CONTACT INVESTIGATION

Contact investigation refers to the assessment of individuals who have been in contact with a recent case of active tuberculosis in order to identify new infections. If the index case has primary or nonrespiratory TB, the investigation is carried out to attempt to identify a source case amongst the contacts.

The goals of a contact investigation are to identify:

- secondary cases of TB disease following exposure, and to initiate treatment as soon as possible
- those who may be newly infected, and to prevent the development of active tuberculosis in these individuals
- the **source** of the new infection (referred to as a **source case investigation**)

Without intervention, approximately 5% of newly infected individuals will develop active tuberculosis within 2 years. If the newly infected individuals are children or are immunocompromised, this percentage is much higher.

When is a Contact Investigation Necessary?

Whenever a patient is found to have, or is suspected of having **active tuberculosis,** a contact investigation to determine those at risk of being newly infected should always be initiated.

Contact investigation is the responsibility, under the *Public Health Act,* of the regional MOH who works collaboratively with TB Control or the TB Clinic and co-ordinates staff in regional settings as appropriate.

Contact investigation should begin as soon as TB has been diagnosed. The initial list of the known contacts should be submitted to Tuberculosis Control or the local TB Clinic on the "Master Contact List" within 7 days of notification of the case. This form is used to track and co-ordinate follow-up, and therefore it is imperative that information be as complete as possible (see Appendix 12 G).

Children

Active tuberculosis in young children is rarely infectious, but it signals a recent infection and indicates the probability of an undiagnosed infectious case amongst the child's close contacts.

- A source case investigation should always be carried out, as the individual who transmitted the disease may still be undiagnosed and infectious.
- Older children, adolescents and adults with respiratory TB should also have sputum specimens submitted in order to evaluate degree of infectiousness.

Sputum induction procedures or gastric aspiration may be necessary in children (see pages 6-9, 6-14).

Priority for Initiation of Contact Investigation

Whenever a case of tuberculosis is diagnosed, either clinically or with laboratory confirmation, decisions (in consultation with TB Control staff or TB Clinic staff) must be made regarding initiation of contact investigations.

Because young children with tuberculosis rarely transmit infection to others and are likely to have been infected recently, investigation is aimed at identifying the source of their infection. If assessment of the child indicates infectiousness, a broader contact investigation may be necessary.

Priority for the initiation of contact investigation should be as follows:

Site	Bacteriology	Action	Priority
Pulmonary (usually cavitary)/ laryngeal	AFB sputum smear-positive Culture positive	Conduct contact * investigation	High
Pulmonary/ laryngeal	AFB sputum smear-positive Culture pending	Commence contact investigation (if culture is not TB and clinical TB ruled out, stop contact investigation)	High
Pulmonary/ laryngeal	AFB sputum smear-negative Culture positive	Conduct contact investigation of household and other close contacts	Lower than AFB sputum smear-positive
Pulmonary/ laryngeal	AFB sputum smear-negative Culture pending	Commence contact investigation if strong clinical suspicion (may discontinue if culture result negative)	Lower than AFB sputum smear-positive
Pulmonary/ laryngeal	AFB sputum smear-negative Culture negative **(Clinical diagnosis only)**	Commence contact and/or source case investigation of household and other close contacts only; if clinical TB is ruled out, stop contact investigation	Low unless repeated cultures change to positive
Non-respiratory		Contact and source case investigation of close contacts only	Low

* This means contact **or** source case investigation, as appropriate.

Conducting a Contact Investigation

Any successful contact investigation requires careful attention to detail in the gathering and evaluation of information. While contact investigation does not always follow this order, the following steps should assist the regional TB program staff to ensure the necessary information is gathered:

- index case medical information review
- patient (index case) interview
- field investigation
- risk assessment for *M. tuberculosis* transmission
- decision about priority of contacts
- evaluation of contacts (high-risk, medium-risk, low-risk)
- follow-up of contacts
- decision about whether to expand testing (the concentric circle approach)
- evaluation of contact investigation activities

Medical Information Review

Review of medical information pertaining to the index case is crucial to making the decision regarding which contacts are at risk of infection with *M. tuberculosis*. This information is usually gathered by TB Control or the local TB Clinic through discussion with the regional MOH, the provincial laboratory, the physician, and/or the admitting hospital. The following information is important in deciding which contacts are most at risk of infection.

Probability of Infectiousness

The probability of infectiousness is dependent on the following:

- site of tuberculosis disease (respiratory vs. nonrespiratory)
- tuberculosis symptoms (particularly cough), and approximate date symptoms began
- sputum smear and culture results, including the dates of specimen collection
- chest radiograph results and date (cavitary pulmonary disease is usually very infectious)
- tuberculosis treatment (medications, dosage, and date treatment was started, DOT or self-administered)

Period of Infectiousness

The period of infectiousness begins with the onset of symptoms (especially coughing), and ends when all the following criteria are met:

- symptoms have improved
- the client has been receiving **adequate** treatment for at least 2 to 3 weeks
- the client has had 3 consecutive negative sputum smears, from sputum specimens collected on 3 different days

The Interview

The patient interview is one of the most crucial parts of the contact investigation because it is used to develop a list of those who are at risk for infection. It should be conducted by experienced TB program staff, and several interviews will probably be necessary to ensure complete information is received. The following strategies will assist in developing excellent interview skills:

- explain to the patient the importance of the contact investigation for preventing and controlling TB
- ensure that the interview takes place under conditions that encourage effective communication and ensure confidentiality
- establish the foundation for a good relationship with the patient, based on mutual trust and understanding
- begin an assessment of the patient's knowledge, feelings, and beliefs about TB and educate the patient
- ask open-ended questions
- have a clear understanding of the objective of the interview
- plan the interview so that each objective is given adequate time
- listen to the patient's concerns about TB and its treatment
- share information freely with the patient

The initial interview should occur as soon as possible after the case is reported, and is therefore often done in hospital. The purpose of this interview is to find out more about the patient's symptoms to help define the period of infectiousness, to find out places where the patient spent time, and to identify the patient's contacts. Follow-up interviews are important to ensure accuracy of information, and are done by the most appropriate person at the time (e.g. facility infection control nurse, PHN, CHR, physician, etc.).

An interview checklist (see page 7-22) will assist the interviewer to ensure all the necessary information is gathered.

Interpreters may be needed if language is a barrier. Care must be taken in the choice of interpreters, being sensitive to issues of confidentiality (a family member or close friend may not always be the best choice.

Symptoms

Ask about any symptoms, but especially about cough or hoarseness, and how long these symptoms have been present. This will assist in determining how long the patient has been infectious.

- Difficulty recalling onset of symptoms can sometimes be helped by asking the patient to relate symptoms to events such as birthdays, holidays, major news events.
- With the patient's approval, family members or other persons who live in the same home may be interviewed to help estimate onset of symptoms.

Hoarseness **may be an indication of laryngeal TB. The presence of a** ***cough*** **indicates a greater likelihood of spreading infection.**

Places

Ask the patient to identify all of the places that they have been since the symptoms began, especially places where they spent the most time.

- This may be a difficult task, which may be made easier by asking the individual to go over their daily routine at home, work or school, and in leisure or recreation activities.
- Ask the individual to think about other places that they have been less frequently, such as parties, meetings, family gatherings.
- It is also important to get information about the characteristics of each place, such as size, time spent there, and ventilation. This information is important to determine the risk of transmission of *M. tuberculosis*.

Contacts

Every TB patient has at least 1 contact, and some may have hundreds.

Ask the patient to give names, dates of birth, addresses and telephone numbers of any individuals they have spent time with in each of the places that they have identified, especially those they see daily. Special emphasis must be given to whether or not the source case has had any close contact with infants or children.

Completing the Interview

At the end of the interview, the decision should be made about who will notify the contacts about the need for follow-up.

- The patients may want to notify some contacts themselves, especially those who are family or close friends. If notification is to be done by the patient, inform them that the nurse will have to follow up any contacts who do not present for testing.
- If TB program staff are to do the notification, the patient should be reassured that notification will only be done under strict guidelines of confidentiality, and that contacts will not be told who named them as a contact.
- The interviewer should be aware that there might be some contacts that the patient is reluctant to identify and others who the patient has forgotten during the initial interview.
- Follow-up interviews should be scheduled when time permits, and the interviewer should ensure the patient knows how to reach them if further names are recalled at a later date.

Field Investigation

Undertaking a field investigation means visiting the patient's home, workplace or school, and the other places where the patient spent time while infectious.

The purpose of the field investigation is to identify contacts of an individual with tuberculosis disease and evaluate the environmental characteristics of the place where exposure occurred. During the field investigation, the health care worker should:

- observe environmental characteristics of the space (size, crowding, ventilation)
- identify additional contacts (especially children) and their phone numbers and addresses
- look for evidence of other contacts who may not be present at the time of the visit, and who the patient has not previously identified (Pictures of others who may live in or visit the home frequently, shoes of others who may live in the home, toys left by children, etc. may help identify others who have been in contact.)
- interview and skin test close contacts who are present and arrange for reading of the results
- educate the contacts about the purpose of a contact investigation, the basics of transmission, the risk of transmitting *M. tuberculosis* to others, and the importance of testing, treatment, and follow-up for TB infection and disease
- refer contacts who have TB symptoms for evaluation

Risk Assessment for *M. tuberculosis* Transmission

Assessing the risk of transmission helps determine which contacts should be given high priority for testing and evaluation. Information gathered during the medical information review, the patient interview, and the field investigation are used during this assessment.

Tuberculosis is an infectious disease transmitted almost exclusively by the airborne route. The risk to contacts of transmission of tuberculosis from an individual with pulmonary tuberculosis depends on the following factors.

The infectiousness of the source case, which is determined by the following:

- The site of tuberculosis disease. For example, pulmonary TB, particularly cavitary pulmonary TB and laryngeal TB are infectious, while lymph node TB is not.
- Tuberculosis symptoms – especially those that cause aerosolization of sputum (cough).
- Results of sputum smear and cultures for acid-fast bacilli (AFB).
  - Individuals whose sputum is "smear-positive" are highly infectious.
  - Those whose sputum is "culture-positive" but "smear-negative", are less infectious but are still capable of spreading infection.
- Findings on chest radiographs. A cavitary lesion suggests disease that is highly infectious.
- Tuberculosis treatment. The degree of infectiousness decreases rapidly once appropriate medications are administered and adhered to. Just how appropriate the medications are may not be certain until the drug susceptibility test results are available.

The environment where transmission likely occurred

▶ The risk of transmission depends on the concentration of infectious droplet nuclei in the air shared by the case and their contacts. Concentration will be higher in a small, enclosed, poorly ventilated room with little exposure to sunlight than in a large, well-ventilated one.

The frequency and duration of exposure

▶ No definition of "significant duration of exposure" can be applied in all cases. It depends on how highly infectious the case is, the type of exposure the contacts have had, and the susceptibility of the contacts. This must be assessed with each case.

2 hours or more of close contact with a highly infectious case is often used as "significant exposure" during initial investigations, but as information is collected, this time may be adjusted.

The susceptibility of the contact may also have an impact on the assessment of risk to individuals following TB exposure.

▶ Individuals with no prior exposure to *M. tuberculosis* are at increased risk of infection when in contact with an infectious case of TB.

- It is important to appreciate that BCG vaccination does not reduce the risk of infection. Its value is in reducing the risk of disease once infection has occurred.
- Prior infection or disease is believed to reduce, but not entirely remove, the risk of re-infection.
- It is possible that certain racial groups (for example African Americans) are at increased risk of infection after exposure.

Assigning Priority for Investigation of Contacts

In order to make the most efficient use of resources, initial contact investigation should be focused on those individuals most at risk of acquiring tuberculosis infection and developing tuberculosis disease, and expanded as necessary.

Contacts with symptoms have priority over all other contacts.

The highest priority for testing should be given to contacts who are most likely to be infected, as assessed during the risk assessment for transmission of *M. tuberculosis*, especially those who are at high risk of developing disease if infected. This usually means children less than 6 years of age, and those who are severely immunocompromised such as the HIV infected.

▶ When TB is diagnosed in young children, it indicates new disease, and undiagnosed infectious tuberculosis in the home or community should be suspected. Every effort should be made to identify the undiagnosed case who has infected this child.

Evaluation and Management of Contacts

Evaluation of contacts for tuberculosis infection and/or disease needs to be carried out in an orderly manner, beginning with those at highest risk.

The provincial tuberculosis Contact Investigation Co-ordinator, or the Calgary or Capital Health TB Clinics, should be consulted when planning a contact investigation. They have access to the "broad picture" provincially, and can assist with compiling information from all regions. Also, they often have information that will assist with the determination of risk. Communication with them (written and/or verbal) should be maintained throughout the investigation to ensure appropriate activities are undertaken.

In many cases, contacts of infectious individuals do not all live within one health region, and assessment of the spread of infection can be difficult. The provincial tuberculosis Contact Investigation Co-ordinator can provide a cross-regional and inter-provincial perspective of the ongoing evaluation of contacts and should therefore be included in decisions regarding contact investigation activities. This means:

- submission of contact lists as contacts are identified (within 7 days of notification of the case)
- information about the whereabouts of named contacts who have moved or live in a different jurisdiction
- reporting all investigation activities **as they are completed.** The identification of secondary cases and converters will necessitate the expansion of the contact investigation.
- reporting compliance with recommendations for follow-up and/or treatment
- joint evaluation of the contact investigation activities (with the co-ordinator) to determine when follow-up is complete

Evaluation Tools

As with screening programs, contact investigation programs rely on several tools to assist with the evaluation of individuals. These tools include:

- medical history, including symptom review
- tuberculin skin test (TST), except where documentation of a previous significant reaction exists
- chest radiograph
- sputum examination

} when indicated

Medical History

Information gathered by asking the contact about the following will assist in the evaluation of the need for further investigation:

- **documented** previous significant tuberculin skin test
  - Sometimes there is no history of a documented previous significant reaction, but the client describes a reaction that sounds "significant." In this instance, a history of probable prior exposure will assist in the decision whether or not to administer a TST.
- past history of tuberculosis disease
- previous treatment for tuberculosis infection or disease
- previous exposure to tuberculosis
- risk factors for developing tuberculosis disease (especially HIV risk factors)
- current symptoms of tuberculosis, such as persistent cough (especially if productive), fever, night sweats, weight loss, fatigue
  - **Contacts with symptoms consistent with tuberculosis have priority over all other contacts** and should have a chest radiograph and 3 sputum specimens submitted for AFB smear and culture immediately. A tuberculin skin test is administered unless there is a history of a previously significant reaction. Refer to the family physician or the TB Clinic for evaluation.

Tuberculin Skin Test (TST)

Background Information

The tuberculin skin test is a useful tool for identifying individuals who have been infected with the tubercle bacillus, although it does not indicate whether the infection is recent, or remote (the individual was infected many years past), nor does it indicate whether the person has disease or not.

To identify those who have been infected, but tested negative during the initial screening, a repeat TST is required 8 to 12 weeks post-contact. Normally, it takes 2 to 8 weeks after tuberculosis infection for the body's immune system to react to tuberculin.

Infected individuals whose immune system is immature or depressed (e.g. HIV infected individuals), infants up to 6 months of age, and those with active tuberculosis disease may not mount a response to the TST. Therefore, a thorough investigation needs to be initiated, and these individuals must be reported to TB Control urgently, regardless of TST reading.

During a contact investigation, individuals who have a significant TST with no prior history of a significant TST are assumed to have been recently infected.

Contacts with a previous significant reaction should not be skin tested again. Investigation should follow the protocol for other significant TST reactors.

Tuberculin skin testing should be performed on contacts determined to be at risk, who have no documentation or description of a previously significant reaction. A single TST should be administered at this time.

The results of this **initial tuberculin skin test** will assist in the determination of the need for further screening activities. If this TST is read as:

Non-significant (<5 mm.)

Contacts who are healthy, should have a repeat TST 8-12 weeks **after the last exposure to the infectious case.** The result of this follow-up TST will help to further define the necessary investigations.

- If the reaction to the second test remains non-significant and the individual remains healthy, no further follow-up is required.
- Converters must be investigated further (follow protocol for significant reactor, see page 2-10) to rule out tuberculosis disease. They are assumed to have been recently infected by the tubercle bacillus, and are therefore at greater risk for development of tuberculosis disease.

Close contacts whose initial TST result is non-significant, but who are **infected with HIV, or are under the age of 6 years,** are at very high risk of development of TB disease if they have been infected. They should be referred immediately to TB Control or the TB Clinic for further investigation, and considered for preventive therapy.

Significant (≥5 mm.)

Further investigation including a chest radiograph and sputum investigation is needed to rule out TB disease.

Chest Radiographs

The radiograph is another crucial tool in the contact investigation protocol. When used in conjunction with the TST result, it is of great assistance to the TB physician in the assessment of the individual for tuberculosis infection or disease. These radiographs should be requisitioned using the "TB Referral Form" (see Appendix 14.3) to ensure they are forwarded to TB Control or the Calgary or Capital Health TB Clinic for interpretation.

Chest radiographs should be ordered (as recommended by TB Control or the TB Clinics) on contacts who:

- have a significant TST reaction
- are HIV positive (regardless of TST reaction)
- are children under the age of 6 years who are close contacts of infectious tuberculosis (regardless of TST reaction)

Sputum Investigation

A positive culture for *M. tuberculosis* is the "gold standard" for the diagnosis of TB disease. 70-80% of all cases are confirmed using this tool.

The examination of sputum for AFB is the most cost-effective tool for the identification of undiagnosed secondary cases. Not only are the results available within a very short time, but this specimen can be easily collected in the client's home.

Any contact who has an abnormal chest radiograph or who has TB symptoms, particularly a productive cough, must have 3 sputum specimens submitted to the laboratory for AFB smear and culture, regardless of the results of the TST.

Efforts should always be made to collect at least 1sputum specimen for AFB on all contacts who have a significant TST. Contact investigators should carry a supply of sputum containers with them whenever they are conducting an investigation. Collect 3 sputum specimens on symptomatic contacts.

Sputum induction or gastric aspirates may be needed in the case of contacts who have difficulty producing sputum, (e.g., young children or the elderly) who are suspected of having tuberculosis disease (see Appendix 14.7).

Preventive Therapy

Preventive drug therapy (now referred to as treatment of latent TB infection) should be considered for all close contacts of infectious cases who have significant TST results.

High-risk contacts, even with a non-significant TST reaction (e.g., children < 6 years of age, the HIV infected, or others who are severely immunocompromised), should start preventive therapy as soon as possible after exposure once active disease is ruled out.

- If the follow-up TST at 8 to 12 weeks indicates no TB infection has occurred, this treatment, depending upon the circumstances, may be discontinued. Preventive treatment in close, HIV infected contacts is usually continued regardless of the results of the follow-up TST, as the individual may be anergic.

- If follow-up at 8 to 12 weeks indicates TB infection has occurred, treatment will be continued.

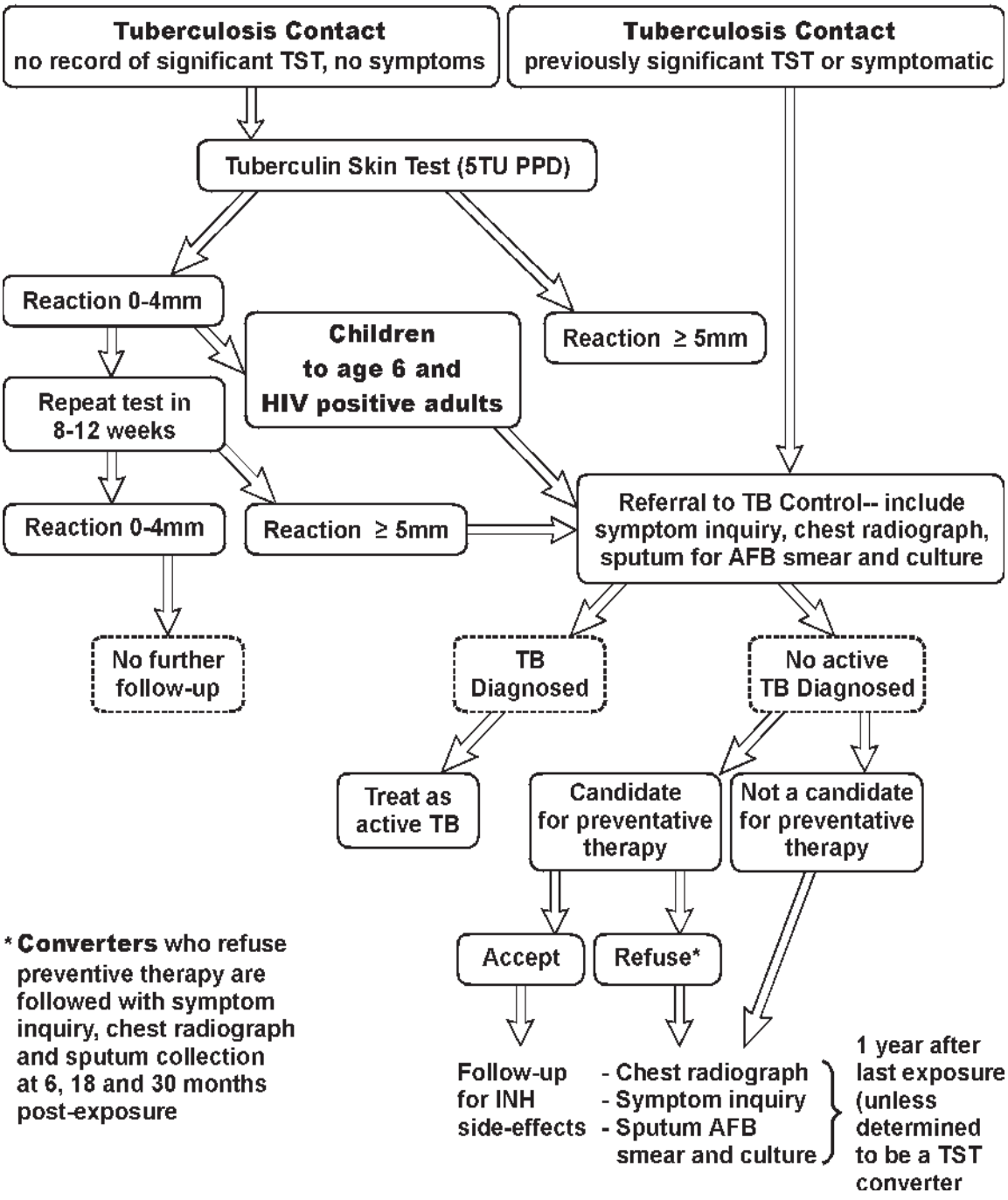
Under certain circumstances, casual contacts may also be offered preventive therapy.

When preventive therapy is not accepted or completed, a repeat chest radiograph and sputum for AFB smear and culture at 12 months post-exposure is required for all contacts thought to be infected (whether recently or in the remote past) who do not complete a full course of preventive therapy.

- All individuals who are documented **converters** who do not complete a full course of preventive therapy will be followed at 6 months, 18 months and 30 months, with a symptom inquiry, chest radiograph and sputum for AFB smear and culture.

The risk of progression from infection to disease is highest in the first 2 years after infection.

Algorithm for Tuberculosis Contact Follow-up



Expanding the Investigation to Medium and Low Risk Casual Contacts

Once the close contacts have been evaluated for tuberculosis infection or disease, the decision must be made whether or not to expand testing to lower risk contacts. Evidence of recent transmission will assist in the determination of the need for expansion. The following factors would indicate recent transmission.

- a secondary case of tuberculosis
- a higher infection rate among contacts than what would be expected in this community
- evidence of transmission to young children
- skin test conversion in contacts

When there is evidence of transmission in the first group of close contacts, the likelihood of further transmission increases, and it is prudent to expand the testing to include those with less contact.

The Concentric Circle Approach to Contact Investigation

The concentric circle approach to contact investigation is a tool used to assist in determining who needs to be screened, and when screening can be considered complete.

Investigation begins with the close contacts of the index case. If none of these individuals have been infected, it is unlikely that those with casual contact need to be screened.

If there is evidence of transmission (as defined previously), those within the next circle are identified and screened. This circle is widened to include the casual contacts of the case. Widening of the circle will continue until there is no further evidence of transmission.

Definition of Contacts

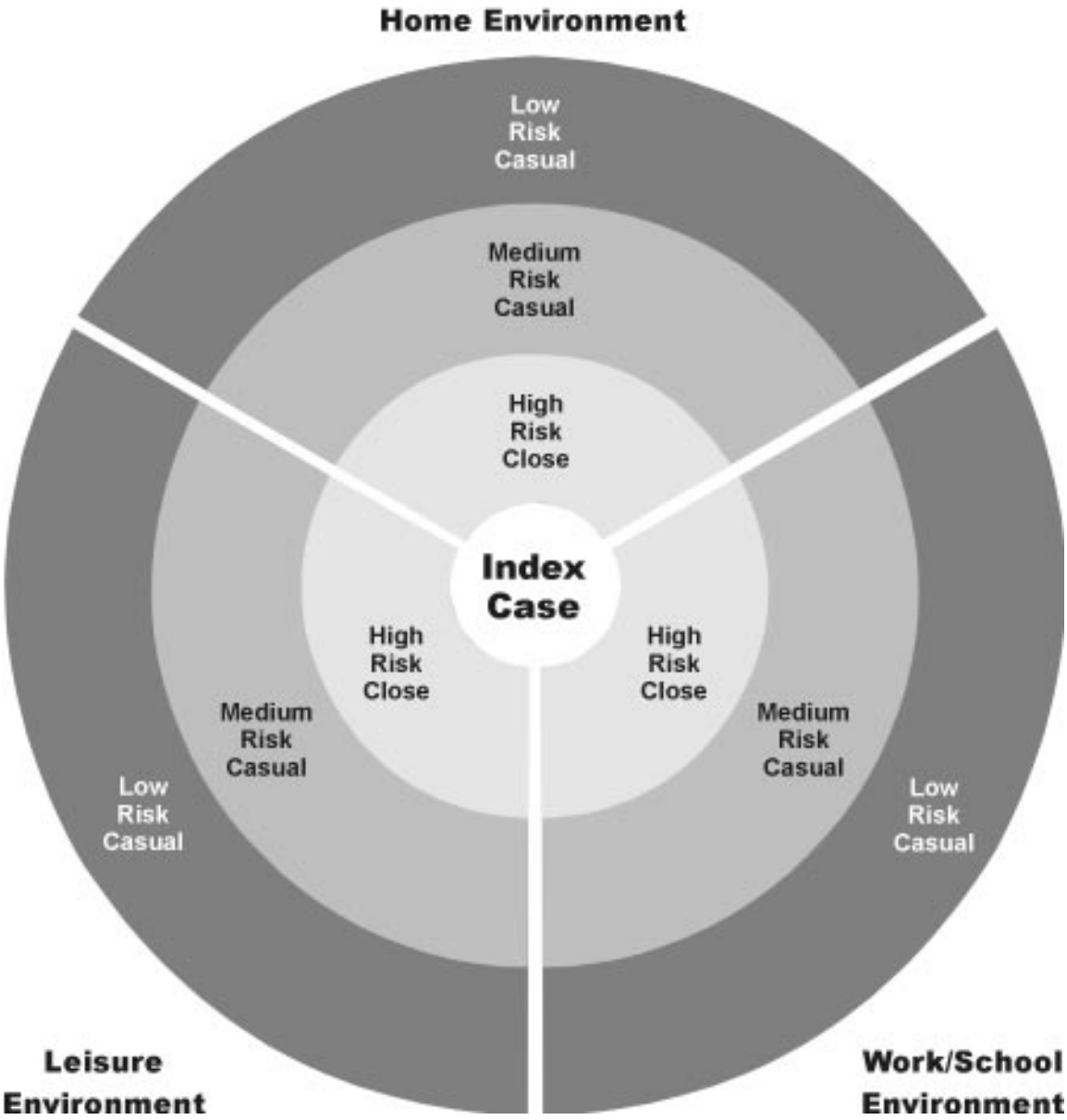
The amount of contact necessary for infection to take place is variable, and dependent on the infectiousness of the case, the environment of exposure, and the duration of exposure. Therefore, the definitions of "close" and "casual" contact may differ from case to case. Tuberculosis Control staff will be of assistance in the determination of risk, but the standard definitions are as follows:

Close contacts: (highest risk) are household or "household equivalent" contacts (in the home, at work or in the community) who share the same breathing space on a regular basis.

Casual contacts: (medium risk) are those who spend less time with the index case, or whose contact is in a more open environment.

Casual contacts: (low risk) are those who spend minimal time with the index case, and are often referred to as "community contacts."

Concentric Circle Analysis



Evaluation of Contact Investigation Activities

Effective and successful contact investigations can help identify and prevent additional cases of tuberculosis infection and disease, and reduce further transmission of tuberculosis. Because of this, evaluation of activities should be an integral part of completing the investigation, and will assist in determining whether available program resources are adequate and can be used effectively.

Evaluation of activities should be done in conjunction with the Tuberculosis Control Contact Tracing Co-ordinator, or the local TB Clinic, and will be based on the standards set out for contact investigation and prevention. The following criteria need to be assessed.

Evaluation should always be considered an integral part of any contact investigation.

- Were an appropriate number of contacts identified?
- Were the highest-priority contacts located and tested?
- Was the contact investigation performed in all settings?
- Was the contact investigation expanded appropriately?
- Were contacts completely evaluated (including follow-up skin test at 8-12 weeks if needed)? Were they recommended appropriate treatment if they had TB infection or disease?
- How many infected contacts completed an adequate regimen of treatment for infection?
- Did all identified cases complete an adequate treatment regimen?
- Did all those who did not complete adequate preventive therapy have a chest radiograph 1year post contact?

The answers to these questions can help to determine not only how successful the contact investigation has been, but also where additional efforts need to be directed.