MR, Reves R, Bur S, et al. Evaluation of investigations conducted to detect and prevent transmission of tuberculosis. JAMA 2002;287:991–5.

[xii] Rose CE, Zerbe GO, Lantz SO, Bailey WC. Establishing priority during investigation of tuberculosis contacts. Am Rev Respir Dis 1979;119:603–9.

[xiii] Capewell S, Leitch AG. The value of contact procedures for tuberculosis in Edinburgh. Br J Dis Chest 1984;78:317–29.

[xiv] Rouillon A, Perdrizet S, Parrot R. Transmission of tubercle bacilli: the effects of chemotherapy. Tubercle 1976;57:275–99.

[xv] Jereb J, Etkind SC, Joglar OT, Moore M, Taylor Z. Tuberculosis contact investigations: outcomes in selected areas of the United States, 1999. Int J Tuberc Lung Dis 2003;7:S384–90.

[xvi] Centers for Disease Control and Prevention. Core curriculum on tuberculosis. 4th edition. Atlanta (GA): Centers for Disease Control and Prevention; 2000.

[xvii] Starke JR, Jacobs RF, Jereb J. resurgence of tuberculosis in children. J Pediatrics 1992;120(6):839-55.

[xviii] World Health Organization TB Program: www.who.int/gtb/policyrd. TBHIV.htm, 2002

[xix] Am J Respir Crit Care Med Vol 177. pp 348-355, 2008.

[xx] TITLE 8: Division 1, Chapter 4, Subchapter 7, Group 16, Article 109, New Section 5199 of the General Industry Safety Orders http://www.dir.ca.gov/oshsb/atdapprvdtxt.pdf

[xxi] *Andrea T. Cruz, Jeffrey R. Starke. A current review of infection control for childhood tuberculosis. Tuberculosis 91 (2011) S11-S15.*