

## **Section IX.**

Contact Evaluation and  
Public Health Management

# Tuberculosis

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## Contact Evaluation and Public Health Management

### Importance of Contact Evaluation

Contact investigations (CIs) are a key part of any tuberculosis control program; they encompass all aspects of TB control, including surveillance, case containment and prevention.

Reasons for conducting contact investigations include:

- Identifying persons who have been exposed to the presenting case, which puts them at greater risk of developing both latent TB infection (LTBI) and active TB than the general population
- Identifying persons who are infected with *M. tuberculosis* (*M. tb*) through appropriate screening
- Ensuring that individuals with LTBI have access to medical evaluation and appropriate treatment to prevent disease from occurring
- Identifying, when possible, the source of TB transmission for the presenting case. This is particularly important for children with active TB since, given their age, transmission is likely to have been recent.
- Identifying, when possible, environmental factors that may contribute to the transmission of TB
- Ensuring medical evaluation, treatment and follow-up for any additional cases of active TB that are identified in the course of contact tracing

Successful contact investigation requires skills in patient assessment, interviewing, counseling and evaluation, in addition to basic epidemiologic methodology.

### Definitions

The following terms are used in this section:

- **Associate:** Close associate to an index patient when the index case has a clinical presentation consistent with recently acquired disease/infection (e.g., children). Associates are tested as part of source case investigations.
- **Concentric Circle:** A method of classifying and screening contacts in order of intensity of exposure and risk of being infected. Contacts with the most exposure or highest risk of infection are screened first.
- **Contact:** An individual who is at risk for TB infection or disease due to exposure to someone with infectious TB disease.
  - **Close Contact:** A person who has had prolonged, intense or frequent contact (on average 8 or more hours per week) with the TB patient during the infectious period. The extent of exposure also depends on environmental conditions.
  - **Other-Than-Close Contact:** A person who has had less prolonged, intense or frequent contact with the TB patient during the infectious period (less than 8 hours per week).
- **Contact Investigation:** A process that involves identifying, evaluating and, if appropriate, placing persons exposed to the TB patient on treatment for either LTBI or TB disease. These individuals are managed until completion of therapy.
- **Contact Investigator:** Field staff, chest center staff or other DOHMH staff member who conducts a contact investigation. In most cases, a Contact Investigator would be a Public Health Adviser or Nurse Case Manager.

- **Exposed:** Person(s) who shared air with the individual who has active TB disease during the infectious period (see *Contact*).
- **High-Priority Contacts:** Contacts who are to be evaluated without delay, including:
  - Those most likely to be infected (e.g., close contacts to highly infectious cases), and
  - Those with risk factors for progression to disease once infected (this applies to close and other-than-close contacts)
- **Index Case, Index Patient:** The individual with confirmed or suspected TB disease reported to the health department. The index patient is not always the source patient.
- **Infectious Period:** The time during which a person with active TB disease is able to transmit *M. tb* to others.
  - **Beginning of Infectious Period:** The infectious period usually begins 12 weeks before the start of anti-TB treatment. This date can be readjusted on a case-by-case basis according to epidemiological and medical considerations.
  - **End of Infectious Period:** The infectious period ends when the person with active TB disease is either isolated or separated from the exposed contacts, or when appropriate treatment starts.
- **Infection Rate:** The percentage of all identified contacts who are newly found to have a positive test for TB infection (TTBI). Contacts who have prior positive test results for TB are not included in this calculation. The calculation is:
  - Contacts with a newly positive TTBI divided by the total number of contacts without prior positive TTBI, multiplied by 100.
- **Noncounted Case:** A case that is determined not to be TB after having been initially classified as a *suspected case*.
- **Positive Skin Test Reaction:** For contacts, a tuberculin skin test (TST) reaction with an induration of 5mm or more.
- **Post-Window Skin Testing:** Testing contacts after the window period—8 weeks after the date of last known experience.
- **Relapse:** A new episode of active TB disease in a person who has previously completed treatment for TB disease.
- **Skin Test Conversion:** A documented increase in reaction size of 10 mm or more within a period of 2 years. This is indicative of recent infection with *M. tb*.
- **Smear or Culture Reversion:** A positive AFB smear or culture, after preceding smears and/or cultures were negative. Smear or culture reversion is a sign that the patient may once again be infectious.
- **Source Case, Source Patient:** A person with confirmed infectious pulmonary or laryngeal TB who is responsible for transmitting *M.tb* to others. The source patient is not necessarily the index patient.
- **Source Case Investigation:** A process to identify the source of transmission of TB when recent transmission is likely. It is used to determine who transmitted *M.tb* to an index patient, infected child or persons in a cluster of TTBI conversions. Source case investigations are routinely performed for all pediatric (younger than 18 years) patients with active TB in any anatomical site.
- **Transmission Determination:** A determination of the probability that TB was transmitted to others by the patient.
  - **Transmission Unlikely:** When the proportion of persons with a positive TTBI in the exposure group is not significantly different from a comparison group, and when there were no documented TTBI conversions or secondary cases.
  - **Transmission Possible:** When the proportion of persons with a positive TTBI among the exposed is greater than expected. However, the number or proportion of contacts tested was not sufficient to assess transmission.
  - **Transmission Probable:** When a higher than expected proportion of exposed persons had a positive TTBI; or a documented TTBI conversion was observed; or secondary case(s) were linked through epidemiological findings to the index case.
- **Treatment Failure:** When the patient's cultures remain persistently positive, despite appropriate treatment for more than 4 months.

- **Unexposed:** Person(s) who did not share airspace with the TB patient during the infectious period.
- **Window Period:** The 8-week period during which the immune system may not yet have developed a response to infection by the TB bacillus. The window period begins on the date of last known exposure. The start date may vary for different contacts of the same patient.
- **Window Period Treatment:** Treatment given to high-risk contacts (children less than 5 years of age and immunosuppressed individuals) who have a negative result on a TTBI during the window period.

## Confidentiality

During the contact investigation process, it is imperative to protect the patient's and their contacts' right to confidentiality. New York State and City Health Codes provide guidelines for maintaining confidentiality and sharing personal health information. See p. 16 for information regarding confidentiality in contact investigations.

## Epidemiological Assessment of Transmission

Transmission of TB from an infectious patient to contacts depends on many factors, including: infectiousness of the TB index patient; duration of infectiousness; characteristics of the shared environment; and duration of contact and proximity of contact. For the purpose of most CIs, the infectious period is defined as the 3 months prior to start of therapy in the index patient. Evaluation of contacts to TB patients is conducted based on the concentric circle approach to contact investigations. The first concentric circle includes testing of close contacts (individuals who spent 8 hours or more per week with the index patient during the infectious period). If transmission is probable among close contacts, testing is expanded to include the second concentric circle, other-than-close contacts.

Transmission from the index case to contacts is defined as unlikely, possible, or probable. See Definitions in this section (p. 154).

## Priorities for Contact Investigation

Contacts of individuals who have smear- and culture-positive pulmonary or laryngeal TB are much more likely to become infected with *M. tb* than are contacts of individuals who have smear-negative or culture-negative pulmonary TB. The policy of the Bureau of Tuberculosis Control (BTBC) is to assign priority to contact evaluation, based on both the characteristics of the known or suspected TB index patient and the characteristics of the contact.

A CI is initiated for suspected or confirmed cases of respiratory (pulmonary and/or laryngeal) TB that have any of the following:

- Smear result of respiratory specimen positive for acid-fast bacilli (AFB)
- Nucleic acid amplification (NAA) test result of respiratory specimen positive for *M. tb*
- Culture result of respiratory specimen positive for *M. tb*
- Cavitory disease with high clinical suspicion of TB, regardless of smear, NAA and/or culture results

When a smear result of a respiratory specimen is positive but NAA-negative, CI will be suspended until the culture result is obtained. The CI should not be delayed while awaiting NAA result.

Evaluation of contacts is prioritized based both on the characteristics of the TB patient and on the contact's risk of progression to disease.

High priority contacts include those who are most likely to be infected (i.e., close contacts of highly infectious cases) as well as all contacts (close and other-than-close) who have other risk factors for progression to disease once infected. CIs are initiated immediately for all respiratory cases with a sputum or pathology smear positive for AFB, pending results of NAA or culture. A CI can be suspended under certain circumstances. (See p. 156, Table IX-1 and p. 160, Table IX-2.)

The concentric circle approach is used to organize, prioritize and test contacts. (See p. 157, Figure IX-1.) The concentric circle is

Table IX-1

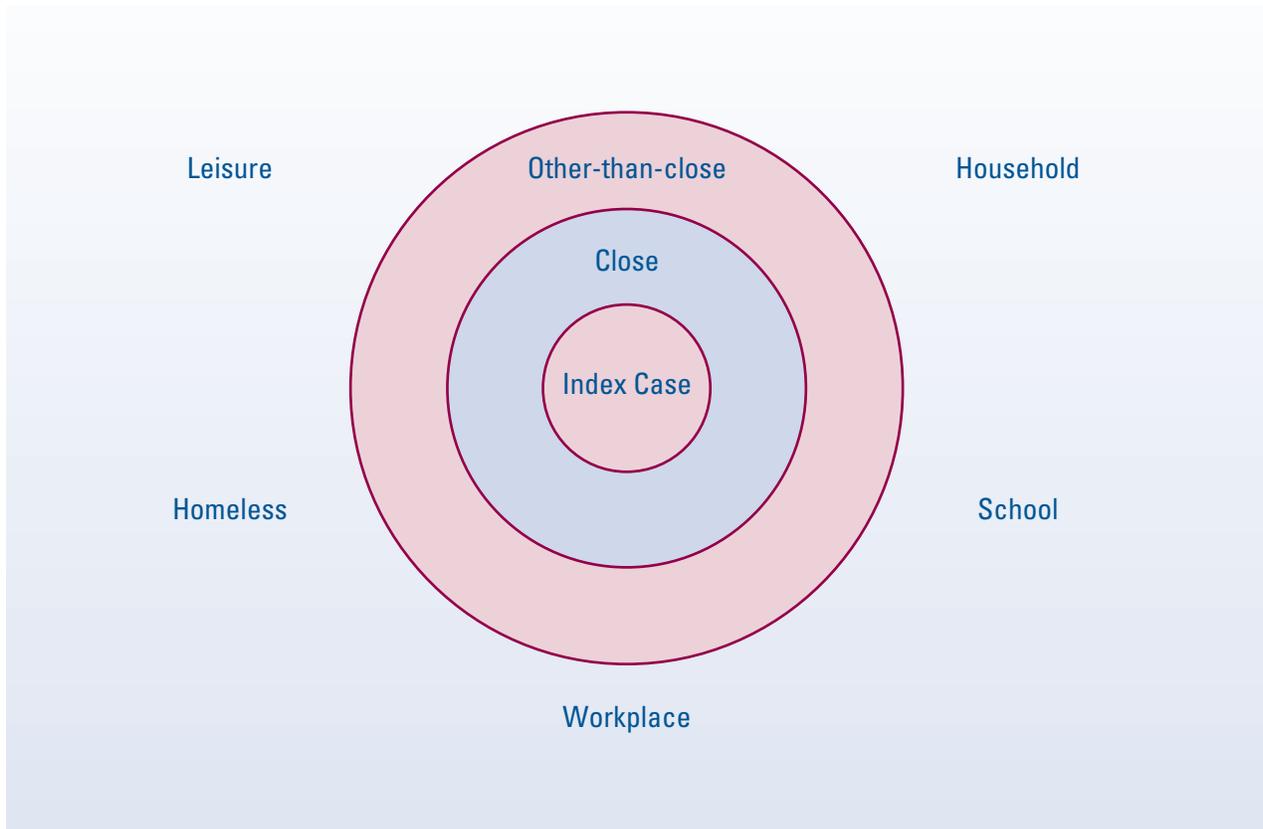
## Decision to Conduct or Continue Contact Investigation by Bacteriological Status and Clinical Suspicion of Respiratory Tuberculosis

Smears <u>Positive</u> for Acid-Fast Bacilli							
Respiratory Smear Result	Nucleic Acid Amplification Result	Culture Result	Clinical Suspicion	Contact Investigation			
				Start (elicit contacts)	Continue (test high priority contacts)	Complete	
Positive for AFB	Positive for <i>M. tb</i> Or Not done	Pending		Yes	Yes	Yes, if verified	
		Positive		Yes	Yes	Yes	
		Negative		Yes	Yes	Yes, if verified	
		Not Done		Yes	Yes	Yes	
	Negative for <i>M. tb</i>	Pending			Yes	Delay	Yes, if verified
		Positive			Yes	Yes	Yes
		Negative	High		Yes	Continue, particularly if cavitory CXR	Yes, if verified
			Low		Yes	Delay	No, unless verified
		Not Done	High		Yes	Continue, particularly if cavitory CXR	Yes, if verified
			Low		Yes	Delay	No, unless verified
Smears <u>Negative</u> for Acid-Fast Bacilli							
Respiratory Smear Result	Nucleic Acid Amplification Result	Culture Result	Clinical Suspicion	Contact Investigation			
				Start (elicit contacts)	Continue (test high priority contacts)	Complete	
Negative for AFB	Positive for <i>M. tb</i>	Pending	High (cavitory CXR)	Yes	Yes	Yes, if verified	
		Positive		Yes, after NAA	Yes	Yes	
		Negative	High (cavitory CXR)	Yes, after NAA	Yes, if medical/epi review determines need	Yes, if verified	
		Not Done		Yes, after NAA	Yes	Yes, if verified	
	Negative for <i>M. tb</i> Or Not done	Pending	High (cavitory CXR)		Yes	Delay	No, unless verified
		Positive			Yes, after culture	Yes	Yes
		Negative	High (cavitory CXR)		Yes	Delay	Yes, if verified
			Low		No	No	No
		Not Done	High (cavitory CXR)		Yes	Delay	Yes, if verified
			Low		No	No	No

Abbreviations: AFB = Acid-fast bacilli; CXR = Chest X-ray; NAA = Nucleic Acid Amplification result

Figure IX-1

## Concentric Circle for Evaluating Tuberculosis Contacts



divided into 5 settings in which the exposure may have occurred:

- Household
- School
- Workplace
- Leisure
- Homeless

Each setting is further divided according to the extent of exposure. The inner circle refers to close contacts and the outer circle refers to other-than-close contacts. The first concentric circle includes testing of close contacts (individuals who spent more than 8 hours per week with the index patient during the infectious period). If transmission is probable among close contacts, testing is expanded to include the second concentric circle, other-than-close contacts.

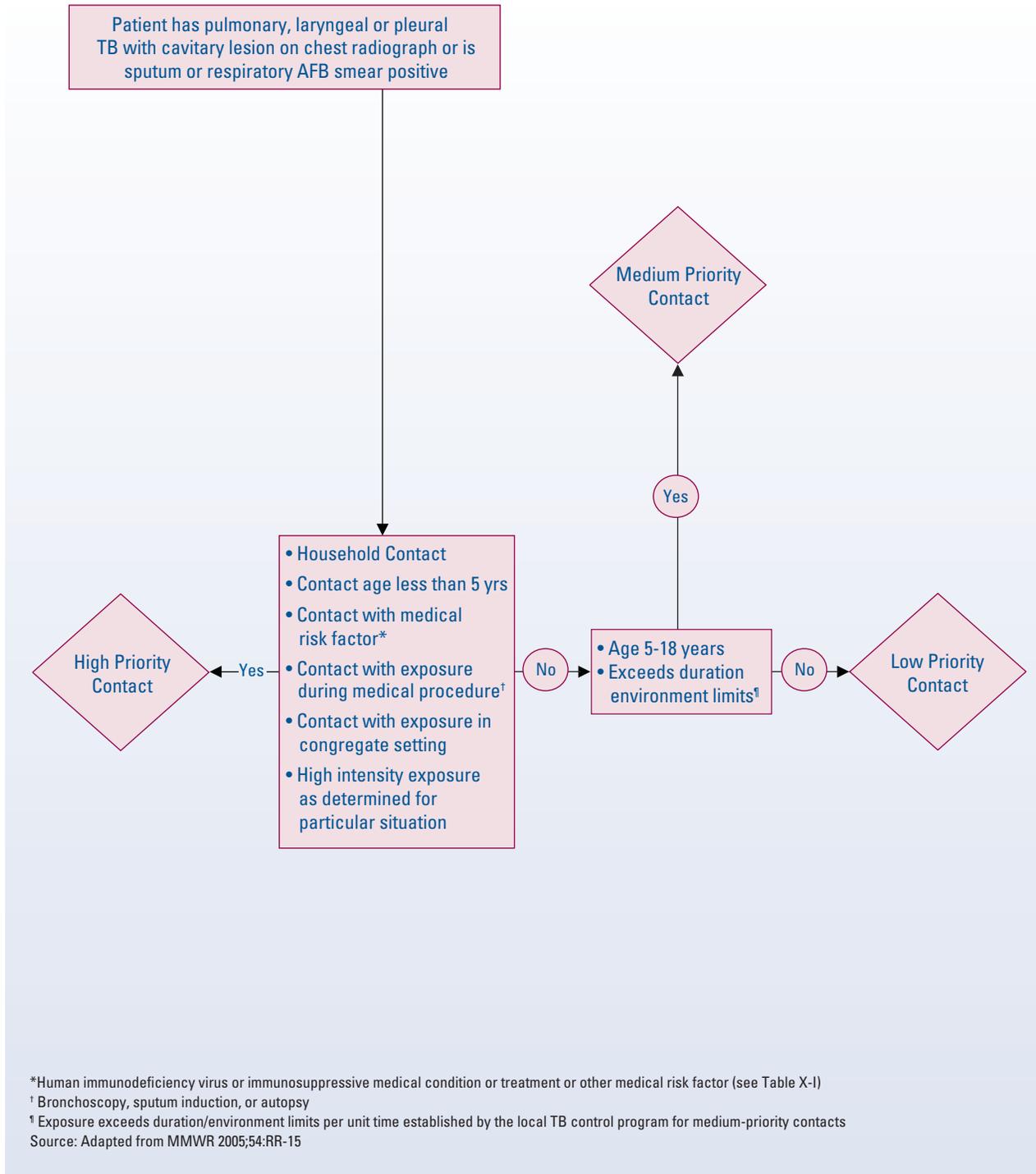
In addition to high-risk contacts that must be tested without delay (e.g., HIV- infected or medical-risk contacts and children under 5 years of age), contacts with the highest level of exposure (close contacts) in each of the settings are tested first. See pp. 158 and 159, Figures IX-2 and IX-3 for the prioritization of contacts for evaluation in different clinical situations.

In addition, a source case investigation should be performed, at least in the household, if an individual younger than 18 years old (i.e., up to the day of the 18th birthday) is found to have TB disease. (See p. 167.) The purpose of the source case investigation is to seek the infectious source patient who infected this individual.

Contacts of patients with extrapulmonary TB should be evaluated only if the patient has concurrent pulmonary or laryngeal TB. Contact evaluation is not necessary for patients with extrapulmonary TB alone, or for patients with culture-negative, non-cavitary pulmonary disease.

Figure IX-2

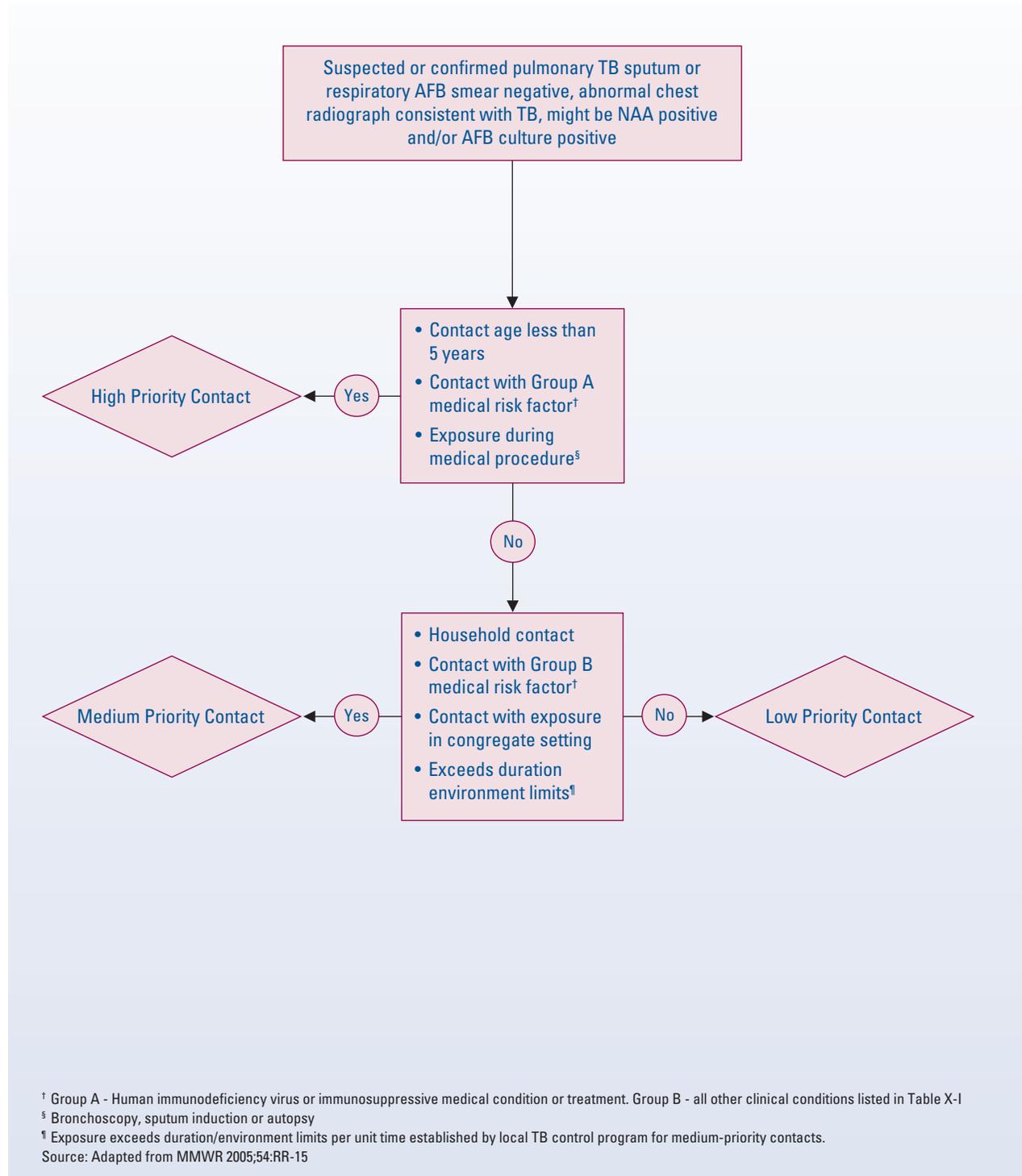
## Prioritization for Evaluation of Contacts Exposed to Persons with Sputum or Respiratory Acid-Fast Bacilli Smear Positive or Cavitory Tuberculosis Cases



Abbreviations: AFB: = acid-fast bacilli; TB= tuberculosis

Figure IX-3

## Prioritization for Evaluation of Contacts Exposed to Persons with Sputum or Respiratory Acid-Fast Bacilli Smear Negative Tuberculosis Cases



Abbreviations: AFB = acid-fast bacilli; NAA = Nucleic acid amplification test; TB = tuberculosis

Table IX-2

## Rationale for Prioritization of Contacts to Tuberculosis Cases

Contacts Most Likely to be Infected (Close Contacts)	Contacts at High Risk of Developing Tuberculosis Once Infected
<ul style="list-style-type: none"> <li>• Contacts exposed to patients with a high degree of infectiousness based on the following factors:               <ul style="list-style-type: none"> <li>◦ Laryngeal or pulmonary TB</li> <li>◦ AFB sputum smear positive</li> <li>◦ Cavitory disease on CXR</li> <li>◦ Cough</li> </ul> </li> <li>• Contacts exposed to patients in:               <ul style="list-style-type: none"> <li>◦ Congregate settings (e.g., prison, shelter, nursing home, single-room-occupancy hotels, health care facilities)</li> <li>◦ Small or crowded rooms</li> <li>◦ Areas that are poorly ventilated</li> <li>◦ Areas without air-cleaning systems</li> </ul> </li> <li>• Contacts who:               <ul style="list-style-type: none"> <li>◦ Have prolonged exposure (longer than 8 hours per week during infectious period)</li> <li>◦ Have been physically close to the patient</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Contacts who are young children less than 5 years of age</li> <li>• Contacts with any of these conditions:               <ul style="list-style-type: none"> <li>◦ HIV infection/AIDS or high risk for HIV infection and refuse HIV testing</li> <li>◦ Injection of drugs</li> <li>◦ Diabetes mellitus</li> <li>◦ Silicosis</li> <li>◦ Prolonged corticosteroid therapy</li> <li>◦ Immunosuppressive therapy</li> <li>◦ Chemotherapy</li> <li>◦ Certain types of cancer (e.g., carcinoma of head, neck or lung) or hematological disorders, such as leukemia and lymphoma</li> <li>◦ Chronic renal failure</li> <li>◦ Gastrectomy or jejunioileal bypass</li> <li>◦ Low body weight (10% or more below ideal)</li> <li>◦ Fibrotic lesions on CXR consistent with old TB</li> </ul> </li> </ul>

Abbreviations: AFB = Acid-fast bacilli; CXR = Chest X-ray; TB = tuberculosis

A CI follows these steps:

- Identification of a case of active TB requiring a CI
- Review of the medical record of the case (interview should not be delayed if medical record is not available)
- Interview with the patient to elicit contacts
- Determination of the infectious period
- Assessment of transmission risk
- Prioritization of contacts
- Field investigation

- Evaluation of contacts
- Transmission determination
- Expansion of contact investigation, if necessary
- Medical evaluation of contacts who have a positive TTBI, and/or have specific medical risk factors
- Start of LTBI treatment
- Monitoring of contacts on LTBI treatment
- Ensuring completion of LTBI treatment

## Calculating the Infectious Period

The infectious period is calculated to identify the period during which exposure is most likely to have occurred, and thus to reduce the number of individuals evaluated during a contact investigation. The calculation of the infectious period depends upon the patient's clinical characteristics.

The infectious period usually starts 12 weeks prior to the beginning of treatment for TB, and ends either on the day that the patient is removed from interaction with the contacts, or on the date appropriate treatment starts. In case of multidrug-resistant TB (MDRTB), a determination of the end of the infectious period should be made in consultation with a BTBC supervising physician.

The infectious period may be recalculated, based on the results of the contact evaluations and on changes in the clinical condition of the TB patient. If transmission was found in contacts who had been clearly exposed at the beginning of the infectious period, the patient is re-interviewed to obtain further information regarding the start of symptoms. It may be necessary to add 1 to 2 additional months to the start of the infectious period and to identify additional contacts exposed to the patient during that time.

If the TB patient had a culture conversion and smear and/or culture status has reverted from negative to positive, a new infectious period must be determined. The decision to extend the infectious period—in either direction—is based on medical and/or epidemiological consultation.

## Assessing Risk of Transmission

The risk of transmission is based on the characteristics of the TB case, the environment in which potential exposure may have occurred and the extent of the potential exposure (see Box). The test results of the contacts will determine if transmission was probable, possible or unlikely (see p. 154).

### Source case characteristics that increase the risk of transmission include:

- Sputum AFB smear positive (the higher the smear grade, the greater the risk)
- Site of disease—pulmonary or laryngeal TB
- Length of time the potential index patient has been infectious (longer time = greater risk)
- Cavitory disease
- Cough or hoarseness (possible sign of laryngeal disease)

### Environmental characteristics associated with increased risk of transmission include:

- Small room size
- Poor ventilation (lack of windows)

### Extent of exposure associated with increased risk of transmission include:

- Prolonged exposure—more than 8 hours/week
- Frequent exposure
- Close physical proximity (e.g., sleeping in the same room)

## Evaluation and Management of Contacts

### Symptom Review

All close contacts should be evaluated for symptoms of TB. Contacts who exhibit TB symptoms have the highest priority.

- Individuals who have symptoms consistent with TB and who have been in close contact with a person who has either a positive *M. tb* culture or an AFB-positive sputum smear, should be evaluated promptly for TB disease with a TTBI, a chest X-ray (CXR), sputum smears and cultures and drug susceptibility testing. (See p. 26.) If appropriate, there should also be a search for extrapulmonary sites of TB.
- For contacts with definite TB symptoms (e.g., weight loss, a cough of at least 2 weeks duration, fever, night sweats) with or without an abnormal CXR, treatment for active TB disease should be initiated while TB culture results are pending, unless there is another likely cause for such symptoms.

- For contacts with vague symptoms, treatment for active TB disease or treatment for LTBI should be withheld until the diagnostic evaluation is complete. Treatment for LTBI should not be initiated until active TB disease has been ruled out.
- Contacts with TB symptoms should be classified as TB Class V (High), regardless of the CXR findings and TTBI results.

### HIV Screening and Testing

All contacts should be evaluated for HIV infection, since it greatly increases the risk of disease progression for persons with LTBI. In the field, an HIV risk-behavior screening tool should be used to assess a contact's risk for HIV infection. HIV counseling and testing should be offered to all contacts, especially close contacts and those other-than-close contacts with HIV risk factors. All contacts should be referred to a chest center or to their private physician for HIV counseling and testing. Rapid HIV testing is currently available at BTBC chest centers.

### Initial Test for Tuberculosis Infection and Follow-Up

All close contacts of an individual who has a positive *M. tb* culture or an AFB-positive sputum smear should be screened for LTBI with a TTBI unless they have documentation of a previous positive TTBI.

If the reaction to the initial TTBI is negative, the contact should be classified as TB Class I, and a repeat TTBI should be given 8 weeks after the contact's last exposure to the index patient during the period of time that the index case was infectious. During the window period between the 2 tests for TB infection, the following contacts should receive a clinical evaluation and CXR to rule out active TB disease, and should start treatment for presumed LTBI, even if the TTBI is negative:

- Contacts younger than 5 years of age (i.e., up to the day of the fifth birthday)
- Contacts between 5 and 15 years of age, at the physician's discretion

Table IX-3

## Individuals Who Need Medical Evaluation and Chest Radiograph

Status		
New Positive Test for TB Infection	Prior Positive Test for TB Infection	Regardless of Test for TB Infection Result (+ or - TTBI)
<ul style="list-style-type: none"> <li>• Contacts (close and other than close)</li> <li>• Persons being evaluated in source case investigation</li> </ul>	<ul style="list-style-type: none"> <li>• Symptomatic</li> <li>• Persons being evaluated in source case investigation</li> <li>• Additional persons with heavy exposure</li> </ul>	<ul style="list-style-type: none"> <li>• Contacts with HIV infection or other medical risk factors</li> <li>• Children younger than 5 years of age identified during window period</li> <li>• Anyone with symptoms suggestive of tuberculosis, regardless of TTBI result or age</li> <li>• Sexual contacts of HIV-infected index patients</li> <li>• All associates in a source case investigation</li> </ul>

TTBI = test for TB infection (TST or blood-based assay)

- Contacts who are HIV positive or otherwise immunosuppressed.
- Contacts with behavioral risk factors for HIV infection who decline HIV testing

If the reaction to the initial TTBI is positive, the contact should undergo a CXR.

- If the CXR and physical are normal, the contact should be classified as TB Class II and started on treatment for LTBI, as indicated (see p. 192.)
- If the CXR is abnormal, or if there is clinical evidence of TB disease, the contact should be classified as TB Class V and evaluated for TB disease (see p. 26).

In some instances, an individual may present at a BTBC chest center and report a positive or negative TTBI. If it is not possible to verify this information, 2 options are available: (1) Perform a CXR if the person reports both a positive TTBI and contact with a person who has TB disease; or (2) Repeat the TTBI, unless the person describes a “very large” reaction (size of a quarter or bigger) to a previous TST or residual evidence (e.g., scar or pigmentation) is seen. In general, the safest option is to perform the CXR if a possible contact reports a prior TTBI infection, even when the history cannot be verified.

### Medical Evaluation and Chest Radiograph

The following persons should receive a medical evaluation, including a CXR, after the index patient is diagnosed (see p. 162, Table IX-3):

- All contacts (close and other-than close) with a positive TTBI
- Persons being evaluated as part of a source case investigation, who have either a positive TTBI result or have documentation of a prior positive TTBI result
- Persons with history of TB disease
- Contacts infected with HIV or other immunosuppressive conditions, regardless of TTBI result
- Children less than 5 years of age who are contacts identified during the window period, regardless of TTBI result
- All persons with symptoms, regardless of TTBI results

- Sexual contacts of HIV-infected index patients who decline HIV counseling and testing

Close contacts with a documented previous positive TTBI should have a CXR if they have symptoms that suggest TB, if they are HIV positive or if they are sexual contacts of an HIV-infected index case and refuse HIV testing.

A CXR should also be considered for the following individuals who have a previous positive TTBI, but who have subsequently been in close contact with a person who has AFB smear-positive pulmonary or laryngeal TB:

- Persons with medical risk factors for TB other than HIV infection
- Children younger than 18 years of age
- Asymptomatic, HIV-negative persons who have had heavy exposure to a person with highly infectious pulmonary or laryngeal TB (i.e., the presence of secondary cases or documented conversions in other contacts).

See p. 193 for guidelines on treatment for LTBI in these situations.

### Repeat Test for Tuberculosis Infection and Follow-Up

If the reaction to the initial TTBI is negative and was given before the end of the 8-week window period, contacts should have a repeat test 8 weeks after their last exposure to the index patient.

If the reaction to the repeat TTBI is negative and the individual is no longer in close contact with an infectious index patient:

- No follow-up is necessary for immunocompetent contacts (including immunocompetent children). Treatment for LTBI, if started, should be discontinued. These contacts should be classified as TB Class I.
- A full course of treatment for LTBI is still indicated for most close contacts who are HIV positive or otherwise immunosuppressed, or who have behavioral risk factors for HIV infection but decline HIV testing, regardless of the TTBI reaction. These contacts should remain classified as TB Class I.

If the reaction to the repeat TTBI is negative, but the individual remains in close contact with an infectious index patient, the person should continue treatment for LTBI if:

- Less than 5 years of age
- Between the ages of 5 and 15, at the physician's discretion
- HIV-positive or otherwise immunosuppressed
- Has behavioral risk factors for HIV infection but declines HIV testing

Contacts whose TTBI is negative but who remain in close contact with an infectious index patient should have a repeat test and, if necessary, a CXR, every 3 months. If the reaction to a repeat TTBI is positive, the contact should be re-evaluated:

- If the CXR is normal, the contact should be classified as TB Class II and started on treatment for LTBI (see p. 192).
- If the CXR is abnormal, the contact should be classified as TB Class V and evaluated for TB disease (see p. 26).

### Contact Evaluation for Patients Whose Cultures Convert Back to Positive

In some instances, a TB patient's cultures may convert to negative and then become positive again. This may happen if a patient is lost to follow-up and discontinues medication before completing treatment, or if treatment was not adequate because of multidrug resistance.

If the patient is located after a treatment lapse of 3 months or longer, and if the patient's cultures have become positive again, or if the patient relapses while on treatment after becoming culture negative, a second window period should be defined and the patient should be re-interviewed. Contacts identified during the initial investigation should be reevaluated if they were exposed again. If new contacts are identified, they should be tested and evaluated.

## Special Considerations for Infant and Child Contacts

Infants (i.e., babies less than 1 year of age) and children younger than 5 years of age (i.e., up to the day of the fifth birthday) who live in the same household as an infectious TB patient should be kept out of the home setting until one of the following conditions is met:

- The infectious patient is taking anti-TB treatment and has demonstrated an adequate clinical response to treatment (i.e., negative AFB smears and a decrease in symptoms).
- The child has started treatment for LTBI (including window prophylaxis).
- The infant is given Bacille Calmette-Guèrin (BCG) vaccine (see p. 227, Appendix I-G). This is the least desirable option.

### Initial Test for Tuberculosis Infection and Chest X-ray for Infants and Children

All infant contacts should receive an initial TTBI, medical evaluation and both a posterior-anterior and lateral CXR, regardless of the results of the TTBI result.

If the CXRs are normal, the infant should start treatment for LTBI, even if the TTBI is negative. Isoniazid should be used for infant contacts of patients with isoniazid-susceptible TB; rifampin should be used for contacts of patients with isoniazid-resistant but rifampin-susceptible TB. Multidrug treatment of LTBI with medications other than isoniazid and rifampin should be considered for infant contacts of patients with isoniazid- and rifampin-resistant TB (see p. 201, Table XI-4).

If the reaction to the initial TTBI was positive, the infant should complete a full course of treatment for LTBI.

If the CXR shows hilar adenopathy with or without a pulmonary infiltrate, the child should be treated with a 6-month regimen similar to the one used for pulmonary TB. If TB diagnosis is in doubt, consultation with a pediatric pulmonologist may be indicated for diagnostic investigation of the cause of lymphadenopathy. (See p. 37.)

## Repeat Test for Tuberculosis Infection and Chest X-ray for Infants and Children

All infant contacts with a negative reaction to the initial TTBI should have a repeat test and posterior-anterior and lateral CXRs (regardless of the TTBI result) when they are at least 6 months of age, and when at least 8 weeks have passed since their last exposure to the infectious index patient. (Infants younger than 6 months of age may be anergic.)

- If the reaction to the repeat TTBI is positive and CXRs are normal, a full course of treatment for LTBI should be administered.
- If the CXRs show evidence of active TB, the child should be treated with a 6-month regimen similar to the one used for pulmonary TB.
- If the reaction to the repeat TTBI is negative and the CXRs are normal, LTBI treatment should be discontinued.
- If the child cannot be separated from the source patient who remains infectious due to unresponsive MDRTB, BCG should be considered if the TTBI is still negative. (See p. 227, Appendix I-G.)

## Contact Investigation for Smear-Negative, Culture-Pending Cases

The BTBC does not routinely evaluate contacts of suspected TB patients (1) whose smears are negative for AFB and whose culture results are pending, or (2) whose smear and culture results are pending.

However, contacts with symptoms of TB, and HIV-positive contacts of suspected TB patients, should be evaluated for LTBI and TB disease, even if the patient is smear negative.

All contacts should be offered HIV counseling and testing, as HIV-positive patients are at increased risk of developing active tuberculosis.

The contact evaluation must be completed if the suspected TB case (TB Class V) is reclassified as a TB Class III on the basis of a positive *M. tb* culture.

If the suspected TB case is reclassified as a culture-negative TB Class III, transmission

from this index patient is less likely. If a contact is found to have LTBI, a physician should review the individual's risk of TB and the need for treatment of LTBI, as the contact may not have been infected from this source case. Some adult contacts whose TTBI is positive may actually have been infected before their exposure to the index patient. In this group of contacts, treatment for LTBI may be less imperative.

## Expanding a Contact Investigation

If transmission has occurred among the closest contacts, based on the criteria indicated on p. 154, the CI should be expanded to include the next level of exposure and/or site.

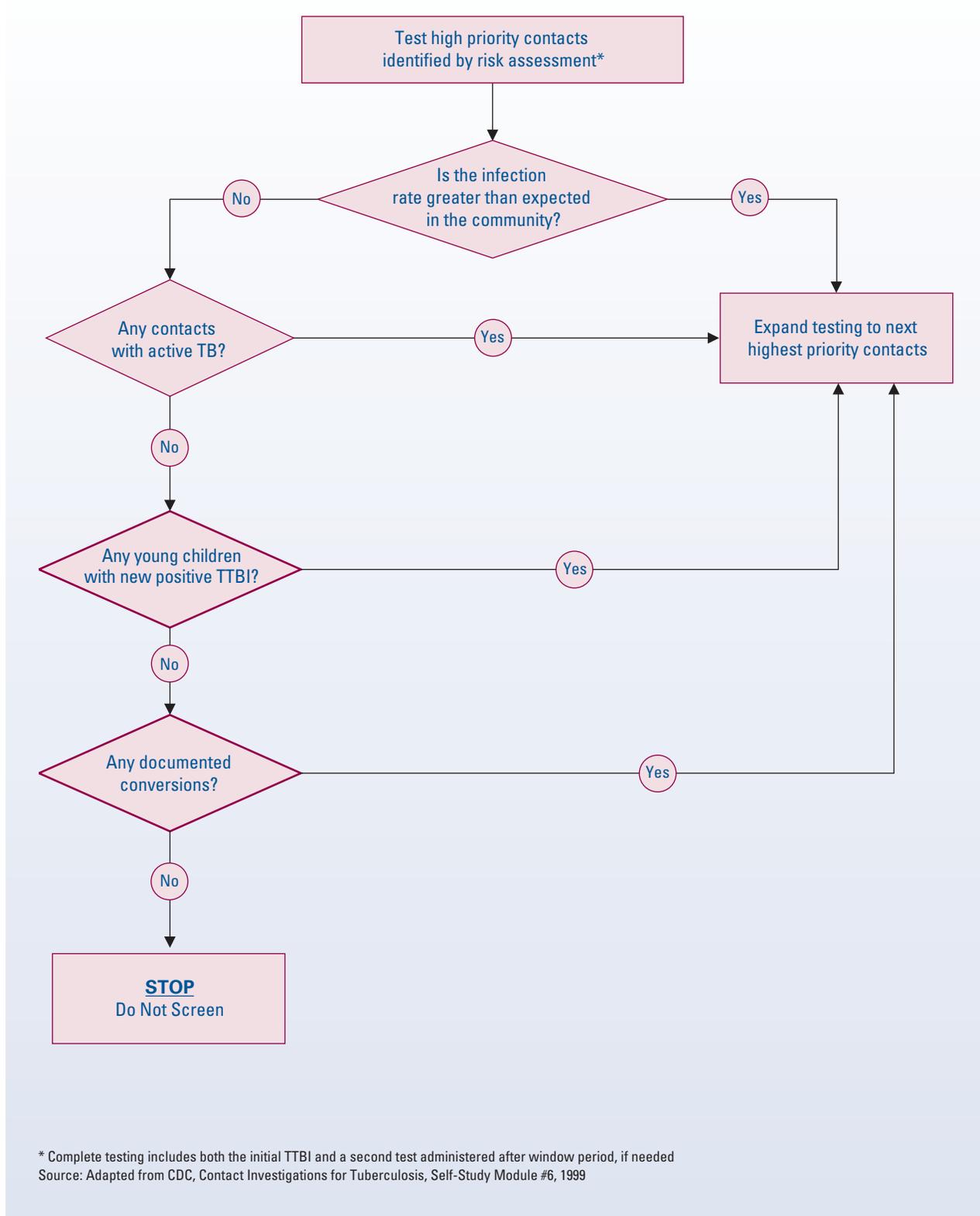
The concentric circle approach should be used to guide the expansion of a CI (see p. 166, Figure IX-4). If transmission is found within the inner circle (i.e., close contacts) of the concentric circle, the investigation should be expanded to the outer circle of that setting (i.e., to include the other-than-close contacts). If there is evidence of transmission in the outer circle in any exposure setting(s), then an additional interview with the index case is conducted to elicit additional contacts and exposure settings (see p. 166, Figure IX-4).

An expanded contact investigation may be needed if the index patient fits one or more of the following criteria:

- Is homeless or currently living in a congregate setting, shelter or single-room-occupancy hotel
- Works in or attends a school or daycare facility
- Works in a potentially politically sensitive worksite
- Works in a setting where coworkers are aware of the TB diagnosis
- Works, studies or lives in a setting with 15 or more individuals
- Is a health care worker
- Arrives in New York City during the infectious period and travel involved 8 hours or more exposure on airplane, train, ship or bus
- Attends a place of worship regularly during the infectious period

Figure IX-4

## Expanding Contact Investigation Tuberculosis Testing



\* Complete testing includes both the initial TTBI and a second test administered after window period, if needed  
Source: Adapted from CDC, Contact Investigations for Tuberculosis, Self-Study Module #6, 1999

TTBI = test for TB Infection

- Attends an after-school program or other extracurricular program during the infectious period.
- Frequently attends a health care setting (e.g., infectious patient was not isolated appropriately during hospitalization or index patient had frequent outpatient visits during the infectious period).

## Airline Exposures

All commercial jets built after the 1980s and a few retrofitted aircraft recirculate cabin air, (filtered air from within the cabin and conditioned air from the outside). Depending on the type of aircraft, air may be recirculated throughout the entire cabin or only within limited zones. All large commercial jet aircraft provide approximately 20 air exchanges per hour during cruising, and lower amounts during descent and when on the ground. There is no evidence that recirculation of cabin air facilitates transmission of infectious disease agents on board. When cabin air is recirculated, it passes through a set of filters before it is mixed with outside conditioned air, which is virtually free of organisms. Filtration of the air removes large particles and particles such as *M.tb* organisms, thus eliminating the risk of exposure for passengers and crew from this source.

In the case of a potential exposure to a patient with active tuberculosis, the airline must cooperate with the public health authorities responsible for informing passengers and/or crew of their potential exposure to *M. tb*. See p. 168, Figure IX-5 for the steps the CDC/DGMQ takes when deciding whether a contact investigation is needed. The CDC/DGMQ must evaluate the risk of TB transmission and decide whether it is necessary to inform selected passengers and crew of the potential exposure. The following criteria are used:

- Infectiousness of the person with TB
- Duration of the exposure
- Time elapsed between the flight(s) and the notification of the case
- Proximity of other passengers and crew to the index patient

The infectiousness of the person with TB is determined based on several criteria. With respect to duration of exposure, informing close contacts is indicated if the total flight duration exceeded 8 hours. Tuberculosis transmission on airlines has been found *only* when exposure to the person exceeded 8 hours. It is difficult to determine retrospectively if the person with TB was symptomatic at the time of the flight. Passenger-to-passenger transmission of *M. tb*, however, has been documented among close contacts seated in the same section of the airplane as the person with infectious TB (i.e., seated in the same row or 2 rows ahead or behind, and cabin crew members working in the same cabin section as the person with TB). Notification therefore, should be made to passengers and crew that were on flights within the 3 months before notification of the case to the health authorities.

If one of the flight crew (i.e., pilot, copilot or flight engineer) is infectious, passengers are not considered to be at risk, as there is no contact between the flight crew and the passengers. Cabin crew members, however, should be notified of the exposure and evaluation should be recommended.

## Source Case Investigation for Pediatric Tuberculosis Cases

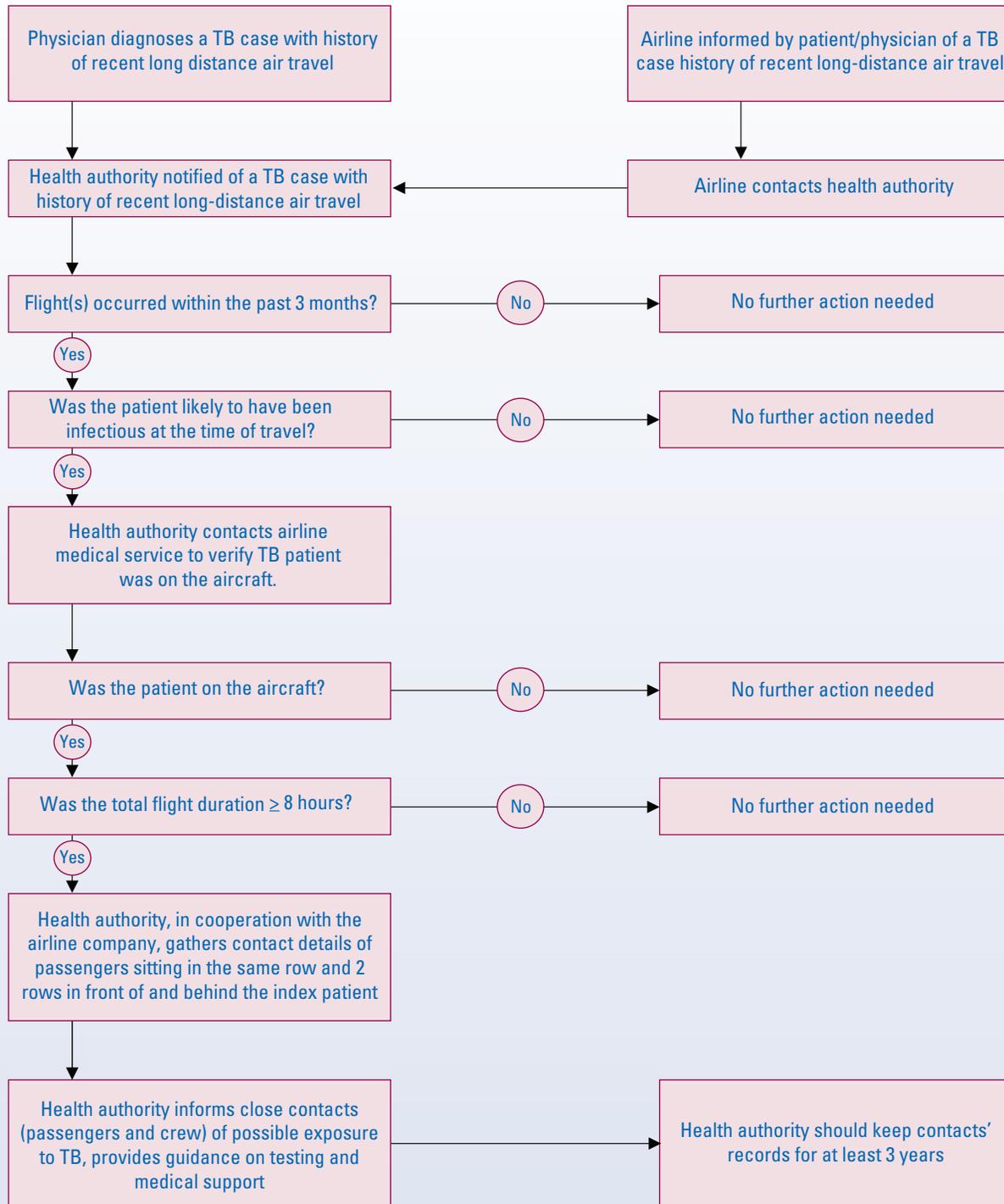
When a child less than 18 years of age is diagnosed with active TB disease, an investigation (source case and/or contact) should be completed based on the specific circumstances of the child's illness.

The investigation evaluates all persons (adults and children) who have had close or household contact with the pediatric index case during the relevant time period. All possible associates in the 1 year prior to the time that the pediatric case was diagnosed should be located.

If the pediatric index patient is deemed to be infectious (i.e., a child older than 10 years of age, with positive respiratory cultures), a contact investigation is also initiated for the pediatric TB case. The source case investigation aims to identify, test and evaluate the following:

Figure IX-5

## Determining if a Contact Investigation is Needed for Potential Air Travel Exposure to Tuberculosis\*



\*Adapted from World Health Organization: Tuberculosis and Travel WHO/HTM/TB/2006.363. Geneva, Switzerland, 2006

Abbreviations: TB = tuberculosis

- The source case—the individual with active TB disease who may have infected the child. (The possible source patient is usually an adult in the home, a frequent visitor or an adult with whom the child spends significant periods of time—e.g., babysitters, daycare personnel, relatives.)
- Secondary cases
- Other high-risk close associates, that is, children and adults who may have been infected in the same setting.

Any possible source patient should be evaluated for TB (see p. 26), with a TTBI. Regardless of the result, source patients should also receive CXR and medical evaluation. Associates with a previously positive TTBI only need CXR (taken after the child was diagnosed) and medical evaluation.

## Case Management and Treatment of Contacts with Latent Tuberculosis Infection

Every contact started on treatment for LTBI should be case managed throughout the duration of treatment. A case manager is assigned to a contact based on where the contact is receiving treatment, not on the location of the index case. Contacts treated at a BTBC chest center are case managed by a nurse case manager (or clinic Public Health Advisor [PHA], based on staffing levels) at the BTBC chest center. Contacts treated at a non-DOHMH facility are case managed by a Field-Based Unit PHA in the borough where the non-DOHMH facility is based.

### Responsibilities of the Case Manager

The contact's case manager is responsible for the following:

- Ensuring monthly follow-up
- Reminder phone calls
- Referrals to other chest center units
- Updating the DOHMH TB registry
- Providing treatment information and outcomes to the case manager of the index case

The index patient's case manager is responsible for the following:

- Knowing the status of all the contacts of the index patient, regardless of who is case managing the contacts
- Providing information as requested to the network epidemiologist
- Reporting the outcome of the contact investigation at the DOHMH Cohort Review

### Return to Supervision Procedures for Contacts Being Treated for Latent Tuberculosis Infection

Contacts who miss their appointments should be located. A phone call should be made within 1 working day of the first missed appointment. If unsuccessful, within 3 working days, a letter should be sent to follow up with their provider. If the contact is being managed at a BTBC chest center, a new appointment time should be sent with a notice to call the chest center if the appointment time is not convenient. If the patient does not contact the case manager and/or chest center by phone or visit, a home visit will be made within 5 working days of the missed appointment. To prevent chronic non-compliance, a reminder card (a phone call for a non-DOHMH patient) should be sent to the client routinely 1 week prior to each appointment.

## Key Sources

Centers for Disease Control and Prevention (CDC). Guidelines for the investigation of contacts of persons with infectious tuberculosis. *MMWR Recomm Rep*. 2005 Dec16;54 (RR-15):1-47.

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Grzybowski S, Barnett GD, Styblo K. Contacts of cases of active pulmonary tuberculosis. *Bull Int Union Tuberc*. 1975;50:90-106.

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Raffalli J, Sepkowitz KA, Armstrong D. Community-based outbreaks of tuberculosis. *Arch Intern Med*. 1996;156(10):1053-1060.

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