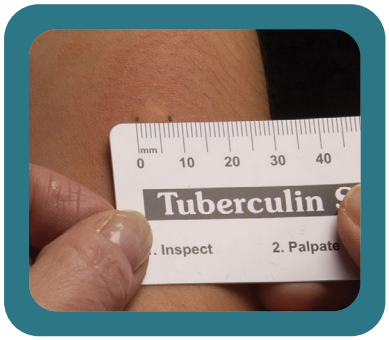
Self-Study Modules on Tuberculosis



Module 8

Contact Investigations for Tuberculosis

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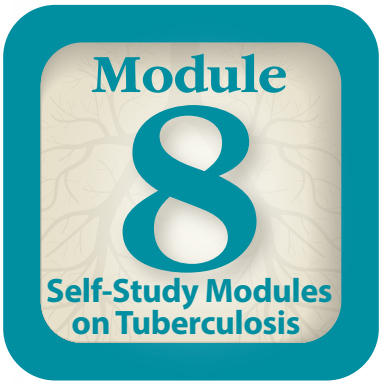
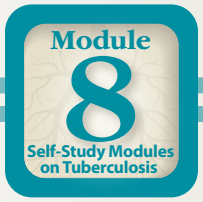


Contact Investigations for Tuberculosis

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for HIV, Viral Hepatitis, STD, and TB Prevention
Division of Tuberculosis Elimination

Atlanta, Georgia
2014



Contents

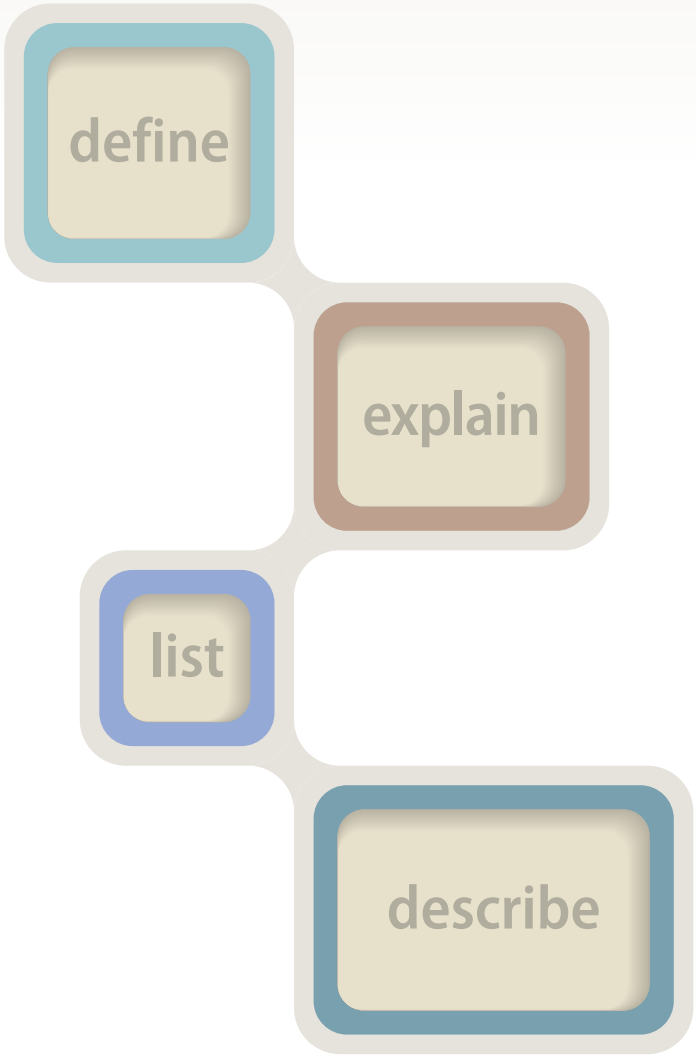
Background

In this module, you will learn about tuberculosis (TB) contact investigations.

Persons who have been exposed to a case* of infectious TB disease are known as TB contacts. A TB contact investigation is a TB control strategy used to identify, find, and assess TB contacts and provide appropriate treatment for latent TB infection (LTBI) or TB disease, if needed. Effective contact investigations interrupt the spread of TB in communities and help prevent outbreaks of TB.

Guidelines for TB contact investigations and management of TB contacts were published in 2005. For more detailed information, please refer to the Centers for Disease Control and Prevention (CDC) *Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis*, available from the CDC website (www.cdc.gov/tb).

* Please note that throughout this module the term "case" will be used instead of "patient" to describe persons with TB disease. Although "case" may seem impersonal, the rationale for using it is to avoid confusion with contacts who may also be considered "patients" if they are found to have LTBI or TB disease.



Objectives

After working through this module, you will be able to

1. Define a TB contact investigation.
2. State the goals of a TB contact investigation.
3. Describe the systematic approach to TB contact investigations.
4. Define a TB source case investigation.

New Terms

New terms introduced in this module are included below. Please refer to the *Self-Study Modules 1–5 Glossary* if you encounter unfamiliar terms related to TB that are not defined in the glossary below.

case—a person with suspected or confirmed TB disease; sometimes referred to as an index case or index patient

case conference—meetings at designated intervals for reviewing the treatment of TB patients currently under care. During a case conference, the case manager presents information to colleagues about the status of each case under medical care and the progress of the contact investigation.

congregate setting—a setting in which a group of persons reside, meet, or gather either for a limited or extended period of time in close physical proximity. Examples include prisons, nursing homes, schools, and homeless shelters.

contacts—persons exposed to someone with infectious TB disease, can include family members, roommates or housemates, close friends, coworkers, classmates, and others

contact investigation—a systematic process to identify persons (contacts) who were exposed to someone with infectious TB disease; assess contacts for infection with *M. tuberculosis* and TB disease; and provide contacts with treatment for latent TB infection or TB disease, if necessary

degree of infectiousness—physical or environmental characteristics that can affect ability to transmit *M. tuberculosis*

exposure period—the timeframe during which a contact may have been infected with *M. tuberculosis*

field visit—visiting a TB case's residence, congregate settings, and other places where the TB case spent time while infectious. A field visit can also be used to locate or meet contacts.

genotype—distinct genetic pattern of an organism

genotyping—a laboratory-based method that can determine the genetic pattern of the strain of *M. tuberculosis* that caused TB disease in a person

index case—the initial TB case that prompts a contact investigation

infectious—refers to a disease that is capable of being spread; a person who has infectious TB disease expels droplets containing *M. tuberculosis* into the air when he or she coughs, sneezes, speaks, or sings

infectious period—time during which a TB case is potentially capable of transmitting *M. tuberculosis*

location-based investigation—an approach for conducting contact investigations onsite at a location where the TB case spent time while infectious. The purpose is to identify and assess potential TB contacts at that location.

pre-interview phase—reviewing existing information about the TB case before the first interview; typically this is the first step in the systematic approach to contact investigation

prevalence of TB infection—the percentage of persons infected with *M. tuberculosis* within a defined population

priority contacts—contacts who are at most risk for TB infection or disease

proxy—a person interviewed in place of a TB case. Potential proxies include family members, close friends, or other persons who know the person well. A proxy is used if the TB case is deceased, physically or mentally unable to participate in interviews, very young, or unable to be located

proxy interview—an interview with persons (proxies) who are familiar with the TB case's practices, habits, and behaviors

secondary case—an instance of TB after a known exposure, usually related to the index case in an investigation

secondary transmission—when any of the secondary case's contacts are found to have latent TB infection or TB disease

source case—a person with TB disease who is responsible for transmitting *M. tuberculosis* to another person or persons

source case investigation—a method used to identify a source case; usually done when a young child is found to have TB disease

TB genotyping information management system (TB GIMS)—a secure CDC-sponsored online national database of *M. tuberculosis* genotyping and TB case information

tumor necrosis factor-alpha (TNF-alpha) antagonists, inhibitors, or blockers—medications used to treat inflammatory or autoimmune diseases such as rheumatoid arthritis, Crohn's disease, psoriatic arthritis, and juvenile rheumatoid arthritis

window period—the time between the contact's last exposure to the TB case and when a TST or IGRA can reliably detect infection with *M. tuberculosis*

window period prophylaxis—treatment for latent TB infection that is given to high-risk contacts who have an initial negative test result for TB infection less than 8 to 10 weeks after their last TB exposure

Module 8 Self-Study Modules on Tuberculosis

Introduction to TB Contact Investigations

Conducting contact investigations is a priority for tuberculosis (TB) programs in the United States. The goals of a contact investigation are to successfully stop TB transmission and prevent future cases and outbreaks of TB disease. It is important to remember that every TB case started as a TB contact.

The goals of a contact investigation are to successfully stop TB transmission and prevent future cases and outbreaks of TB disease.

What is a TB Contact Investigation?

A TB contact investigation is a systematic process to

1. Identify persons (**contacts**) exposed to a person with infectious TB disease (a **case**)
2. Assess contacts for infection with *M. tuberculosis* and TB disease
3. Provide appropriate treatment for contacts with latent TB infection (LTBI) or TB disease

Who are TB Contacts?

Contacts are persons who have shared airspace with a person with infectious TB disease.

Contacts are persons who have shared airspace with a person with infectious TB disease. These persons may include household members, friends, coworkers, classmates, and others. During a contact investigation, public health investigators identify contacts by interviewing the TB case and visiting places where the case spent time while infectious.

Why is it Important to Identify and Assess TB Contacts?

It is important to quickly identify, find, and assess contacts for TB infection and disease. Approximately 1% of all TB contacts have TB disease at the time of the contact investigation and are in need of treatment. Additionally, about 20% to 30% of TB contacts are infected with *M. tuberculosis* and are at risk for developing TB disease if not diagnosed and treated for LTBI.

Contacts infected with *M. tuberculosis* who are at particularly high risk for developing TB disease rapidly include

- Children younger than 5 years of age
- Persons with weakened immune systems due to
  - HIV infection
  - Immunosuppressive therapy, including **tumor necrosis factor-alpha (TNF-alpha) antagonists**, prolonged use of high-dose adrenocorticosteroids, or medications received after organ transplantation

For a contact investigation to be considered successful, contacts should complete treatment if they have LTBI or TB disease.

Contacts who have either LTBI or TB disease should be offered the appropriate treatment unless there is a compelling reason not to do so (e.g., the contact has hepatitis or end-stage liver disease). For a contact investigation to be considered successful, contacts should complete treatment if they have LTBI or TB disease.

Who is Responsible for Conducting TB Contact Investigations?

Health departments are accountable for ensuring contact investigations are performed for TB cases reported in their jurisdictions, even when patients are receiving care outside the health department.

In the United States, state and local health departments are legally responsible for the prevention and control of TB in their communities. Thus, they are accountable for ensuring contact investigations are performed for TB cases reported in their jurisdictions, even when patients are receiving care outside the health department.

Although health departments are responsible for conducting contact investigations, some steps of a contact investigation may be given to persons or programs outside of the health department. For example, if transmission of *M. tuberculosis* occurs at a healthcare facility, the contact investigation may include hospital epidemiologists and infection control professionals. Whenever contact investigation activities are delegated, the health department should work with those involved to ensure that the local policies and procedures are followed.

Whenever contact investigation activities are delegated, the health department should work with those involved to ensure that the local policies and procedures are followed.

For some contact investigations, there may be areas and programs involved that are not under the jurisdiction of state or local health departments. For example, some contact investigations may involve military bases, federal prisons, diplomatic missions, or American Indian or Alaska Native tribal reservations. If an area or program has its own healthcare system or TB control program, state and local health departments can offer technical consultation and support.

For sites without their own healthcare system or TB control program, agreements can be made with authorities about how to handle the public health response. In tribal areas, health departments should coordinate with both tribal leadership and the system that is providing healthcare to tribal members, such as the Indian Health Service (IHS) or tribally run healthcare systems.

The Centers for Disease Control and Prevention (CDC) is available to assist in the coordination of contact investigations that involve tribal jurisdictions, multiple jurisdictions, or international jurisdictions.

Which TB Cases Require a Contact Investigation?

Cases with Infectious Forms of TB Disease

A contact investigation is required for all confirmed cases that have infectious forms of TB disease (e.g., TB disease of the lungs, airways, or larynx).

Confirmed TB Cases

A contact investigation is required for all confirmed cases that have infectious forms of TB disease (e.g., TB disease of the lungs, airways, or larynx).

Suspect TB Cases

The contact investigation process should be started for persons suspected of having infectious TB disease, even before confirmation.

The contact investigation process should be started for persons suspected of having infectious TB disease, even before confirmation. This includes persons with positive sputum smears and a positive nucleic acid amplification test result. For persons with positive sputum smears and a negative nucleic acid amplification test result, a contact investigation is not indicated.

For suspect cases with negative sputum smears or sputum smears not performed, the contact investigation process should be started if the case has abnormal chest x-ray findings consistent with TB disease.

For suspect cases with negative sputum smear results and no pulmonary cavities, a contact investigation should only be considered for certain circumstances, such as if the suspect was identified during an outbreak or source case investigation that included vulnerable or susceptible contacts.

If it is later determined that the suspect case does not have infectious TB disease, the contact investigation should be stopped.

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Cases with Noninfectious Forms of TB Disease

Cases with noninfectious forms of TB disease generally do not require a contact investigation.

Cases with noninfectious forms of TB disease generally do not require a contact investigation. This includes cases that only have extrapulmonary TB disease (e.g., TB disease in the brain, the kidneys, or the bones and joint).

Cases Younger than 10 Years of Age

In most instances, a contact investigation is not necessary for children younger than 10 years of age.

In most instances, a contact investigation is not necessary for children younger than 10 years of age. This is because they are less likely to transmit *M. tuberculosis*. If the case is younger than 5 years of age, a **source case investigation** might be indicated (for more information, see the Source Case Investigations section of this module, page 76).

For more specific information on initiating a contact investigation, refer to the CDC *Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis*, available from the CDC website (www.cdc.gov/tb).

When Should the TB Contact Investigation Begin?

The first few steps of the TB contact investigation process should start as soon as a suspected or confirmed infectious TB case comes to public health attention.

In all U.S. jurisdictions, clinicians are required to rapidly report TB disease or a suspicion of TB disease to public health authorities. The first few steps of the TB contact investigation process should start as soon as a suspected or confirmed infectious TB case comes to public health attention. This includes reviewing medical information and interviewing the case within one working day after the case is reported to the health department.

It is important to respond promptly because

- Some contacts may already have TB disease and are in need of treatment;
- Some contacts could be at risk for rapid development of TB disease;
- Some contacts may become more difficult to locate as time goes by, such as homeless persons;
- There could be ongoing transmission of *M. tuberculosis;* and
- Cases may have difficulty remembering all of their contacts as time goes by.

Contact investigations initiated for suspect TB cases should be stopped if it is later determined that the person does not have infectious TB disease.

Study Questions 8.1–8.4

8.1 What is a TB contact investigation?

8.2 What are the goals of a TB contact investigation?

8.3 Which TB cases require a contact investigation?

8.4 Who is responsible for conducting TB contact investigations?

Answers to study questions are on pages 83–89

Case Study 8.1

You are a TB case manager at a busy clinic. Two new TB cases have been assigned to you. Indicate which case(s) require a contact investigation and note the reason why you made your decision.

- **Jose is a 35-year-old agricultural worker diagnosed with extrapulmonary TB of the kidneys. He lives with his wife in a small, rented house in a rural area.**

- **Dale is a 72-year-old widower who lives alone. He drives himself to the local retirement center for bingo and poker four times a week. He was recently evaluated for TB disease by his physician because he complained of having a cough, shortness of breath, fatigue, and weight loss. His sputum smears were positive and his culture results are pending. Dale's chest x-ray shows a cavity in the right upper lobe of his lungs. The physician suspects TB and started Dale on a four-drug regimen.**

Answers to case studies are on pages 90– 98

How Should TB Contact Investigations be Prioritized?

Because of limited resources and competing demands, health departments may not be able to complete the contact investigation process for all confirmed or suspected infectious TB cases promptly. Thus, health departments may need to prioritize among contact investigations and dedicate resources to those considered a higher priority.

If a health department needs to prioritize between contact investigations, the focus should be on contact investigations where the likelihood of transmission is high and contacts are at an increased risk for rapid development of TB disease.

If a health department needs to prioritize between contact investigations, the focus should be on contact investigations where the likelihood of transmission is high and contacts are at an increased risk for rapid development of TB disease.

In general, priority should be given to contact investigations involving

- Cases that are likely to be highly infectious
- Settings where transmission of *M. tuberculosis* is likely
- Contacts at high risk for rapid development of TB disease if infected with *M. tuberculosis*

Highly Infectious Cases

Transmission of M. tuberculosis *depends on a variety of factors, but it is more likely to occur when a case is highly infectious.*

Transmission of *M. tuberculosis* depends on a variety of factors, but it is more likely to occur when a case is highly infectious. Highly infectious cases generally have one or more of the following characteristics:

- Pulmonary, laryngeal, or pleural TB
- Positive sputum smear results
- Cavities on chest x-ray
- Actions that can increase the likelihood of transmission
  - Coughing
  - Sneezing
  - Singing

For example, a case with pulmonary TB who was coughing for three months before receiving treatment and who has positive sputum smears is more likely to be infectious than a case who has negative sputum smears and has rarely been coughing. Therefore, the first case would be considered a higher priority for a contact investigation.

Settings Where Transmission of *M. tuberculosis* is Likely

Another factor to consider when prioritizing among contact investigations is the setting in which transmission may have occurred. Transmission is more likely if there is a high concentration of *M. tuberculosis* in the air. The concentration of bacteria in the air is affected by the setting's

Transmission is more likely if there is a high concentration of M. tuberculosis *in the air.*

- Size
- Ventilation
- Air-cleaning system

M. tuberculosis is more likely to be transmitted in small, crowded spaces that do not have adequate airflow. For example, transmission is more likely in a small office with little or no ventilation than it is in a large, well-ventilated grocery store. Settings with air-cleaning systems such as high-efficiency particulate air (HEPA) filters and ultraviolet lights can decrease the concentration of *M. tuberculosis* in the air. (For more information, refer to *Module 5, Infectiousness and Infection Control.*)

In addition to the size, ventilation, and air-cleaning systems of the setting, it is also important to consider activities that have occurred in the setting that can increase the likelihood of transmission. For example, medical procedures such as bronchoscopy, sputum induction, TB wound irrigation, or autopsy of TB cases can produce a high concentration of *M. tuberculosis* in the air. Therefore, contact investigations involving settings where these procedures take place should be considered a priority.

Contacts at High Risk for Rapid Development of TB Disease if Infected with *M. tuberculosis*

Contacts who are at a particularly high risk for rapidly developing TB disease after infection with *M. tuberculosis* include

- Children younger than 5 years of age
- Persons with weakened immune systems due to
  - HIV infection
  - Immunosuppressive therapy, including TNF-alpha antagonists, prolonged use of high-dose adrenocorticosteroids, or medications received after organ transplantation

Any contact investigation involving these persons should be given priority.

Who Conducts the TB Contact Investigation?

A TB contact investigation involves many different steps and procedures. Depending on the program, the activities of the contact investigation may be conducted by an individual or a contact investigation team.

The staff involved in conducting a contact investigation can include

- Case managers
- Field investigators
- Outreach workers
- Epidemiologists and surveillance staff
- Program managers

Ideally, one person should be assigned responsibility for the overall management of the investigation to ensure all activities of the contact investigation are conducted.

The actual job titles for team members may vary by jurisdiction. In some jurisdictions, one staff member may fill several roles. Ideally, one person should be assigned responsibility for the overall management of the investigation to ensure all activities of the contact investigation are conducted. In certain situations, infection control professionals or other staff from facilities where exposure occurred may be involved as part of the contact investigation team.

For the purposes of this module, the person responsible for conducting the contact investigation will be referred to as the "contact investigator."

What Knowledge and Skills are Necessary to Conduct a TB Contact Investigation?

To conduct a TB contact investigation, it is ideal for the contact investigator and others on the team to have the following knowledge and skills:

- A basic understanding of TB transmission and pathogenesis (for more information, refer to *Module 1, Transmission and Pathogenesis of Tuberculosis*)
- Effective communication skills to build trust and rapport with the case during interviews (for more information, refer to page 29 of this module)
- Data management and data analysis skills
- An understanding of TB genotyping

Data Management and Data Analysis

Contact investigations typically involve a large amount of demographic, medical, and epidemiologic information that needs to be systematically collected, organized, and analyzed.

To successfully conduct a contact investigation, investigators need to have skills in data management and data analysis. This is because contact investigations typically involve a large amount of demographic, medical, and epidemiologic information that needs to be systematically collected, organized, and analyzed. This data is typically used for case management, epidemiologic analysis, and program evaluation.

When conducting a contact investigation, public health programs need to determine

- Which data needs to be collected and why
- Who is responsible for collecting and how
- How data is to be managed and safeguarded

Data management during a TB contact investigation can be very time consuming. Therefore, the benefits of having the data must justify the level of effort and resources required.

An Understanding of TB Genotyping

TB genotyping is a laboratory-based method that can determine the genetic pattern of the strain of *M. tuberculosis* that caused TB disease in a person. Each strain has a distinct genetic pattern, or **genotype**. Genotyping is done for culture-positive cases of TB disease.

In the United States, genotyping information on individual cases is available to state and local health departments through the **TB Genotyping Information Management System (TB GIMS)**, a secure CDC-sponsored online national database of genotyping and case information.

Typically, genotype information will not be available during the early stages of a contact investigation. When it does become available, the results can help confirm, disprove, or detect connections among cases.

Typically, genotype information will not be available during the early stages of a contact investigation. When it does become available, the results can help confirm, disprove, or detect connections among cases. If two cases have matching genotypes, they may be connected even if the connection is not recent or obvious. For example, two persons whose TB strains match by genotype might not know one another, but they may have both been exposed to the same infectious case several years earlier. (For more information on genotyping, refer to *Module 9, Tuberculosis Outbreak Detection and Response*.)

Study Question 8.5

8.5 Which TB contact investigations should be given priority?

Answers to study questions are on pages 83–89

Systematic Approach to TB Contact Investigations

How is a TB Contact Investigation Conducted?

Contact investigations should be conducted using a systematic process that includes the following 10 steps:

1. Review existing information about the case
2. Determine an initial estimate for the infectious period and estimate the degree of infectiousness
3. Interview the case
4. Review information and develop a plan for the investigation
5. Refine the infectious period and degree of infectiousness
6. Prioritize contacts
7. Conduct field visits
8. Conduct contact assessments
9. Determine whether to expand or conclude an investigation
10. Evaluate the contact investigation activities

The actual sequence and timing of contact investigation steps and activities may vary from one investigation to another.

The actual sequence and timing of contact investigation steps and activities may vary from one investigation to another. Moreover, local public health programs may have additional guidance on policies and procedures for conducting contact investigations within their jurisdictions. These policies and procedures should be written and available to staff responsible for conducting contact investigations. Regardless of variations among local program policies, an effective investigation will include all of the above 10 steps. This section of the module will provide an overview of each of the steps.

Step 1. Review Existing Information about the Case

As soon as a suspected or confirmed case of TB comes to public health attention, contact investigators should begin gathering and reviewing all existing information about the case.

As soon as a suspected or confirmed case of TB comes to public health attention, contact investigators should begin gathering and reviewing all existing information about the case.

Existing information can help the investigator

- Estimate the infectious period
- Estimate the degree of infectiousness
- Identify potential contacts
- Identify potential exposure locations
- Conduct effective interviews

Reviewing the existing information is sometimes referred to as the **pre-interview phase**.

Information to Collect and Review before the Initial Interview with the Case

The following information should be collected and reviewed during the pre-interview phase:

Medical Information

- Site(s) of TB disease
- Current TB treatment regimen
- TB symptoms and estimated onset date
- Chest x-rays or other diagnostic imaging dates and results
- Tuberculin skin test (TST) or interferon-gamma release assay (IGRA) dates and results
- Sputum smear and culture dates and results
- Nucleic acid amplification (NAA) test dates and results
- Genotype results (if available)
- HIV test dates and results
- Details about prior diagnosis with LTBI or TB disease, and any treatment
- Medical risk factors that could have increased the case's risk for infection with *M. tuberculosis* or development of TB disease

Demographic and Social Information

- Name and aliases
- Date of birth
- Sex
- Addresses and telephone numbers
- Preferred language

- Next of kin, emergency contacts, and names of parents or guardians, if the case is a minor
- Details about any known TB exposures
- History of substance use, mental illness, or any other issues that could affect the interview or the contact investigation
- Social or behavioral risk factors that could have increased the case's risk for infection with *M. tuberculosis* or development of TB disease
- Contact names, particularly children or persons with weakened immune systems, who live with or frequently spend time with the case
- Recent travel or immigration
- History of jail or homelessness

Some of the above information may not be available during the pre-interview phase. If information cannot be obtained at this step, the investigator should obtain it during the interview phase.

Sources of Information for TB Cases

Pre-interview information can be obtained from the following sources:

- Public health records
- Medical records
- Discussions with the case's clinicians
- Tuberculosis Genotyping Information Management System (TB GIMS)

Public Health Records

Contact investigators should cross-check locally available TB registries and surveillance databases to determine if the case was previously included in a TB contact investigation or diagnosed with LTBI or TB disease. Information from the Report of Verified Case of Tuberculosis (RVCT) should also be reviewed.

Additional information about the case's HIV status and any prior TB exposure, assessment, or treatment may also be found by reviewing health department's HIV and STD surveillance records.

Medical Records

All available and relevant medical records for the case, including any from the health department, hospital, clinic, and if applicable, long-term care facility or correctional facility, should be reviewed.

For cases who were hospitalized while infectious, nurse progress notes may include the names of family and friends who visited. In addition, health insurance information may provide the work location of the case. This information can help identify potential contacts and can be used as prompts during case interviews.

Discussions with the Case's Clinicians

Speaking with the case's private or public clinicians can help clarify information obtained from medical records as well as provide additional details about the case.

Tuberculosis Genotyping Information Management System (TB GIMS)

Typically, genotype information will not be available during the early stages of a contact investigation. Genotyping information for specific cases is available to state and local health departments through TB GIMS. Local health departments can access genotyping data in various ways, usually either through TB GIMS directly or from the state TB program.

For more information about TB GIMS, please refer to the CDC website on TB GIMS (www.cdc.gov/tb/publications/factsheets/statistics/gims.htm).

Step 2: Determine an Initial Estimate for the Infectious Period and Estimate the Degree of Infectiousness

The infectious period is the time during which a case is potentially capable of transmitting M. tuberculosis.

The **infectious period** is the time during which a case is potentially capable of transmitting *M. tuberculosis*. As there is no well-established method to determine the exact start date of the infectious period, it must be estimated. Estimating a case's infectious period helps to focus investigation efforts on identifying contacts who were most likely exposed to *M. tuberculosis* while the case was **infectious**.

Estimating a case's infectious period helps to focus investigation efforts on identifying contacts who were most likely exposed to M. tuberculosis *while the case was infectious.*

Contact investigators should prepare an initial estimate for the infectious period based on information collected during the pre-interview phase. This initial estimate will be revised as additional information becomes available throughout the contact investigation process.

Below is a method to help estimate the infectious period. For more specific information on estimating the infectious period, refer to the CDC *Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis*, available from the CDC website (www.cdc.gov/tb).

For cases that have positive sputum smears, the minimum start date of the infectious period is usually 3 months before the onset of respiratory symptoms (e.g., cough) or 3 months before the first finding consistent with TB disease, whichever is earlier.

Estimating the Start of the Infectious Period for Sputum Smear Positive Cases

For cases that have positive sputum smears, the minimum start date of the infectious period is usually 3 months before the onset of respiratory symptoms (e.g., cough) or 3 months before the first finding consistent with TB disease, whichever is earlier.

For example, if the case's symptoms started on November 1st, the start of the infectious period would be August 1st (3 months before the symptoms started). See Figure 8.1.

Some cases may not remember when their TB symptoms began, and others may report that they have had no symptoms. In this situation, the start of the infectious period should be, at a minimum, 3 months before the first finding consistent with TB disease. For example, if a case has had no symptoms, but had a chest x-ray taken on September 1st which showed a cavity, the start of the infectious period would be June 1st (3 months before the chest x-ray).

Estimating the Start of the Infectious Period for Sputum Smear Negative Cases

For TB cases with TB symptoms and negative sputum smear results, the start of the infectious period would be 3 months before symptom onset or 3 months before the first finding consistent with TB disease, whichever is earlier.

For TB cases with negative sputum smear results, no symptoms, and no pulmonary cavities, the start of the infectious period is 1 month (4 weeks) before TB disease was first suspected by a healthcare provider. For example, if the healthcare provider first suspected TB disease on September 15th, the infectious period would be 1 month before that date (August 15th). See Figure 8.2.

Table 8.1 shows recommendations for estimating the start of the infectious period.

Table 8.1—Recommendations for Estimating the Start of the Infectious Period by Case Characteristics

Case with Respiratory TB Symptoms	Case with Positive Sputum Smear	Case with Pulmonary Cavity on Chest X-ray	Recommended Minimum Beginning of the Infectious Period
Yes	No	No	3 months before symptom onset or first finding consistent with TB disease, whichever is longer
Yes	Yes	Yes	3 months before symptom onset or first finding consistent with TB disease, whichever is longer
No	No	No	1 month (4 weeks) before date of suspected diagnosis
No	Yes	Yes	3 months before finding consistent with TB disease

Estimating the End of the Infectious Period

The infectious period ends when all of the following are met:

- Effective treatment 2 weeks or longer;
- Diminished symptoms (e.g., coughing less); and
- Mycobacteriologic response (e.g., decrease in grade of sputum smear positivity).

If a case is returning to a congregate setting, or to any other setting where susceptible persons may be exposed, he or she should have at least three consecutive negative sputum smear results before being considered noninfectious.

For contact investigation purposes, the infectious period can also end when the case is isolated under airborne infection isolation precautions, even if not all of the criteria above have been met. This is because these precautions limit the case's ability to transmit *M. tuberculosis* to additional contacts.

Figure 8.1 shows an example of how to determine an initial estimate for the beginning and end of the infectious period for a case with a positive sputum smear result and symptoms of TB disease. In this example, the case had negative sputum smears, no symptoms, and over 2 weeks of treatment by December 1st. Therefore, the end of the infectious period would be December 1st.

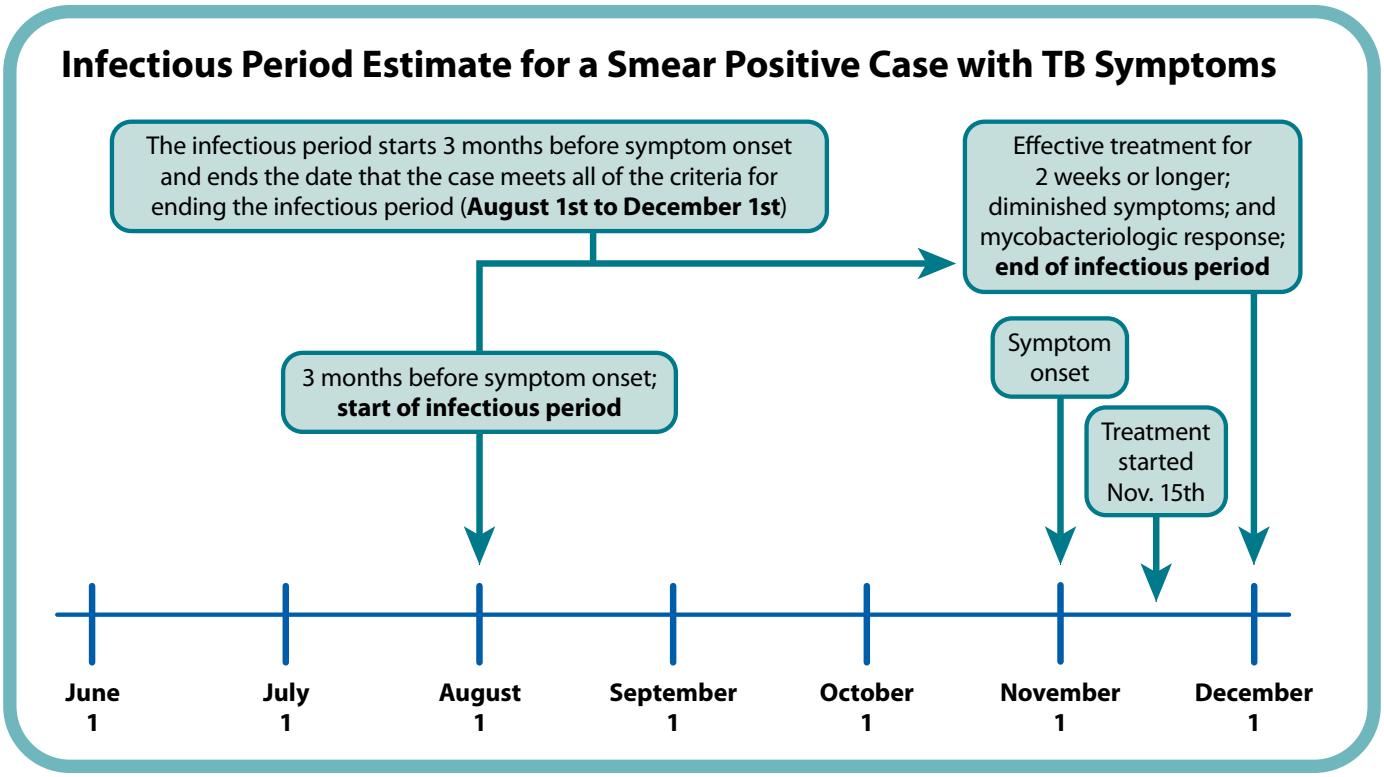

Figure 8.1—Example of determining an initial estimate of the infectious period for a smear positive case with TB symptoms.

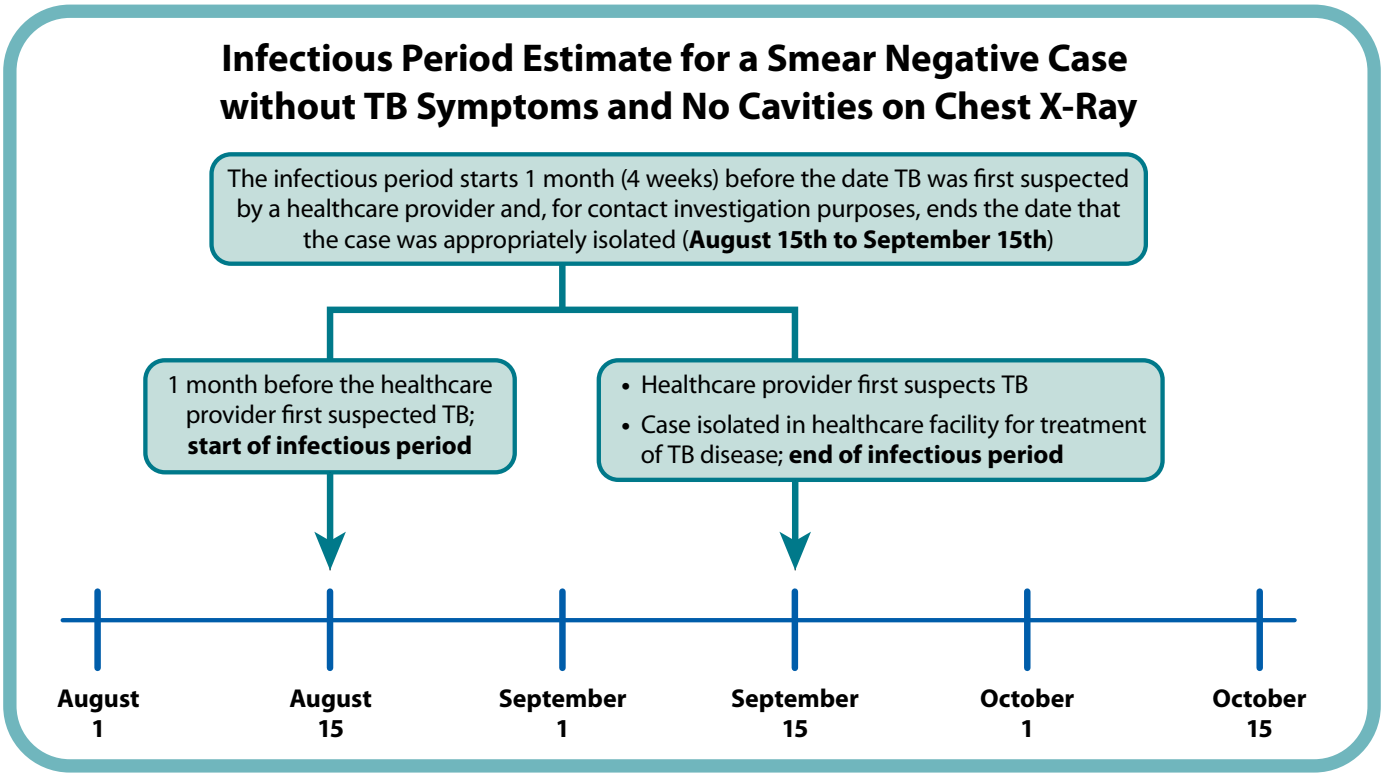

Figure 8.2—Example of determining an initial estimate of the infectious period for a smear negative case who does not have TB symptoms or a cavity on chest x-ray.

Figure 8.2 shows an example of how to determine an initial estimate of the beginning and end of the infectious period for a case with a negative sputum smear result, no pulmonary cavities, and no symptoms of TB. In this example, the case was isolated on September 15th, the same date that TB was first suspected. Therefore, the end of the infectious period would be September 15th.

Estimating the Degree of Infectiousness

Estimating the degree of infectiousness of a case helps investigators focus contact investigation efforts. The greater the degree of infectiousness, the more likely that transmission occurred.

Estimating the **degree of infectiousness** of a case helps investigators focus contact investigation efforts. The greater the degree of infectiousness, the more likely that transmission occurred.

An initial estimate for the degree of infectiousness can be made during the pre-interview phase. If an estimate is made, it may need to be revised after the interview with the case and as the investigation continues.

Table 8.2 presents factors that should be taken into consideration when determining the degree of infectiousness of a case.

Table 8.2—Factors Associated with Infectiousness and Noninfectiousness

Factors Associated with More Infectiousness	Factors Associated with Less Infectiousness
Presence of a cough	No cough
Cavity in the lung	No cavity in the lung
Acid-fast bacilli on sputum smear	No acid-fast bacilli on sputum smear
TB of the lungs, airway, or larynx	Most extrapulmonary (non-respiratory) TB
Patient not covering mouth or nose when coughing	Patient covering mouth or nose when coughing
Not receiving adequate treatment or having prolonged illness	Receiving adequate treatment for 2 weeks or longer
Undergoing cough-inducing procedures	Not undergoing cough-inducing procedures
Positive sputum cultures	Negative sputum cultures

For more information on infectiousness, see *Module 5, Infectiousness and Infection Control.*

Study Question 8.6–8.7

8.6 What is the infectious period?

8.7 When does the infectious period end?

Answers to study questions are on pages 83–89

Case Study 8.2

Calculate the infectious periods for the following TB cases:

- **Isaac is a 42-year-old man who was hospitalized on December 4th with symptoms of fever, night sweats, and cough. He was placed in airborne infection isolation. On the same date (December 4th), AFB sputum smears were collected and reported as positive with final cultures pending. Chest x-rays were taken on December 4th and reported as abnormal with cavitary disease.**

  Isaac was diagnosed with suspected pulmonary TB and appropriate TB treatment was started on December 5th. Isaac states that he started coughing around November 6th. His symptoms resolved on December 24th. Three consecutive sputum AFB smears were negative on February 10th.

- **Trang is a 52-year-old woman who had a checkup with her primary care provider on May 19th. During this visit, she was found to have an abnormal chest x-ray. Sputum collected on the same day was reported as AFB smear positive with final cultures pending. On May 20th she was diagnosed with suspected pulmonary TB, started appropriate treatment, and was put on home isolation. Trang claims she never had a cough or any other symptoms. Three consecutive induced sputum AFB smears were negative on June 15th, June 18th, and June 21st.**

Answers to case studies are on pages 90– 98

Step 3: Interview the Case

The foundation of an effective contact investigation is the case interview. If the investigator does not communicate well with the case to obtain accurate information, persons who need medical assessment and treatment may be missed.

The foundation of an effective contact investigation is the case interview. If the investigator does not communicate well with the case to obtain accurate information, persons who need medical assessment and treatment may be missed. To obtain complete and accurate information from the case, it is important that the contact investigator is trained and skilled in conducting interviews.

What is the Main Goal of the Case Interview?

The main goal of the case interview is to identify contacts who may have been exposed to M. tuberculosis.

The main goal of the case interview is to identify contacts who may have been exposed to *M. tuberculosis*. To gather information about contacts, the investigator should ask the case

- **Where** he or she spent time during infectious period
- **What** activities or events he or she participated in during infectious period
- **Whom** he or she spent time with during infectious period

Where the Case Spent Time During Infectious Period

Asking the case about places where he or she spent time can help determine whom he or she spent time with during the infectious period. These places can include locations of

- Residence
- Work, school, or volunteer activities
- Social, leisure, religious, or recreation activities
- Illicit or illegal activities

Asking the case about places where he or she spent time can help determine whom he or she spent time with during the infectious period.

For each place identified, the case should be asked about the

- Amount of time spent in each place
- Characteristics of each place, such as room size, crowding, and whether windows were open or closed

This information can help the investigator estimate the risk of transmission for each place and, thus, prioritize field visits for assessing the various sites.

Compiling a list of places is also useful because the case may not always be able to provide enough information about each of his or her contacts. This information about places could then be used to conduct a **location-based investigation**. For more information about conducting a location-based investigation, refer to page 45 of this module.

What Activities and Social Events the Case Participated in During Infectious Period

The investigator should ask the case about activities during the infectious period. It can be helpful for the case to outline a typical day starting with getting up in the morning until going to bed at night.

In addition to asking the case about places where he or she has spent time, the investigator should ask about activities during the infectious period. It can be helpful for the case to outline a typical day starting with getting up in the morning until going to bed at night. Asking specifically about participation in activities or special events such as parties or holiday celebrations might help the case remember additional exposure settings and contacts. Reviewing a calendar or appointment book with the case could also be helpful for determining travel, holidays, and social events during the infectious period.

The investigator should also specifically ask the case if he or she was involved in any activities such as volunteering in a nursing home, day care, or hospital, where persons who are at high risk for rapid development of TB disease could have been exposed.

Whom the Case Spent Time with During Infectious Period

The investigator should ask the case to give the names and aliases of persons with whom he or she spent time while infectious.

The investigator should ask the case to give the names and aliases of persons with whom he or she spent time while infectious. This includes any persons who live in the same home or share a sleeping space with the case. Additionally, the investigator should identify any persons with whom the case spent a lot of time. The compiled list of places and activities should be used to prompt the case to remember persons with whom he or she spent time.

The case should be asked specifically about any time spent with contacts who

- Have symptoms of TB disease, such as cough or weight loss;
- Are younger than 5 years of age;
- Have a medical condition that weakens the immune system (e.g., HIV or immunosuppressive therapy).

Another strategy to identify contacts is to review the case's cell phone directory and online social networking accounts (e.g., Facebook, LinkedIn). This can help the case remember friends and events. This should be done with the case's permission.

For each contact listed, the investigator should obtain locating information, phone number(s), or preferably both so that he or she can be notified about their exposure to TB.

If the case does not have enough information to help identify or find some contacts, the investigator should ask him or her for ideas on how to gather the information from other sources (e.g., a work roster).

Investigators should be aware that the case may be reluctant to talk about some or all of their contacts. For example, a case may not want to identify people who use illegal drugs, reside in the United States illegally, or he or she may be worried about confidentiality. The interviewer should be sensitive to the case's fears, explain the importance of testing contacts, and assure the case that all information will be kept confidential.

What Are Additional Objectives of the Case Interview?

Additional objectives of the case interview are to discuss the contact investigation process, educate the case about TB disease, and confirm and expand upon information obtained from the pre-interview phase.

Additional objectives of the case interview are to

- Discuss the contact investigation process;
- Educate about TB disease; and
- Confirm and expand upon information obtained from the pre-interview phase.

Discuss the Contact Investigation Process

A case who understands why and how a contact investigation happens is more likely to provide information to help find their contacts.

When interviewing a case, the investigator should go over the process and the reasons for the interview. A case who understands why and how a contact investigation happens is more likely to provide information to help find his or her contacts. The investigator should ensure that the case understands that all information provided will remain confidential to the extent possible and that information will be shared with only persons who need to know (e.g., other public health personnel). The case should be informed that sometimes despite best efforts their TB status may be inadvertently disclosed to others. For example, the case's friend, family member, or co-worker may share information to others. The case and the investigator should discuss this possibility and be prepared to address the situation if privacy is not maintained. To prevent breaches in confidentiality, the case should be advised to inform only persons he or she trusts about their TB diagnosis. (For more information on confidentiality, see *Module 7, Patient Rights and Confidentiality in Tuberculosis Control.*)

Educate about TB Disease

During the interview, it is important to assess the case's knowledge about TB. The case may have little to no knowledge or have misconceptions about TB. The case interview can be an opportunity to educate the case about TB transmission and treatment. A case who understands his

The case interview can be an opportunity to educate the case about TB transmission and treatment.

or her TB diagnosis and how TB is transmitted is more likely to be invested in the contact investigation, as well as their TB treatment. Patient education materials may be useful to bring to the interview. (For more information on patient education strategies, refer to *Module 6, Managing Tuberculosis Patients and Promoting Adherence*.)

Confirm and Expand Upon Information Obtained from the Pre-Interview Phase

The case interview is also an opportunity to confirm and expand upon information collected during the pre-interview phase. The case may be able to provide additional information and details that were not captured by the medical record review.

The investigator should specifically ask about any TB symptoms and TB history, as well as confirm personal and medical information. Any additional information about the onset of symptoms can be used to refine the estimated infectious period.

When and Where Should the Case Interview be Conducted?

The initial interview should be within one working day after an infectious case is reported to the health department.

The initial interview should be **within one working day** after an infectious case is reported to the health department. This allows the investigator to find contacts who may already have TB disease as soon as possible.

A re-interview should be scheduled for 1–2 weeks after the initial interview so that the case will have had time to adjust to their TB diagnosis and treatment. The re-interview is also an opportunity to continue to build a trusting relationship between the case and the investigator and to learn about more contacts.

Additional interviews should be scheduled as needed. Re-interviews do not need to be formal. Investigators can continue to collect information throughout the process. For example, some re-interviews can be conducted during directly observed therapy (DOT) visits or field visits.

Interviews can be in the hospital, the TB clinic, the case's home, or any other location that is convenient for the case and that respects his or her privacy.

The interviews should be done in person (see Figure 8.3). The interviews can be in the hospital, the TB clinic, the case's home, or any other location that is convenient for the case and that respects his or her privacy. Health care workers should follow infection control precautions while interviewing someone who has potentially infectious TB.

Figure 8.3—Contact investigator interviewing a case who is no longer considered infectious.

What are Some Strategies for Conducting Effective Interviews?

Some strategies for effective interviews are summarized in Table 8.3. Additionally, several training resources are available for enhancing interviewing skills, including *Effective TB Interviewing for Contact Investigation: Self-Study Modules* and the *Effective TB Interviewing for Contact Investigations DVD*, both available from the CDC website (www.cdc.gov/tb/education).

Building Trust and Rapport

The most important skill in conducting an interview is the ability to build trust and rapport with the case.

The most important skill in conducting an interview is the ability to build trust and rapport with the case. This can help ensure that the case is comfortable in providing information that is important to the contact investigation. For example, a case may feel stigma associated with TB disease and may be reluctant to share the names of his or her contacts. Additionally, a case may be involved in illegal activities and not feel comfortable

sharing information about those activities and contacts with the investigator. Thus, it is important that the contact investigator builds a trusting relationship with the case by finding common ground, using effective communication skills, maintaining confidentiality, and displaying respect and empathy. Finding common ground typically does not have to do with the case having TB disease. For example, the investigator and the case may find that they have similar hobbies and interests. (Refer to *Module 6, Managing Tuberculosis Patients and Promoting Adherence*, for more information regarding trust and rapport.)

During the interview, contact investigators should use open-ended questions to gather information from the case.

Using Open-Ended Questions

During the interview, contact investigators should use open-ended questions to gather information from the case. Open-ended questions encourage discussion because they encourage more than a "yes" or "no" response. The questions in Table 8.4 are examples of open-ended questions that can be used during interviews.

Using an Interview Checklist

Although the use of a checklist can help ensure that all of the interview objectives are systematically met, it is important to remember that the interview is a conversation between the interviewer and the case.

To ensure that interview objectives are being met, an interview checklist can be used. The use of an interview checklist can prompt the investigator to obtain information on places and activities, as well as remind the investigator to educate the case about TB and the contact investigation process. Although the use of a checklist can help ensure that all of the interview objectives are systematically met, it is important to remember that the interview is a conversation between the interviewer and the case. The interviewer should be flexible and allow for a natural flow of the conversation. The interview checklist should not be a distraction while trying to build rapport with the case. Furthermore, the investigator should be alert to other information that may not be reflected on the checklist. Figure 8.4 shows an example of a checklist that can be used during a case interview.

Depending on the situation, other tools may be helpful during an interview. For example, some jurisdictions that encounter cases among homeless populations may have a list of temporary shelters that can be used to help prompt the investigator to ask the case about each location.

Table 8.3—Strategies for Conducting Effective TB Case Interviews

- Have a clear understanding of the objectives of the interview.
- Plan the interview so that each objective is given adequate time.
- Ensure the interview takes place under conditions that protect the privacy of the case and encourage effective communication.
- Arrange for the assistance of an interpreter if you do not speak the same language as the case.
- Establish the foundation for an effective working relationship based on trust and respect.
- Explain what a contact investigation is, how a contact investigation protects contacts from getting sick with TB disease, and what the case can do to help.
- Begin with an assessment of the case's knowledge, feelings, and beliefs about TB.
- Remain objective, open-minded, and nonjudgmental.
- Ask open-ended questions and listen carefully to the case's responses.
- Recognize and address the case's fears and concerns about TB.
- Use opportunities that arise during the interview to educate the case about TB.

Table 8.4—Examples of Open-Ended Questions for TB Case Interviews

- What symptoms do you have?
- When did your symptoms begin?
- How long have you had these symptoms?
- When did you first go to a healthcare provider about your symptoms?
- What medications do you take for your illness?
- Where do you sleep each night?
- Who else sleeps there?
- Where else do you sleep?
- Who visits your home?
- What is your daily routine?
- How do you get to work or school?
- Who rides with you to work or school?
- What is the room like where you spend most of your time at work or school?
- Who are the persons you spend time with at work, school, church, etc.?
- Who are the persons you see every day?
- What do you do in your free time?
- Where did you go on vacation?

TB Interview Checklist

A. Introduction

- ☐ Introduce self and provide identification
- ☐ Explain your role in TB control
- ☐ Explain the purpose of the interview

B. Information and Education Exchange

- ☐ Observe the case's physical and mental state, body language, and communication skills
- ☐ Collect and confirm the following information:

___ Name
___ Alias/nicknames
___ Date of birth
___ Address
___ Telephone number
___ Next of kin
___ Other locating information
___ Physical description
___ Known exposure to TB
___ Recent hospitalization(s) for TB
___ Medical provider for TB
___ Transportation availability
___ Other medical conditions
___ Outpatient DOT plan
___ Barriers to adherence

- ☐ Assess disease comprehension and provide TB education
- ☐ Obtain and confirm TB symptom history
- ☐ Refine infectious period
- ☐ Discuss case's current diagnosis
- ☐ Discuss infection control procedures and medical appointments

C. Contact Identification

- ☐ Collect information on contacts in the household, workplace, school, congregate settings, and social or recreational environments during the infectious period
- ☐ Ask about any activities where they could have exposed persons at high risk for rapid development of TB disease (e.g., volunteering in a nursing home or day care)
- ☐ Ask the case about contacts who
  - ○ Have symptoms of TB disease
  - ○ Are younger than 5 years of age
  - ○ Have a weakened immune system
- ☐ Information about contacts should include

___ Name
___ Alias/nicknames
___ Age, race, sex
___ Address
___ Telephone number
___ Other locating information
___ Physical description
___ Hours of exposure per week
___ Dates of first and last exposures
___ Location where exposure occurred
___ Frequency and duration of exposure
___ Physical proximity to case when exposure occurred

D. Conclusion of the Interview

- ☐ Request, then answer the case's questions
- ☐ Review and reinforce the adherence plan
- ☐ Confirm next appointment (if known)
- ☐ Arrange reinterview and home visit (if not already completed)
- ☐ Leave your name and telephone number
- ☐ Thank the case and close interview

Figure 8.4—Sample TB interview checklist. Adapted from *TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker* from the Global Tuberculosis Institute at Rutgers, the State University of New Jersey.

How Should Information Obtained from the Interview be Compiled?

During or immediately after the interview, the investigator should take notes to keep track of the information being discussed.

During or immediately after the interview, the investigator should take notes to keep track of the information being discussed. Sometimes a contact investigation form can help investigators compile the information obtained from the interview. Ideally, investigators should complete the form after the interview since it may be a distraction during the interview and make it more difficult to develop rapport. Whatever the approach, key findings from the interview must be recorded in the public health record.

Forms used for contact investigations vary from jurisdiction to jurisdiction. Some jurisdictions might use a standard form but have additional documents that can be incorporated based on the situation. For example, if the contact investigation involves a case who is homeless, some jurisdictions may have additional forms that may be incorporated to record key information relevant to homeless shelters.

Interview Special Circumstances

Interviews Involving Minors

The age when adolescents can be interviewed without the presence or consent of parents or guardians is the same as the legal age of consent in most jurisdictions and most circumstances. Before interviewing minors, the investigator should be familiar with jurisdictional policy and legal code. The presence or consent from a parent or legal guardian may be required.

Interview Not Possible

A contact investigation must still be done even if it is not possible to interview the case.

In some instances, it is not possible to interview the case. The case could be deceased, difficult to locate, or medically or psychologically unable to participate in interviews. **A contact investigation must still be done even if it is not possible to interview the case**.

In these situations, information on where and with whom the case spent time might be obtained from

- The case's medical records
- Databases such as public health records and local correctional facility systems
- Comparison of genotypes with other cases
- Proxy interviews
- Location-based contact investigations

The case's medical, public health, and correctional facility records should be carefully reviewed to see if there is any information to help identify contacts. The case's TB genotype information, when available, should also be compared with other recent cases to discover potential connections to other cases.

Proxy interviews are interviews conducted with persons familiar with the case's practices, habits, and behaviors.

Additionally, **proxy interviews** can be used to elicit information. Proxy interviews are interviews conducted with persons familiar with the case's practices, habits, and behaviors. **Proxies** may include family members, close friends, or other persons who know the case well.

A location-based approach to contact investigations is where potential TB contacts are found and offered TB assessments onsite, if possible. This can be useful if places where the case spent time while infectious are known. For more information on location-based approach, please refer to page 45 of this module.

Study Questions 8.8–8.10

8.8 What is the main goal of the TB case interview?

8.9 List three strategies for conducting effective interviews.

8.10 What is a proxy interview? Who may serve as an appropriate proxy?

Answers to study questions are on pages 83–89

Case Study 8.3

You are the public health worker assigned to conduct a contact investigation for Judith, a 73-year-old woman who was recently diagnosed with infectious TB disease. Judith lives with her daughter in a small house outside of town. You are conducting the case interview in her home.

What questions should you ask Judith during the interview to learn more about her contacts?

Answers to case studies are on pages 90– 98

Step 4: Review Information and Develop a Plan for the Investigation

After the investigator has interviewed the case, he or she should meet with his or her supervisor or the contact investigation team to review all of the information obtained thus far and develop a plan on how to proceed.

After the investigator has interviewed the case, he or she should meet with his or her supervisor or the contact investigation team to review all of the information obtained thus far and develop a plan on how to proceed. The planning process can be done during a **case conference**. To develop a plan, the investigator or team should do the following activities:

- Refine the infectious period and degree of infectiousness for the case as necessary
- Prioritize contacts for assessment
- Prioritize places to conduct field visits

All of these above activities are discussed in more detail in the next few steps (steps 5–7) of the systematic approach to contact investigation (pages 38–46 of this module).

As part of the planning process, the investigator or investigation team should also

- Establish a communication plan among staff and others involved in the investigation
- Clarify any jurisdictional issues
- Establish timeframes and methods for investigation activities, data collection, and management
- Determine stakeholders
- Determine potential media interest
- Establish a schedule for case conferences or meetings to review challenges and progress

The investigation plan should be written and include where to conduct field visits, which contacts are currently considered a priority for assessment, and a timeline for accomplishing these tasks.

The investigation plan should be written and include where to conduct field visits, which contacts are currently considered a priority for assessment, and a timeline for accomplishing these tasks. Having a plan will help ensure that the goals and objectives of the contact investigation are met, and resources are used as efficiently and effectively as possible. Additionally, if the health department has multiple TB cases requiring contact investigations, the above information should be used to help prioritize which contact investigations require immediate attention and resources. The plan should be considered a work in progress with changes to be made as needed throughout the investigation.

During case conferences about the contact investigation, investigators should note any similarities and potential connections to other recent TB cases in the area (e.g., homelessness, substance use). If cases have a characteristic in common, further investigation should be done to see if the cases are connected. This is because TB outbreaks generally involve persons with similar demographic characteristics and TB risk factors. (For more information, refer to *Module 9, Tuberculosis Outbreak Detection and Response.*)

Step 5: Refine the Infectious Period and Degree of Infectiousness

At the planning meeting, the investigator should use the information from the initial interview to determine if the estimates of the infectious period and the degree of infectiousness need to be refined.

At the planning meeting, the investigator should use the information from the initial interview to determine if the estimates of the infectious period and the degree of infectiousness need to be refined.

For example, the initial estimate of the infectious period for the case described in Figure 8.1 (page 21) was August 1st to December 1st, based on information collected in the pre-interview phase. If the interview revealed that the case's symptoms actually started September 1st, instead of November 1st, the infectious period would need to be revised. Rather than beginning on August 1st, the infectious period should begin on June 1st (3 months before symptoms began). Figure 8.5 shows the refined infectious period for the case presented in Figure 8.1.

Additionally, from the initial interview it may become known that the case participated in certain activities that may influence the degree of infectiousness. For example, during the interview the investigator may find out that the case sang in a choir during their infectious period. Since singing is considered an action that increases infectiousness, the initial estimate for the degree of infectiousness would need to be refined. The increased degree of infectiousness estimate will have implications for the prioritization of the contact investigation, as well as for the prioritization of contacts needing assessment.

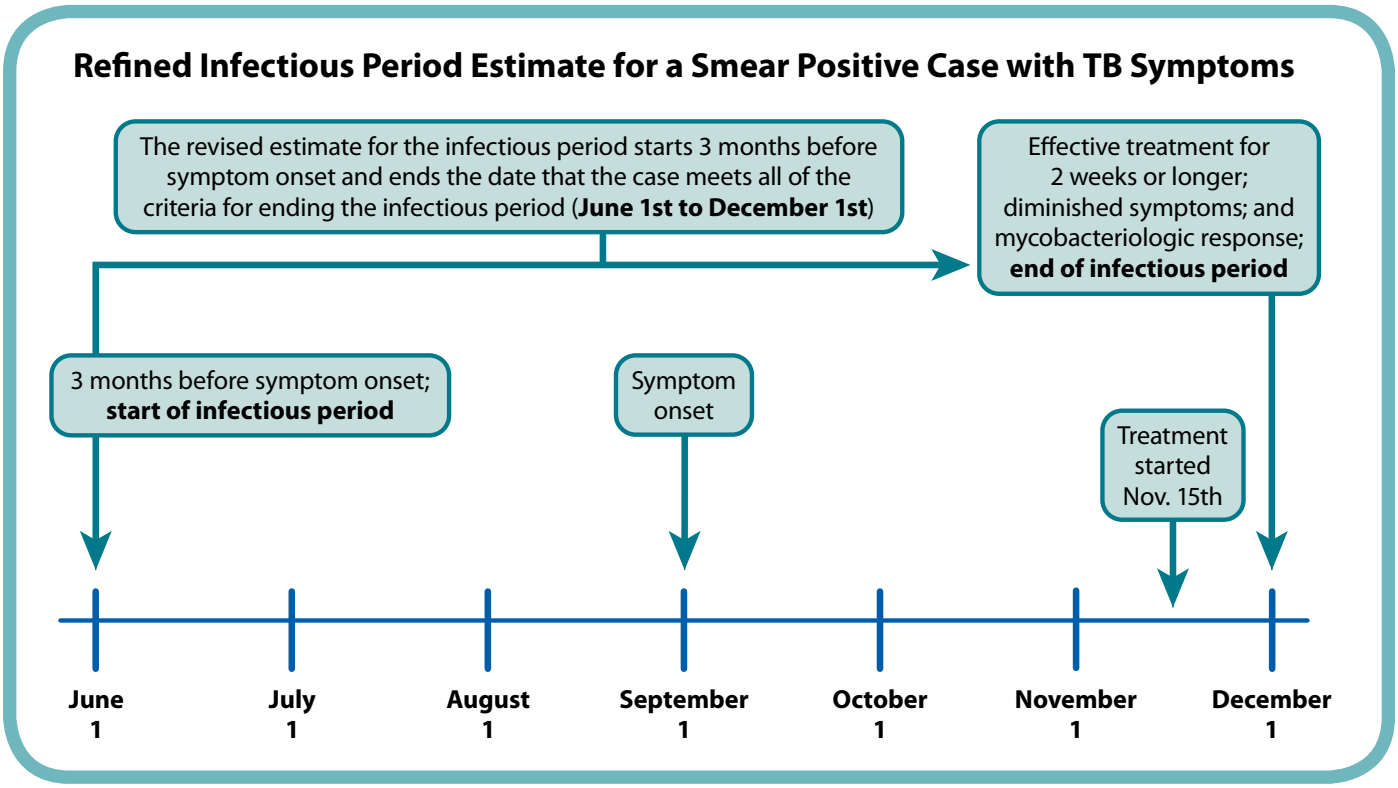

Figure 8.5—Example of refining the infectious period.

Step 6: Prioritize Contacts

At the planning meeting, the investigator should use information from the initial interview to prioritize contacts for assessment.

The priority assigned to each contact should be based on the likelihood of transmission from the case and the contact's risk for development of TB disease.

The priority assigned to each contact should be based on the following:

- Likelihood of transmission from the case
- Contact's risk for development of TB disease

Some jurisdictions have tools to assist with assigning priority to contacts. Such tools should take both factors into account.

The terms "close" and "casual" have been used in some public health programs to describe the degree of exposure contacts had to an infectious TB case. However, these terms do not always distinguish between contacts who require immediate assessment because of their higher risk of developing TB disease with those who may be at a low risk.

Priority should be given to locating and assessing contacts who

- Are exhibiting symptoms of TB disease
- Are at risk for rapid development of TB disease (e.g., contacts younger than 5 years of age and contacts with weakened immune systems)
- Had repeated or extended exposure to the case
- Were exposed in an environment where transmission was likely, such as a small, crowded, or poorly ventilated room or vehicle
- Were exposed during medical procedures that can release substantial numbers of *M. tuberculosis* into the air (e.g., bronchoscopy)

The highest priority should be given to locating and assessing contacts reported by the case as having symptoms of TB disease.

The highest priority should be given to locating and assessing contacts reported by the case as having symptoms of TB disease. A contact with symptoms could have undiagnosed TB disease and be transmitting *M. tuberculosis* to others.

Decisions about the priority level assigned to contacts should be made in consultation with supervisory clinical and management staff or during a case conference with the contact investigation team.

Decisions about the priority level assigned to contacts should be made in consultation with supervisory clinical and management staff or during a case conference with the contact investigation team. The priority level assigned to contacts can change over time as new information becomes available. Thus, contacts' priority assessment should be reviewed at least weekly, and updated as necessary based on the results of the investigation.

For more detailed information about assigning priority to contacts, refer to the CDC's *Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis*, available from the CDC website (www.cdc.gov/tb).

Study Question 8.11 – 8.12

8.11 What two factors should be taken into account when determining the priority of each contact?

8.12 In general, which contacts should be considered priority?

Answers to study questions are on pages 83– 89

Case Study 8.4

Derrick is a 47-year-old man who has had a severe cough for about two months and started treatment for TB disease three days ago. He lives alone in a small apartment and works the night shift three times a week with two other employees at the convenience store a few blocks away from his home. During the day, Derrick goes to friends' apartments nearby or stays in his apartment to watch TV. He often goes to the local bar in his neighborhood with his friends Reggie and Melvin. He usually eats at one of two restaurants—the Main Street Diner or Susie's Kitchen.

Derrick says that his girlfriend, Tonya, spends the night with him a few times a week, and often brings her 2 year-old son, Luke. Derrick also mentions another girlfriend, Kelly, who has stayed over about 10 times in the past three months. Last month, Derrick spent several days at Kelly's house, where she lives with her mother.

- **Based on this information, who are Derrick's contacts?**

- **Which contacts are at higher risk for TB infection and TB disease?**

Answers to case studies are on pages 90– 98

Case Study 8.5

One week ago, Hector came to the health department complaining of night sweats, weight loss, and a cough that has lasted about a month. His sputum smears were positive and he started a four-drug regimen for TB disease.

When you interviewed Hector, you found out he lives with his 32-year-old wife, Mimi; his two sons, Luis, 2, and Javier, 4; and his mother-in-law, Alma, 65. Hector's cousin, Henry, has stopped by the house a few times in the past month.

Hector rides to work 5 days a week in a car with his friend Joe. The ride lasts about 30 minutes.

Hector works in a mail order packing warehouse. About 100 employees work in the main room with Hector, but the room is divided into several sections. There are 20 persons in Hector's section, and four of these persons are assigned to work closely with Hector. Hector eats lunch outside every day with these four coworkers.

About twice a week and on weekends, Hector goes to a small neighborhood bar located in the basement of a building. At the bar, Hector spends most of the time talking to the bartender. He notes that the bartender has been coughing a lot lately.

- **Based on this information, who are Hector's contacts?**

- **Which contacts should be considered a priority?**

Answers to case studies are on pages 90– 98

Step 7: Conduct Field Visits

Field visits are an essential component of a TB contact investigation as they allow the investigator to view and assess the environment in which transmission may have occurred.

A **field visit**, also sometimes called a site visit, means visiting the case's residence and other places where the case spent time while infectious. Field visits are an essential component of a TB contact investigation as they allow the investigator to view and assess the environment in which transmission may have occurred.

In some instances, a field visit to a residence is conducted at the same time as the initial interview or re-interview with the case. Additional locations to visit can be determined by using the list of places reported during the interview or discussed during the planning meeting.

Field visits serve four main functions:

1. Identify additional cases of TB disease
2. Identify additional contacts
3. Gather additional information about environmental characteristics of places where exposure occurred
4. Lay a foundation for additional contact investigation activities at those locations, if needed

During field visits, the contact investigator should

- Maintain confidentiality of cases and contacts
- Refer persons with symptoms of TB disease for immediate medical evaluation, including a chest x-ray
- Observe environmental characteristics of the site such as room size, crowding, ventilation, low ceilings, and dense air
- Look for evidence of contacts not present at the time of the visit, such as pictures or belongings of others who may visit or live at the case's residence (see Figure 8.6)
- Obtain lists of clients, employees, volunteers, and visitors who were present at worksites during the case's infectious period
- Explore the possibility of offering TB assessment to contacts onsite at that location

The field visit can also be an opportunity to educate cases and contacts about the purpose of a contact investigation and the basics of TB testing and treatment.

The use of a standardized data collection form can assist investigators in recording important information about each site visited. Field visit forms will vary from jurisdiction to jurisdiction.

Figure 8.6—The investigator is conducting a field visit. She is looking for evidence of other contacts.

Location-Based Approach to Contact Investigations

The goal of a location-based approach is to assess persons who could have been exposed at a particular location (e.g., bar, drug-usage site, or shelter), but may not have been named as contacts.

In some situations, field visits will also be used as an opportunity to learn about potential contacts and to offer onsite TB assessments for those contacts. This is referred to as a **location-based approach to contact investigation**. If a traditional name-based approach does not produce an adequate list of contacts, or if the case does not provide information about contacts, a location-based approach to the contact investigation should be considered. The goal of this approach is to assess persons who could have been exposed at a particular location (e.g., bar, drug-usage site, or shelter), but may not have been named as contacts.

A location-based approach can be particularly useful when

- It is not possible to interview the case, but investigators can establish places where the case spent time during the infectious period
- A case does not or cannot provide the name or the location of their contacts
- Shelters or other social service agencies are unable to provide a list of contacts

During location-based assessments, investigators should actively seek out information that could help identify priority contacts.

Field Visit Safety

Personal Safety for the Contact Investigator

Contact investigators who conduct field visits should follow health department policies and local law enforcement recommendations regarding personal safety.

Contact investigators who conduct field visits should follow health department policies and local law enforcement recommendations regarding personal safety. Current information about local high-risk areas for crime can be useful in planning and conducting safe field visits.

General safety precautions recommended for contact investigators include

- Wearing an identification badge with a current photograph
- Working in pairs when visiting isolated or dangerous areas
- Having a working cell phone
- Limiting visibility of valuable items
- Informing a coworker or supervisor of itinerary, planned route, and expected time of return

Infection Control Precautions

Contact investigators should follow infection control precautions while visiting or interviewing a potentially infectious TB case at any location, including the home.

Contact investigators should follow infection control precautions while visiting or interviewing a potentially infectious TB case at any location, including the home.

If the visit or interview takes place in an airborne infection isolation (AII) room, the investigator should wear an N95 respirator for which they have been fit-tested.

If a case is discharged home while still infectious, the investigator should wear an N95 respirator and the case should be asked to wear a surgical mask. The investigator may also choose to do the interview outdoors. However, because the sight of respirators or masks might add to the social stigma of TB, investigators should be careful about using them where others may notice. For more information about infection control precautions for TB, refer to *Module 5, Infectiousness and Infection Control*.

Study Questions 8.13– 8.14

8.13 What are the four main functions of a field visit?

8.14 List four safety precautions investigators should take while conducting field visits.

Answers to study questions are on pages 83– 89

Case Study 8.6

Carmen is a 30-year-old woman who was recently diagnosed with infectious TB disease. She works at the local community college and lives with her aunt.

A contact investigator from the local health department is conducting an interview with Carmen at Carmen's home. Three coworkers and her aunt have been reported to be contacts by Carmen.

Refer back to Figure 8.6 on page 45. Based on what is visible in the photo, is there evidence of any additional contacts in Carmen's home other than her aunt?

Answers to case studies are on pages 90– 98

Step 8: Conduct Contact Assessments

Contact investigators should meet and assess priority contacts within three working days of the contact being identified.

Contact investigators should meet and assess priority contacts within three working days of the contact being identified.

When meeting with the contacts, the investigator should ensure that confidentiality is maintained by not revealing any personally identifying information about the case or any specific details about their exposure.

The major activities of the contact assessment include

- Meeting with the contact
  - Maintaining confidentiality
  - Collecting and confirming information
- Conducting a medical evaluation
  - Medical history
  - HIV test
  - TB symptom review
  - TST or IGRA to test for infection with *M. tuberculosis*

For more detailed information on contact assessment activities, refer to the Assessment and Management of TB Contacts section of this module, page 58.

Step 9: Determine Whether to Expand or Conclude an Investigation

Expanding the investigation includes assessing contacts who were not originally considered a priority or finding new contacts in need of TB assessment.

As part of the contact investigation process, it is important to continually review findings to determine if there is a need to expand investigation efforts beyond the priority contacts. Expanding the investigation includes assessing contacts who were not originally considered a priority or finding new contacts in need of TB assessment.

Evidence of Recent Transmission

The need for expansion is generally determined by evidence of recent transmission.

The need for expansion is generally determined by evidence of recent transmission. Evidence of recent transmission further confirms that a case was infectious and, thus, implies an increased likelihood that others were infected.

Evidence of recent transmission includes

- TB infection or TB disease in contacts younger than 5 years of age
- Change in contacts' TST or IGRA status from negative to positive

- A greater-than-expected rate of TB disease or TB infection among priority contacts
- Evidence of **secondary transmission**
- TB disease among contacts not initially considered priority (particularly if genotypes match that of the case)

TB Infection or TB Disease in Contacts Younger than 5 years of Age

When children younger than 5 years of age have LTBI or TB disease, there is reason to suspect recent transmission.

When children younger than 5 years of age have LTBI or TB disease, there is reason to suspect recent transmission.

Change in Contacts' TST or IGRA Status from Negative to Positive

As part of a contact assessment, contacts should receive a TST or IGRA to determine if they are infected with *M. tuberculosis*. Contacts with an initial negative TST or IGRA result should be retested 8 to 10 weeks after their last exposure to the case. If the result of the repeat test is positive, this implies that recent transmission may have occurred. (For more information on using TST or IGRA during contact assessments, refer to page 61.)

A Greater-than-Expected Rate of TB Disease or TB Infection among Priority Contacts

Greater-than-Expected Rate of TB Disease

It is important to remember that for each secondary case of TB, a separate contact investigation needs to be considered immediately.

During a contact investigation it is not unusual to find one case of TB among priority contacts. An infected contact who develops TB disease is referred to as a **secondary case** of TB. It is important to remember that for each secondary case of TB, a separate contact investigation needs to be considered immediately.

More than one secondary case suggests the contact investigation may need to be expanded to other contacts. It can also mean an outbreak is occurring, particularly if genotypes match, because matching genotypes help confirm transmission links. Also, if an additional case in the same geographic area around the same time has a matching genotype, and neither case identified the other as a contact, contact investigators should determine if there were any missed connections between these two cases.

Greater-than-Expected Prevalence of TB Infection

A greater-than-expected prevalence of TB infection among contacts can also be evidence of recent transmission. The **prevalence of TB infection** is the percentage of persons infected with *M. tuberculosis* within a defined population.

To determine if the prevalence of infection among contacts is higher than expected, it is necessary to know the background prevalence of TB infection ideally among a local population similar to that of the contacts being evaluated (e.g., immigrants from Mexico). In the absence of information on a specific local population similar to the contacts being evaluated, the prevalence in the general population within the local area can be used. However, the latter prevalence will not be a good estimate if the contacts being evaluated are substantially different from the general population in terms of possible prior exposure to TB. If the prevalence of TB infection among contacts is higher than the background prevalence, this could indicate recent transmission and a need to expand the contact investigation.

The prevalence of TB infection among contacts can be calculated by the following steps:

1. Determine the total number of contacts who have completed testing (TST or IGRA). Do not include contacts who have a documented previous positive test result, have not completed testing, or who were not tested.
2. Determine the number of contacts with a newly positive TST or IGRA result.
3. Divide the number of contacts with a newly positive test result by the total number of contacts that have completed testing (i.e., divide the number from Step 2 by the number from Step 1)
4. Multiply the number from Step 3 by 100%. The resulting number is the TB infection prevalence for that group of contacts.

An example of how to determine the prevalence of newly diagnosed infection with *M. tuberculosis* among contacts is shown in Figure 8.7.

Evidence of Secondary Transmission

Secondary transmission is strong evidence of a potential outbreak occurring, particularly if genotypes match.

If the contact investigation for the secondary case finds additional persons with LTBI or TB disease, this is referred to as **secondary transmission**. Secondary transmission is strong evidence of a potential outbreak occurring, particularly if genotypes match. More information about detecting TB outbreaks is presented in *Module 9, Tuberculosis Outbreak Detection and Response*.

Example Calculation of TB Infection Prevalence for a Group of Contacts

Eleven contacts were identified for a reported TB case. One contact had a documented previous positive TST result. The other 10 contacts did not have documented previous TST results. These 10 contacts had a skin test administered; seven had positive TST results and three had negative TST results.

Step 1: **Determine the total number of contacts who completed testing for *M. tuberculosis* infection. Do not include contacts who have a documented previous positive test result, have not completed testing, or who were not tested.**

10 contacts completed testing.

Step 2: **Determine the number of contacts with a newly positive TST result.**

7 of the 10 contacts who were tested had a positive TST result.

Step 3: **Divide the number of contacts with a newly positive test result by the total number of contacts that completed testing.**

7/10 = 0.70

Step 4: **Multiply the number from Step 3 by 100%.**

0.70 x 100% = 70%

Answer: **The TB infection prevalence for the contacts is 70%.**

Figure 8.7—Calculation of TB infection prevalence for a group of contacts.

TB Disease among Contacts Not Considered Priority

If a contact who was originally considered a low priority for assessment is found to have TB disease, this may indicate a need to expand the investigation to other low priority contacts.

If there is a plan to expand the investigation, the TB program still needs to continue to ensure that all priority contacts are properly assessed, managed, and treated.

Generally, if any of the above evidence of recent transmission is found, expanding the contact investigation to include contacts at a lower priority should be considered. This may also indicate a need to re-interview the case to identify other contacts. If there is a plan to expand the investigation, the TB program still needs to continue to ensure that all priority contacts are properly assessed, managed, and treated. If this is a challenge, consultation and assistance from the next higher level of public health administration should be sought (e.g., the county health department would consult with the state health department).

If an outbreak is suspected, supervisory staff should immediately be alerted.

It is important to note that evidence of recent transmission may indicate an outbreak is occurring. If an outbreak is suspected, supervisory staff should immediately be alerted. More information about detecting TB outbreaks is presented in *Module 9, Tuberculosis Outbreak Detection and Response*.

If no evidence of recent transmission is found, the investigation usually would not be expanded.

Concluding a Contact Investigation

If no evidence of recent transmission is found, the investigation usually would not be expanded.

A contact investigation can be concluded if

- All contacts have been assessed for TB infection and disease
- Contacts with LTBI have completed or are close to completing treatment
- No additional secondary cases of TB are found, either among identified contacts or through reviewing genotype information

Once the contact investigation is concluded, all investigation activities should be evaluated.

Study Questions 8.15–8.16

8.15 List five indicators of recent transmission.

8.16 When can a contact investigation be concluded?

Answers to study questions are on pages 83–89

Step 10: Evaluate the Contact Investigation Activities

An evaluation of the investigation activities should be conducted with or by a supervisor.

An evaluation of the investigation activities should be conducted with or by a supervisor. The purpose of evaluating the activities of the investigation is to determine

- If the appropriate contacts were identified
- How many contacts were diagnosed with LTBI
- How many contacts with LTBI completed treatment
- How many additional cases of TB disease were found
- How many secondary cases of TB disease completed treatment
- How many contacts were not located
- How many contacts were located, but did not complete assessment
- The timeliness of identifying and assessing contacts, and starting treatment if necessary
- If the contact investigation was performed in all necessary settings
- If the contact investigation was expanded appropriately

The answers to these questions will help determine how effectively and efficiently the contact investigation activities were conducted.

Evaluation of activities should be conducted during case reviews and contact investigation team meetings throughout the contact investigation process. This will allow for any necessary immediate changes to improve the outcomes of the investigation.

The cohort review process provides an opportunity to evaluate the contact investigation activities for each case within a certain time frame and identifies areas in need of improvement.

At the end of the investigation, an evaluation can help identify areas in need of improvement. Additionally, many public health programs use a cohort review process. This allows for an opportunity to evaluate the contact investigation activities for each case within a certain time frame and identifies areas in need of improvement. Several resources are available about the TB cohort review process, including *Understanding the TB Cohort Review Process: Instruction Guide and DVD Package*. This resource is available from the CDC website.

Contact investigations are also an important indicator of the overall effectiveness of a TB control program. Thus, on a programmatic level, an aggregate of all contact investigation activities should be compiled and analyzed using data from the National Tuberculosis Indicators Project (NTIP).

Evaluation of program performance ensures that resources are being used effectively and for the highest priority activities. Conducting contact investigations is a priority activity. Information from each contact investigation should be compiled separately and examined by management staff as part of ongoing part of program evaluation activities.

The results of these program evaluations can be used to

- Determine program effectiveness
- Identify program strengths and areas in need of improvement
- Determine training needs
- Prioritize program activities and resources

In order to evaluate the contact investigation activities and overall program effectiveness, there should be a system in place to keep track of the number of contacts

- Identified
- Assessed and yet-to-be assessed
- Diagnosed with LTBI or TB disease
- Started on treatment for LTBI or TB disease
- Who have completed treatment

Study Questions 8.17–8.18

8.17 What is the purpose of evaluating the TB contact investigation?

8.18 List the 10 steps of the systematic approach to contact investigation.

Answers to study questions are on pages 83–89

Module 8 Self-Study Modules on Tuberculosis

Assessment and Management of TB Contacts

This section provides more detailed information about Step 8 of the Systematic Approach to Contact Investigations.

A contact assessment involves examining the contact for LTBI or TB disease. Health departments should have policies and procedures in place for the assessment and management of TB contacts. If a contact refuses to respond to requests for assessment, some states have communicable disease regulations or laws that set the precedents for legal action.

Health departments should have policies and procedures in place for the assessment and management of TB contacts.

What is Included in a Contact Assessment?

The major activities of the contact assessment include

- Meeting with the contact
  - Collecting and confirming information
  - Maintaining confidentiality
- Conducting a medical evaluation
  - Medical history
  - HIV test
  - TB symptom review
  - TST or IGRA to test for infection with *M. tuberculosis*

Meeting with Contacts

Investigators should meet in person and assess priority contacts within three working days of the contact being identified.

Investigators should meet in person and assess priority contacts within three working days of the contact being identified. When meeting with contacts, investigators should introduce themselves and explain that the purpose of the visit is to discuss a health matter. Before discussing any specific information, the investigator should verify the contact's identity. The discussion should be continued at a place that allows for privacy.

The investigators should inform the contact that he or she may have been exposed to TB and will need to be medically evaluated for TB disease or LTBI. The investigators should explain TB disease and how it is transmitted, diagnosed, and treated. TB educational tools can be used to help answer any questions the contact may have about TB disease or LTBI.

Contacts should be asked if they have any signs and symptoms of TB disease; or if they have a history of TB disease or LTBI, whether they completed treatment for either.

When meeting with contacts, the investigator should ensure that confidentiality is maintained by not revealing any personally identifying information about the case or any specific details about the exposure.

Collecting and Confirming Information

Contacts generally do not need to undergo the same in-depth interviewing process as TB cases. Contacts should be asked if they have any signs and symptoms of TB disease; or if they have a history of TB disease or LTBI, whether they completed treatment for either. It may be useful to ask the contact a few questions to confirm where they spent time and if they have any acquaintances who have signs and symptoms of TB. These questions may provide information about additional contacts and places the case had not mentioned.

Maintaining Confidentiality

When meeting with contacts, the investigator should ensure that confidentiality is maintained by not revealing any personally identifying information about the case or any specific details about the exposure. Additionally, the investigator should be careful not to accidentally reveal clues about the case. Confidentiality should not be violated even if contacts refuse to be evaluated.

The following strategies can be used to protect confidentiality when meeting with contacts:

- Do not identify the case's sex. For example, "Somebody was diagnosed with TB and they were concerned about you" instead of "A woman was diagnosed with TB and she was concerned about you."
- Do not mention the case's healthcare worker, place and dates of diagnosis, or hospitalization.
- Do not mention the environment in which the exposure occurred. For example, "You have been around somebody who has TB" instead of "You have been around somebody at work who has TB."
- Do not confirm the name of the case if the contact correctly guesses his or her identity.

The investigator should also let the contact know that any information provided will remain confidential.

Conducting a Medical Evaluation

The contact's medical evaluation may occur in the field or at the clinic. The following are components of a medical evaluation for contacts:

- Medical and social history
- HIV test
- TB symptom review
- TST or IGRA

Medical and Social History

The medical history of the contact should include information about prior LTBI or TB diagnosis, treatment, or exposure, and medical or social risk factors for progression to TB disease.

HIV Test

Contacts should be offered an HIV test if their status is unknown, even if the person is at low risk for HIV.

TB Symptom Review

All contacts should be assessed for symptoms of TB disease. General symptoms of TB disease include

- Fever
- Chills
- Night sweats
- Weight loss
- Appetite loss
- Fatigue
- Malaise

Symptoms of pulmonary TB disease include

- Cough lasting 3 weeks or longer
- Chest pain
- Coughing up blood or sputum (phlegm)

Symptoms of extrapulmonary TB disease depend on the part of the body that is affected. For example

- TB disease in spine may cause back pain
- TB disease in kidneys may cause blood in urine
- TB disease in lymph nodes may cause swelling in the neck
- TB disease of the larynx may cause hoarseness

Contacts with symptoms of TB disease should be further evaluated with a chest x-ray and three respiratory specimens for AFB smear and culture.

Contacts with symptoms of TB disease should be further evaluated with a chest x-ray and three respiratory specimens for AFB smear and culture. For more information on diagnosing TB disease, please refer to *Module 3, Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease*.

Contacts should be tested for M. tuberculosis *infection using either a TST or an IGRA.*

TST or IGRA

Contacts should be tested for *M. tuberculosis* infection using either a TST or an IGRA. Contacts who have a history of TB disease or a previous positive TST or IGRA result generally do not need to be retested for *M. tuberculosis* infection. They should be assessed for signs and symptoms of TB disease and asked about prior treatment for LTBI or TB disease.

For those contacts given a TST or tested with an IGRA, a repeat test may be needed depending on the result of the test. The same method of testing for infection should be used for both the initial and repeat test (i.e., if the first test was a TST, the repeat test should be a TST). For more information on administering and interpreting TST or IGRA results, refer to *Module 3, Targeted Testing and the Diagnosis of Latent Tuberculosis Infection and Tuberculosis Disease*.

If the initial TST or IGRA is negative, a repeat test is needed if the initial test was given less than 8 to 10 weeks since the contact's last exposure to the case.

Initial Negative TST or IGRA

If the initial TST or IGRA is negative, a repeat test is needed if the initial test was given less than 8 to 10 weeks since the contact's last exposure to the case. This is because it can take 2 to 8 weeks after being infected with *M. tuberculosis* for the body's immune system to mount a response detectable by the tests. The time between the contact's last exposure to the case and when a TST or IGRA can reliably detect infection is referred to as the **window period**.

The time between the contact's last exposure to the case and when a TST or IGRA can reliably detect infection is referred to as the window period.

The repeat test should be conducted 8 to 10 weeks after the last exposure to the case. If the result of the repeat test is positive, and TB disease is ruled out, the contact should be classified as recently infected and followed-up and treated appropriately.

Figure 8.8 shows an example of calculating the window period and determining when a repeat test should occur for contacts with an initial negative test result.

If the initial TST or IGRA is positive, the contact should be considered positive for M. tuberculosis *infection and a repeat test is unnecessary, even if it has been less than 8 weeks since the last exposure to the case.*

Initial Positive TST or IGRA

If the initial TST or IGRA is positive, the contact should be considered positive for *M. tuberculosis* infection and a repeat test is unnecessary, even if it has been less than 8 weeks since the last exposure to the case. A TST result of 5 mm or more is considered a positive result for a TB contact. The interpretation of IGRA results is the same for all patients; no cut-points are defined differently for contacts. TB disease should first be ruled out before initiating LTBI treatment.

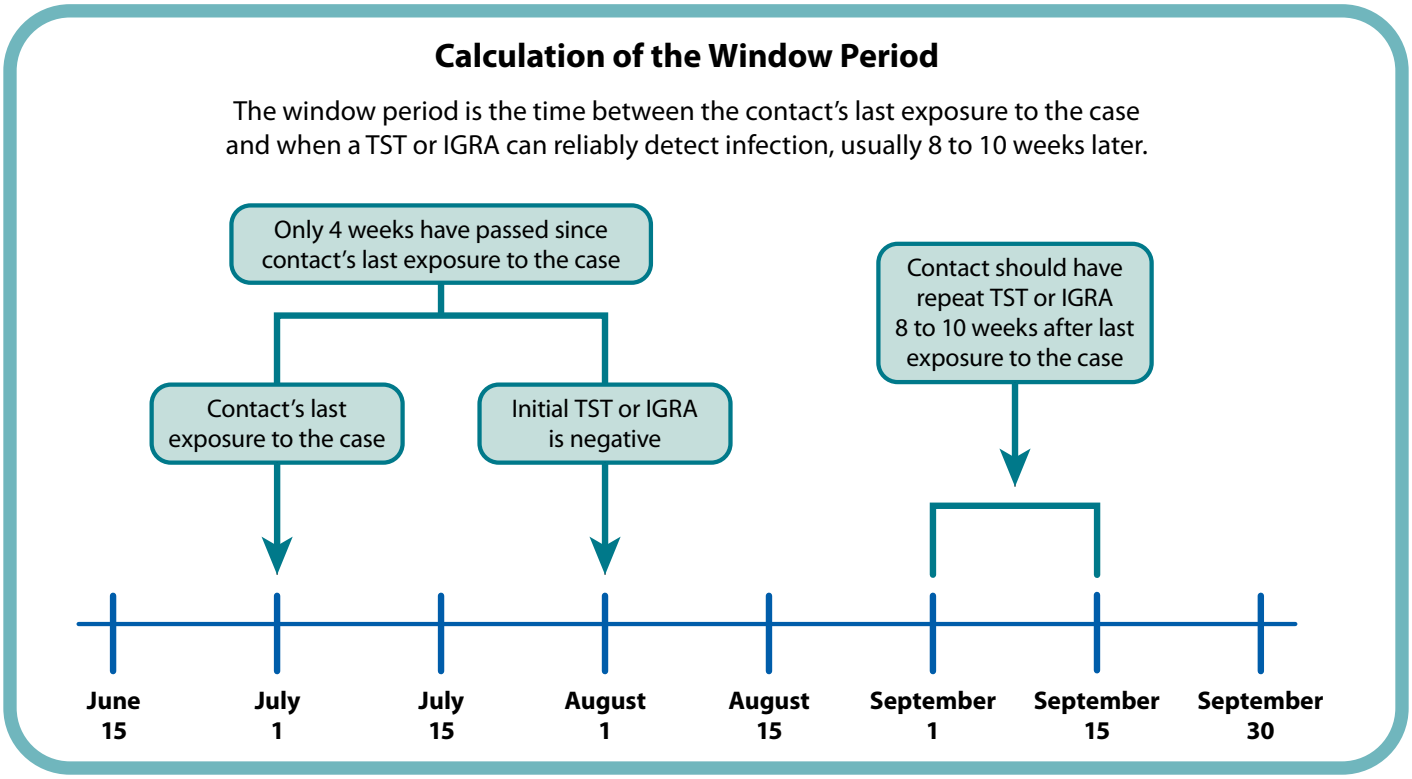

Figure 8.8—Example of calculating the window period. If a contact's last exposure to a TB case was July 1st, and he or she had a negative TST or IGRA on August 1st, a second TST or IGRA should be done between September 1st and September 15th (8 to 10 weeks after July 1st).

Management and Treatment of Contacts

For a contact investigation to be considered successful, contacts who have TB disease or LTBI should complete treatment. The appropriate management and treatment of these contacts is the responsibility of the health department.

Management and Treatment of Contacts with TB Disease

Contacts who have TB disease should be managed and treated in accordance with CDC treatment guidelines.

Contacts who have TB disease should be managed and treated in accordance with CDC treatment guidelines. DOT and the use of incentives and enablers are recommended to support adherence and achieve completion of treatment. For more information about the treatment of TB disease, refer to *Module 4, Treatment of Tuberculosis Infection and Tuberculosis Disease*. For detailed recommendations for the treatment of TB disease, refer to the *Official American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America Clinical Practice Guidelines: Treatment of Drug-Susceptible Tuberculosis*. It is important to remember that for each contact who is found to have infectious TB disease, a separate contact investigation needs to be started immediately.

Management and Treatment of Contacts with LTBI

Once TB disease has been ruled out, treatment for LTBI should be offered to all contacts with a positive TST or IGRA, unless there is a compelling reason not to do so.

Once TB disease has been ruled out, treatment for LTBI should be offered to all contacts with a positive TST or IGRA, unless there is a compelling reason not to do so. Treatment should be offered regardless of whether the contact has received the BCG vaccine in the past. Treatment should also be offered to contacts with a prior positive TST or IGRA who did not complete treatment for LTBI.

In general, contacts with a positive TST or IGRA and a documented history of LTBI treatment completion do not need to be re-treated. However, in some circumstances, repeat treatment for LTBI may be advisable based on the contact's risk for re-infection with *M. tuberculosis* and progression to TB disease.

Special Considerations in TB Contact Assessment and Management

Window Period Prophylaxis

Contacts Younger than 5 Years of Age

Because of their age, young children with *M. tuberculosis* infection are known to have been recently infected, and thus are at a high risk of progressing to TB disease. Young children are also more likely than older children and adults to develop life-threatening forms of TB disease, especially meningeal and disseminated disease.

Children younger than 5 years of age should be medically assessed, including a chest x-ray, regardless of a history of LTBI or TB disease treatment or an initial negative TST or IGRA result. Since TB disease may present differently in children than adults, clinicians with pediatric TB disease experience should be consulted during the assessment and medical evaluation process.

Once TB disease has been ruled out, children younger than 5 years of age should receive LTBI treatment, even if their initial TST or IGRA result is negative. This is called window period prophylaxis.

Once TB disease has been ruled out, children younger than 5 years of age should receive LTBI treatment, even if their initial TST or IGRA result is negative. This is called **window period prophylaxis**.

Window period prophylaxis can be stopped if ALL of the following conditions are met:

- The child is at least 6 months of age
- The second TST or IGRA is negative
- The second TST or IGRA was done at least 8 weeks after the child was last exposed to an adult with infectious TB disease

If the second TST or IGRA is positive, a full course of LTBI treatment should be continued and completed.

Contacts with HIV Infection

Because of their weakened immune systems, persons living with HIV are at high risk for rapidly developing TB disease. Contacts known or suspected to be HIV-infected should be medically evaluated, including a chest x-ray, to rule out TB disease. Expert consultation should be sought for contacts with HIV infection who need TB treatment.

Once TB disease has been ruled out, HIV-infected contacts should receive window period prophylaxis for LTBI regardless of their initial IGRA or TST result.

Once TB disease has been ruled out, HIV-infected contacts should receive window period prophylaxis for LTBI regardless of their initial IGRA or TST result. In general, treatment of LTBI should be continued even if the second TST or IGRA result is negative. This is because some HIV-infected contacts may not be able to produce a positive TST or IGRA result because of their weakened immune systems. Clinicians should use TB exposure information (e.g., frequency, duration, and infectiousness of the case) to guide their decision on whether to continue or discontinue LTBI treatment.

Contacts with Other Immune Impairment

Expert consultation should be sought to determine if contacts with immune impairments other than HIV infection (e.g., contacts taking immunosuppressive therapies) could benefit from window period prophylaxis, regardless of their initial TST or IGRA results. Offering treatment for presumed *M. tuberculosis* infection may be considered if the likelihood of infection is high, based on the circumstances of the exposure and prevalence of TB infection among other contacts.

Table 8.5 summarizes the CDC recommendations for the prophylactic treatment of presumed infection with *M. tuberculosis* for contacts younger than 5 years of age and contacts with HIV infection.

Table 8.5 Recommendations for Prophylactic Treatment of Presumed Infection with *M. tuberculosis* for Contacts Younger than 5 Years of Age and Contacts with HIV Infection

Prophylactic Treatment	Contacts Less than 6 Months of Age*	Contacts Older than 6 Months but Younger than 5 Years of Age	Contacts with HIV (any age)
When to start	As soon as possible if medical assessment and chest x-rays show no evidence of current TB disease, even if initial TST or IGRA result is negative		
When to stop	Contact reaches 6 months of age **and** TST or IGRA done 8 to 10 weeks after last exposure is negative **or** Once a full course of treatment for LTBI is completed	TST or IGRA done 8 to 10 weeks after last exposure is negative **or** Once a full course of treatment for LTBI is completed	Once a full course of treatment for LTBI is completed

* Negative TST and IGRA results can be unreliable in children younger than 6 months of age.

Contacts to Drug-Resistant TB

Treatment regimens for contacts should reflect the drug susceptibility patterns of the *M. tuberculosis* isolate of the presumed source case. Selection of treatment regimens for contacts to drug-resistant TB requires expert consultation. Additionally, supporting adherence to LTBI treatment for infected contacts of drug-resistant TB is very important. Consideration should be given to providing DOT and using incentives and enablers for contacts believed to be infected with drug-resistant *M. tuberculosis*.

Contacts of Isoniazid-Resistant TB

If a person is a contact to isoniazid-resistant TB, a 4-month regimen of daily rifampin may be recommended. In situations where rifampin cannot be used, rifabutin may be substituted.

Contacts of Multidrug-Resistant TB

The risk for developing TB disease should be considered before recommending LTBI treatment for contacts to multidrug-resistant (MDR) TB. MDR-TB contacts may be treated for 6–12 months or they can be observed for signs and symptoms of disease without treatment. If treating an MDR-TB contact for LTBI, an alternative regimen of drugs to which the *M. tuberculosis* isolate is known to be susceptible should be used. Immunocompromised contacts should be treated for 12 months. All persons with

suspected MDR LTBI should be followed and observed for signs and symptoms of TB disease for 2 years, regardless of the treatment regimen. An expert in the treatment of MDR TB should be consulted.

For more information about the treatment of LTBI, refer to *Module 4, Treatment of Latent Tuberculosis Infection and Tuberculosis Disease*. For detailed recommendations for the treatment of LTBI, refer to the CDC's *Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection* and *Update of Recommendations for Use of Once-Weekly Isoniazid-Rifapentine Regimen to Treat Latent Mycobacterium tuberculosis Infection*.

Figure 8.9 on page 67 diagrams the assessment and management process of TB contacts. This figure is presented as a guide only, and is not meant to substitute for careful consideration of each contact's risk of infection and progression to TB disease.

Data Management and Collection for Contacts

To ensure that contacts are managed and followed-up appropriately, it is essential to have a good data collection and management system.

To ensure that contacts are managed and followed-up appropriately, it is essential to have a good data collection and management system. Data should be recorded throughout the contact assessment and management process. This information will also be used to evaluate the success of the contact investigation.

Information collected from each contact may vary by jurisdiction. Each jurisdiction may have their own forms for collecting information about contacts and for summarizing investigation findings. Some health jurisdictions have a separate record for each contact, while others have multiple contacts recorded on a single form that is attached to the index case records.

Table 8.6 lists information that should be collected about each contact. Some of this information will be collected from the case during the interview, and some of it will be collected from the contact during the investigation process.

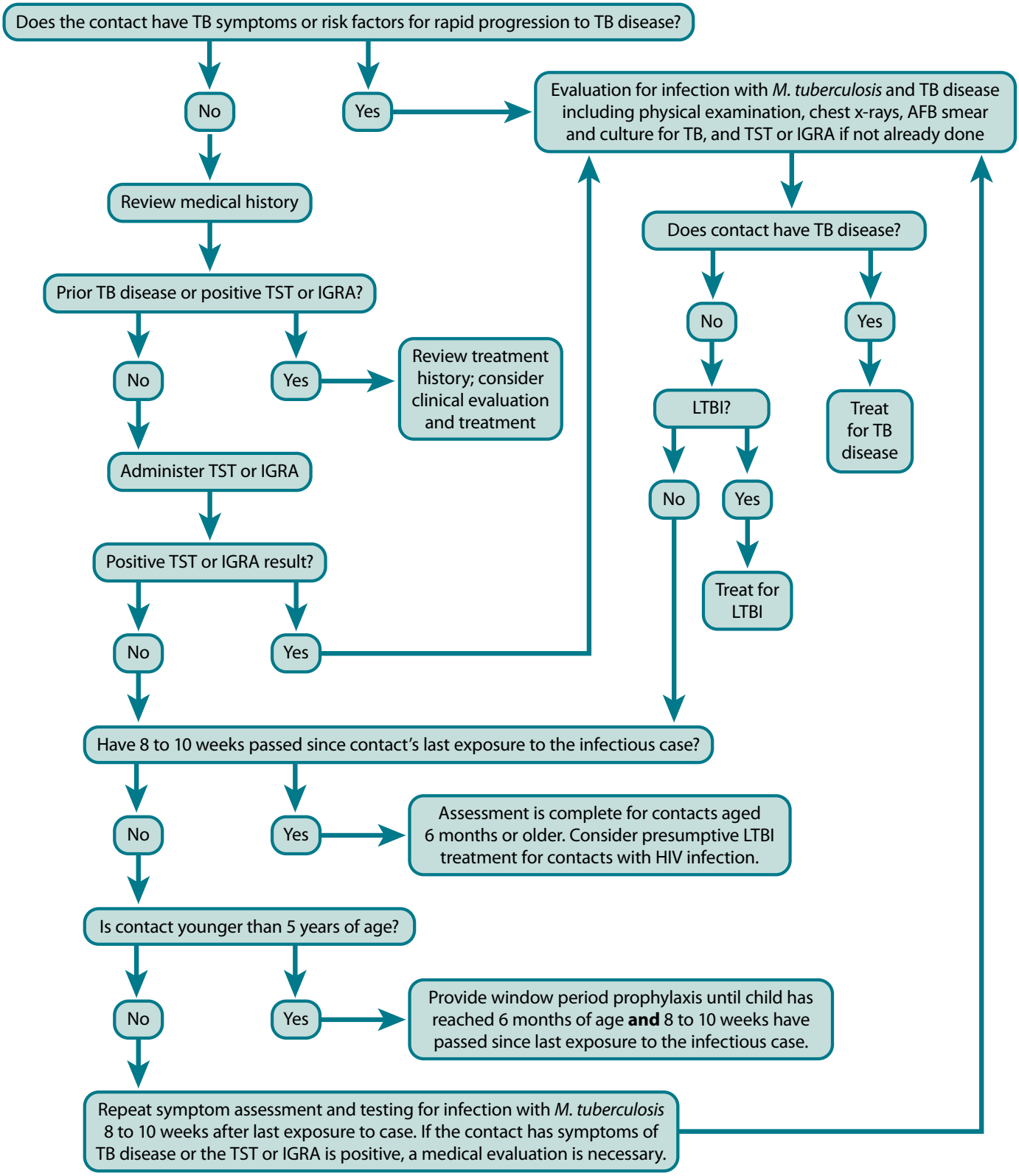

Figure 8.9—Assessment and management of TB contacts.

Table 8.6 Information to Collect About Each Contact

Information to Obtain from the Case
■ Name(s) ■ Address(es) and telephone number(s) ■ Sex ■ Physical description ■ Contact's relationship to the case ■ Date of last exposure to the case ■ Location where exposure occurred ■ Frequency and durations of the exposure(s) ■ Physical proximity between the contact and the case during the exposure
Information to Obtain from the Contact
■ Basic demographic information, including name(s), date of birth ■ Preferred language ■ Address(es) and telephone number(s)
Information to Obtain During the Assessment Process
■ Date and location of the assessment ■ Risk factors for development of TB disease ■ Symptoms of TB disease, if any ■ TST or IGRA dates and results ■ Chest x-ray dates and results ■ HIV infection status ■ Final diagnostic classification ■ Treatment and other follow-up

Study Questions 8.19– 8.21

8.19 What are the major activities of the contact assessment?

8.20 What is the window period?

8.21 What is window period prophylaxis? Which contacts should receive window period prophylaxis?

Answers to study questions are on pages 83– 89

Case Study 8.7

Priya is a 34-year-old woman who was diagnosed with infectious TB disease. As part of her contact investigation, you identified the following priority contacts:

- *Naveen (husband, 35 years old)*
- *Sanjay (son, 3 years old)*
- *Asha (close friend, 37 years old)*
- *Paul (co-worker, 52 years old)*
- *Marie (co-worker, 43 years old)*

Five weeks have passed since the contacts were last exposed to Priya while she was infectious. These contacts (a total of 5) have been assessed by the contact investigation team. None of the contacts were found to have TB symptoms.

The skin test results were as follows:

- *Naveen: 11 mm*
- *Sanjay: 0 mm*
- *Asha: 5 mm*
- *Paul: 3 mm*
- *Marie: 0 mm*

What follow-up testing and treatment are needed for contacts with a positive skin test?

Should any follow-up testing be given to contacts with a negative skin test?

Which contacts should receive a repeat skin test? When should the repeat test be performed?

Answers to case studies are on pages 90– 98

TB Contact Investigations in Congregate Settings

This section highlights challenges and solutions to conducting TB contact investigations in congregate settings. Local public health programs should consult with the next higher level of public health administration if needed.

What is a Congregate Setting?

A **congregate setting** is a setting in which a group of persons reside in close physical proximity. Examples of congregate settings include

- Schools
- Shelters
- Nursing homes
- Correctional facilities
- Workplaces
- Hospitals or other healthcare settings

How are Contact Investigations Conducted in Congregate Settings?

Contact investigations involving congregate settings should follow the systematic contact investigation process presented on pages 15–56 of this module. However, there may be some additional challenges to consider when conducting an investigation in a congregate setting, including

- Large numbers of contacts
- Incomplete data for determining which contacts should be prioritized for assessment
- Difficulties related to maintaining confidentiality
- Incomplete information about contacts' names and locating information
- A need to collaborate with officials and administrators who are not familiar with TB
- Media interest, particularly for investigations involving schools or worksites
- Political implications of negative publicity related to TB
- Legal implications for the facility

To effectively address potential challenges, contact investigations involving congregate settings often require additional resources to ensure that other essential TB control activities are not disrupted.

To effectively address these potential challenges, contact investigations involving congregate settings often require additional resources. This is to ensure that other essential TB control activities are not disrupted.

An initial notification of the need for a contact investigation in the congregate setting can occur by phone call. This call should also be used to schedule an in-person meeting with administrators to discuss the contact investigation process.

At the meeting, the following items should be discussed:

- Purpose of the meeting
- Basic TB concepts
- Confidentiality issues
- Infectious period
- Total number of persons in the congregate setting
- Process of identifying, prioritizing, and testing contacts
- Potential media interest

Because of confidentiality issues, contact investigators should be careful not to reveal personally identifying information to administrators without the case's knowledge and without reviewing local jurisdiction policy and consultation with a supervisor at the TB program. In some situations, a signed confidentiality agreement from the administrators or consent from the case may be needed.

Whenever possible, health departments should collaborate with administrators from congregate settings to identify opportunities for efficient and convenient assessment of contacts and delivery of treatment to contacts for LTBI or TB disease.

Whenever possible, health departments should collaborate with administrators from congregate settings to identify opportunities for efficient and convenient assessment of contacts and delivery of treatment to contacts for LTBI or TB disease. Onsite assessment is typically the most effective way to reach contacts. If such an approach is not possible, special arrangements may be necessary to ensure priority contacts are completely assessed. For example, health departments may need to extend clinic hours or hire additional staff. As a last resort, the health department can notify contacts in writing to seek assessment for TB with their own healthcare provider.

Correctional Facilities

Investigations involving correctional facilities can be particularly challenging because of crowded conditions, large numbers of contacts (both inmates and correctional employees), poor ventilation, incomplete records, inaccessible records, misconceptions about TB and its transmission, slow access to medical care, and high turnover or movement of inmates.

Identifying contacts requires that investigators collect information on where the case spent time, as well as any work assignments and activities within the correctional facility. Because of the potential intensity of exposure within a crowded or poorly ventilated space, contacts should be considered high priority unless records indicate a brief exposure. Investigators should also locate priority contacts who have been transferred, released, or paroled. For contacts who start treatment, it is important to have follow-up supervision to ensure completion of treatment, particularly if the contact has been released or paroled.

Schools

Contact investigations in schools typically feature a potentially large number of contacts and can come with unique challenges because children are involved.

Contact investigations in schools typically feature a potentially large number of contacts and can come with unique challenges because children are involved. Contact investigations based in schools may generate community and media attention. Therefore, TB control officials should anticipate media coverage and plan a collaborative strategy with the school to address parental and community concerns. Often, the concern from parents and the community can lead to the entire school being tested, regardless of the priority level of the contact. Some parents or guardians may not offer consent to have their children assessed for TB. In these circumstances, the health department should be prepared to consult with legal experts if necessary.

Identifying and assigning priorities to contacts may be challenging as it can be difficult to define the duration and proximity of exposure to the case. If available, contact investigators should refer to class assignments, extramural activities, and bus rosters to assist in prioritization. Additionally, interviews with the case, his or her parents or guardians, and school officials can elicit more information.

Homeless Shelters

Contact investigations involving shelters and homeless persons can be complicated because they often require assessment of a large number of contacts. Additionally, these investigations can be difficult because of the transient characteristics and lifestyle of some homeless persons. Locating the contacts of a homeless TB case can be challenging because of the following potential characteristics associated with homeless persons:

- Migration from one shelter or jurisdiction to another
- Mental illnesses
- Alcohol or drug use
- Periodic incarceration
- Preexisting medical conditions (e.g., HIV)

To help identify contacts, investigators should work with the administrators at homeless shelters. Some shelters may maintain daily sign-in sheets or logs. These may be used to help identify persons who were at the shelter at the same time as the case. However, it is important to note that in some jurisdictions, this information may be restricted by law.

To identify and assess additional contacts who may not have been named by the case, a location-based approach may be useful (refer to page 45 of this module).

Study Question 8.22

8.22 List five challenges associated with conducting contact investigations in congregate settings.

Answers to study questions are on pages 83–89

Module 8 Self-Study Modules on Tuberculosis

Conducting Source Case Investigations

What is a Source Case Investigation?

A source case is a person with TB disease who is responsible for transmitting M. tuberculosis *to another person or persons. A source case investigation is a method used to identify source cases.*

A **source case** is a person with TB disease who is responsible for transmitting *M. tuberculosis* to another person or persons. A **source case investigation** is a method used to identify source cases.

The purposes of a source case investigation are to determine

- Who transmitted *M. tuberculosis* to a child or to a group of persons (such as healthcare workers or correctional facility inmates and staff) who have been recently infected with *M. tuberculosis*
- Whether the source case is still infectious
- Whether the source case was reported to the health department
- Whether any other persons were infected by the source case
- The drug susceptibility test results and genotyping results of the source case who transmitted TB to a child

When Should a Source Case Investigation be Conducted?

Because source case investigations require a lot of time and effort and generally do not result in finding the source case or additional priority contacts, a health department must determine when it is necessary to conduct a source case investigation. State or local policies should be consulted for the specific criteria for conducting a source case investigation. A source case investigation could be considered in the following situations:

- A child 5 years of age or younger has been diagnosed with TB disease
- An infant 2 years of age or younger has been diagnosed with LTBI
- Healthcare settings where serial TB testing indicates recent *M. tuberculosis* infection in a healthcare worker
- Correctional facilities (e.g., jails, prisons) where TB testing indicates an increase in *M. tuberculosis* infection among inmates or staff

TB disease in children 5 years of age or younger and LTBI in infants 2 years of age and younger indicates that *M. tuberculosis* was recently transmitted. If exposure to an infectious case is unknown, a source case investigation may help find a person with undiagnosed TB disease who had contact with the child. It may also find additional contacts who have recent *M. tuberculosis* infection from the same source case and need medical attention.

In healthcare settings, if serial TB testing detects a change in a healthcare worker's TST or IGRA status from negative to positive, this could indicate recent TB transmission. If the source of exposure is unknown, a source case investigation can help determine whether there is unrecognized infectious TB within the healthcare facility. For more detailed information, please refer to the CDC's *Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Settings*, available from the CDC website (www.cdc.gov/tb).

If TB testing in correctional facilities indicates an increase in *M. tuberculosis* infection among inmates or employees, a source case investigation should be considered to determine if there is a case of unrecognized infectious TB in the facility.

How Are Source Case Investigations Conducted?

A source case investigation moves in the opposite direction of a contact investigation, but the same principles and investigative skills apply.

A source case investigation moves in the opposite direction of a contact investigation, but the same principles and investigative skills apply. A source case investigation usually begins by reviewing existing information (e.g., medical records) to confirm that the person has been recently infected with *M. tuberculosis*. Once it has been determined that the person has been recently infected, the next step is to determine potential source cases. This is done by interviewing the person who has been recently infected or by conducting proxy interviews if the source case investigation involves a young child.

Conducting Source Case Investigations Involving Children

If the source case investigation is for a child, their parent, guardian, or someone else who knows the child's lifestyle should be interviewed.

If the source case investigation is for a child, their parent, guardian, or someone else who knows the child's lifestyle should be interviewed. The principles of a source case interview are similar to the standard TB contact investigation interview; however, the emphasis is on finding the source of TB instead of finding contacts to the case.

During the interview, the investigators should ask about whom the child has spent time with at the following locations or activities:

- Home (e.g., persons living in the household, frequent visitors, babysitters)
- School
- Day care (both inside the home and outside the home)
- Car pools or buses
- Play groups
- Recreational activities
- Places of recent travel

Additionally, investigators should ask if any person whom the child has spent time with has shown symptoms of TB disease. Once potential sources have been identified, they should be located and assessed. Assessments during source case investigations typically focus on symptom reviews, potentially followed by chest x-rays and respiratory specimen collection for AFB smear and culture. Compared to a contact investigation, less emphasis is usually placed on testing for infection unless investigators are concerned about potential ongoing transmission.

Conducting Source Case Investigations Involving Healthcare Workers and Correctional Facility Staff or Inmates

When a source case investigation involves a person who is thought to have been infected at a healthcare or correctional setting, investigators should determine the timeframe during which the person may have been infected. This time frame is referred to as the likely **exposure period**. The exposure period usually begins 8 weeks prior to the most recent negative TST or IGRA result and ends 2 weeks before the first positive TST or IGRA result. The exposure period should be used to determine potential source cases. The persons infected with *M. tuberculosis* should be interviewed to identify the following persons or locations visited during the exposure period:

- Persons with symptoms of infectious TB disease
- Persons at increased risk for having TB disease
- Locations where they spent time during the exposure period where source cases may also have been present

In addition to interviewing newly infected persons, investigators can also identify potential source cases by determining which areas of the facility are associated with the new TB infections.

Investigators may also review medical records at the facility for recent respiratory illnesses that may have been infectious TB disease, but were diagnosed as something else. Once the potential source cases have been determined, they should be located and assessed for TB disease. For inmates who have been in more than one facility, efforts should be made to collaborate with all facilities affected.

Data in Source Case Investigations

If source case investigations are conducted, data should be monitored to determine the value of the investigations. Data should include

- Total number of source case investigations conducted
- Number of persons assessed for TB disease
- Number of times a source case was identified
- Whether identified source cases were previously known to the health department or if they were detected as a direct result of a source case investigation

How Can TB Genotyping Information Contribute to a Source Case Investigation?

TB genotyping can contribute to source case investigations by either confirming or disproving a named person as the source case. Additionally, genotyping can identify potential source cases that were not originally identified in the investigation.

TB genotyping can contribute to source case investigations by either confirming or disproving a named person as the source case as well as identifying potential source cases that were not originally identified in the investigation.

For example, if a source case investigation is conducted for a child or another case with active TB disease, their TB genotype information can be compared to other recent cases in the jurisdiction to determine if the genotypes match. If the genotypes match, this could mean that these cases were linked in the same chain of transmission. To confirm this, the medical records of the recent case should be reviewed and discussions with contact investigators of the case should be held to determine if there were any connections between these two cases.

When a suspected source case is identified, genotyping can support evidence of the transmission link to the case if the isolates from both have matching genotypes. If the investigation yields no suspected source case, a review of all genotyping results from cases living in the same region as the case may identify a genotype match.

Study Questions 8.23–8.24

8.23 What is a source case investigation?

8.24 How can genotyping contribute to source case investigations?

Answers to study questions are on pages 83–89

Case Study 8.6

Jung is a 3-year-old child who has been diagnosed with TB meningitis. Jung, his parents, and his paternal grandmother immigrated to the United States from China one year ago.

Should a source case investigation be conducted?

What information should you try to obtain?

Answers to case studies are on pages 90– 98

Additional Resources

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11. Nahid P, Dorman SE, Alipanah N, Barry PM, Brozek JL, Cattamanchi A, Chaisson LH, Chaisson RE, Daley CL, Grzemska M, Higashi JM, Ho CS, Hopewell PC, Keshavjee SA, Lienhardt C, Menzies R, Merrifield C, Narita M, O'Brien R, Peloquin CA, Raftery A, Saukkonen J, Schaaf HS, Sotgiu G, Starke JR, Migliori GB, Vernon A. *Official American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America Clinical Practice Guidelines: Treatment of Drug-Susceptible Tuberculosis*. Clinical Infectious Disease 2016:1–49. http://cid.oxfordjournals.org/content/early/2016/07/20/cid.ciw376.full.

Answers to Study Questions

8.1 What is a TB contact investigation?

A TB contact investigation is a systematic process to

- Identify persons (contacts) exposed to a person with infectious TB disease (a case)
- Assess contacts for infection with *M. tuberculosis* and TB disease
- Provide appropriate treatment for contacts with LTBI or TB disease

8.2 What are the goals of a TB contact investigation?

The goals of a TB contact investigation are to successfully stop TB transmission and to prevent future cases and outbreaks of TB disease.

8.3 Which TB cases require a contact investigation?

A contact investigation is required for all confirmed cases that have infectious forms of TB disease (e.g., TB disease of the lungs, airways, or larynx).

The contact investigation process should be started for persons suspected of having infectious TB disease, even before confirmation. This includes persons with positive sputum smears and a positive nucleic acid amplification test result. For persons with positive sputum smears and a negative nucleic acid amplification test result, a contact investigation is not indicated.

For suspect cases with negative sputum smears or sputum smears not performed, the contact investigation process should be started if the case has abnormal chest x-ray findings consistent with TB disease.

For suspect cases with negative sputum smear results and no pulmonary cavities, a contact investigation should only be considered for certain circumstances, such as if the suspect was identified during an outbreak or source case investigation that included vulnerable or susceptible contacts.

If it is later determined that the suspect case does not have infectious TB disease, the contact investigation should be stopped.

8.4 Who is responsible for conducting TB contact investigations?

In the United States, state and local health departments are legally responsible for the prevention and control of TB in their communities. Thus, they are accountable for ensuring contact investigations are performed for TB cases reported in their jurisdictions, even when patients are receiving care outside the health department.

Answers to Study Questions, Continued

8.5 Which TB contact investigations should be given priority?

In general, priority should be given to contact investigations involving

- Highly infectious cases
- Settings where transmission of *M. tuberculosis* is likely
- Contacts at high risk for rapid development of TB disease if infected with *M. tuberculosis*

8.6 What is the infectious period?

The infectious period is the time during which a case is potentially capable of transmitting *M. tuberculosis*.

8.7 When does the infectious period end?

The infectious period ends when all of the following criteria are met:

- Effective treatment 2 weeks or longer;
- Diminished symptoms (e.g., coughing less); and
- Mycobacteriologic response (e.g., decrease in grade of sputum smear positivity).

8.8 What is the main goal of the TB case interview?

The main goal of the interview with a TB case is to identify contacts who have been exposed to *M. tuberculosis*.

Answers to Study Questions, Continued

8.9 List three strategies for conducting effective interviews.

- Have a clear understanding of the objectives of the interview.
- Plan the interview so that each objective is given adequate time.
- Ensure the interview takes place under conditions that protect the privacy of the case and encourage effective communication.
- Arrange for the assistance of an interpreter if you do not speak the same language as the case.
- Establish the foundation for an effective working relationship based on trust and respect.
- Explain what a contact investigation is, how a contact investigation protects contacts from getting sick with TB disease, and what the case can do to help.
- Begin with an assessment of the case's knowledge, feelings, and beliefs about TB.
- Remain objective, open-minded, and nonjudgmental.
- Ask open-ended questions and listen carefully to the case's responses.
- Recognize and address the case's fears and concerns about TB.
- Use opportunities that arise during the interview to educate the case about TB.

8.10 What is a proxy interview? Who may serve as an appropriate proxy?

Proxy interviews are interviews conducted with persons who are familiar with the case's practices, habits, and behaviors. Potential proxies include family members, close friends, or other persons who know the case well.

8.11 What two factors should be taken into account when determining the priority of each contact?

The priority assigned to each contact should be based on the following:

- Likelihood of transmission from the case
- Contact's risk for development of TB disease

Answers to Study Questions, Continued

8.12 In general, which contacts should be considered priority?

Priority should be given to contacts who

- Are exhibiting symptoms of TB disease
- Are at risk for rapid development of TB disease
- Had repeated or extended exposure to the case
- Were exposed to a case in an environment where transmission was likely, such as a small, crowded, or poorly ventilated room or vehicle
- Were exposed to a case undergoing medical procedures that can release substantial numbers of *M. tuberculosis* into the air

8.13 What are the four main functions of a field visit?

- Identify additional cases of TB disease
- Identify additional contacts
- Gather additional information about environmental characteristics of places where exposure occurred
- Lay a foundation for additional contact investigation activities at those locations, if needed

8.14 List four safety precautions investigators should take while conducting field visits.

- Wear an identification badge with a current photograph
- Work in pairs when visiting isolated or dangerous areas
- Have a working cell phone
- Limit visibility of valuable items
- Inform a coworker or supervisor of itinerary, planned route, and expected time of return
- Practice appropriate infection control procedures

8.15 List five indicators of recent transmission.

- TB infection or TB disease in contacts younger than 5 years of age
- Change in contacts' TST or IGRA status from negative to positive
- A greater-than-expected rate of TB disease or TB infection among priority contacts
- Evidence of secondary transmission
- TB disease among contacts not initially considered priority (particularly if genotypes match that of the case)

Answers to Study Questions, Continued

8.16 When can a contact investigation be concluded?

A contact investigation can be concluded if

- All contacts have been assessed for TB infection and disease
- Contacts with LTBI have completed or are close to completing treatment
- No additional secondary cases of TB are found, either among identified contacts or through reviewing genotype information

8.17 What is the purpose of evaluating the TB contact investigation?

Evaluating the TB contact investigation can help determine how effectively the contact investigation activities were conducted and identify areas that may be in need of improvement.

Specifically, the purpose of evaluating contact investigation activities is to determine

- If the appropriate contacts were identified
- How many contacts were diagnosed with LTBI
- How many contacts with LTBI completed treatment
- How many additional cases of TB disease were found
- How many secondary cases of TB disease completed treatment
- How many contacts were not located
- How many contacts were located, but did not complete assessment
- The timeliness of identifying and assessing contacts, and starting treatment if necessary
- If the contact investigation was performed in all necessary settings
- If the contact investigation was expanded appropriately

Answers to Study Questions, Continued

8.18 List the 10 steps of the systematic approach to contact investigation.

1. Review existing information about the case
2. Determine an initial estimate for the infectious period and estimate the degree of infectiousness
3. Interview the case
4. Review information and develop a plan for the investigation
5. Refine the infectious period and degree of infectiousness
6. Prioritize contacts
7. Conduct field visits
8. Conduct contact assessments
9. Determine whether to expand or conclude an investigation
10. Evaluate the contact investigation activities

8.19 What are the major activities of the contact assessment?

The major activities of the contact assessment include meeting with the contact and conducting a medical evaluation. During the meeting, the investigator should collect and confirm information and be sure to maintain the confidentiality of the case. Contacts should receive a medical evaluation that includes a medical history, HIV test, a TB symptom review, and a TST or IGRA to test for infection with *M. tuberculosis*.

8.20 What is the window period?

The window period is the time between the contact's last exposure to the case and when a TST or IGRA can reliably detect infection.

8.21 What is window period prophylaxis? Which contacts should receive window period prophylaxis?

Window period prophylaxis is treatment for LTBI that is given to high-risk contacts (including children younger than 5 years of age, persons living with HIV, and other immunosuppressed persons) who have an initial negative test for TB infection less than 8 to 10 weeks after their last exposure to the case.

Answers to Study Questions, Continued

8.22 List five challenges associated with conducting contact investigations in congregate settings.

Challenges that are sometimes associated with conducting contact investigations in congregate settings include

- Large numbers of contacts
- Incomplete data for determining which contacts should be prioritized for assessment
- Difficulties related to maintaining confidentiality
- Incomplete information about contacts' names and locating information
- A need to collaborate with officials and administrators who are not familiar with TB
- Media interest, particularly for investigations involving schools or worksites
- Political implications of negative publicity related to TB
- Legal implications for the facility

8.23 What is a source case investigation?

A source case investigation is a method used to identify source cases. A source case is a person with TB disease who is responsible for transmitting *M. tuberculosis* to another person or persons.

8.24 How can genotyping contribute to source case investigations?

TB genotyping can contribute to source case investigations by either confirming or disproving a named person as the source case. Additionally, genotyping can identify potential source cases that were not originally identified in the investigation.

Cases linked in the same chain of transmission should have matching genotypes. If the investigation yields no suspected source case, a review of all genotyping results from cases living in the same region as the case may identify a genotype match.

Case Study Answers

8.1 You are a TB case manager at a busy clinic. Two new TB cases have been assigned to you. Indicate which case(s) require a contact investigation and note the reason why you made your decision.

Jose is a 35-year-old agricultural worker diagnosed with extrapulmonary TB of the kidneys. He lives with his wife in a small, rented house in a rural area.

Dale is a 72-year-old widower who lives alone. He drives himself to the local retirement center for bingo and poker four times a week. He was recently evaluated for TB disease by his physician because he complained of having a cough, shortness of breath, fatigue, and weight loss. His sputum smears were positive and his culture results are pending. Dale's chest x-ray shows a cavity in the right upper lobe of his lungs. The physician suspects TB and started Dale on a four-drug regimen.

Dale requires a contact investigation because he has cavitary TB disease and his sputum smears are positive. Jose does not require a contact investigation because he has extrapulmonary TB of the kidneys, which is not infectious.

Case Study Answers, Continued

8.2 Calculate the infectious periods for the following TB cases:

Isaac is a 42-year-old man who was hospitalized on December 4th with symptoms of fever, night sweats, and cough. He was placed in airborne infection isolation for two weeks. On the same date (December 4th), AFB sputum smears were collected and were reported as positive with final cultures pending. Chest x-rays were taken on December 4th and reported as abnormal with cavitary disease. Isaac was diagnosed with suspected pulmonary TB with appropriate treatment started on December 5th. Isaac states that he started coughing around November 6th. His symptoms resolved on December 24th. Three consecutive sputum AFB smears were negative on February 10th.

The beginning of Isaac's infectious period is August 6th (three months before the onset of symptoms). For contact investigation purposes, his infectious period ends on December 4th since he was effectively isolated and was no longer exposing any contacts. Biologically, the end of the infectious period would be February 10th because of the negative sputum smears, improved symptoms, and treatment for at least 2 weeks.

Trang is a 52-year-old woman who had a checkup on May 19th with her primary care provider. During this visit, she was found to have an abnormal chest x-ray. Sputum collected on the same day was reported as AFB smear positive with final cultures pending. On May 20th she was diagnosed with suspected pulmonary TB, started appropriate treatment, and was put on home isolation. Trang claims she never had a cough or other symptoms. Three consecutive induced sputum AFB smears were negative on June 15th, June 18th, and June 21st.

The beginning of Trang's infectious period is February 19th (three months before the first finding consistent with TB). The end of her infectious period would be June 21st because she has three negative sputum smears and has been on treatment for at least 2 weeks.

Case Study Answers, Continued

8.3 You are the public health worker assigned to conduct a contact investigation for Judith, a 73-year-old woman who was recently diagnosed with infectious TB disease. Judith lives with her daughter in a small house outside of town. You are conducting the case interview in her home.

What questions should you ask Judith during the interview to learn more about her contacts?

To identify Judith's contacts, it is important to first determine her period of infectiousness. To estimate the start of the infectious period, you should ask Judith what symptoms she had (if any) and when they began. To determine the end of the infectious period, you should refer to her medical record.

Once the infectious period has been estimated, you should ask Judith about the following:

- Where she spent time during her infectious period
- What activities or events she participated in during her infectious period
- Who she spent time with during her infectious period

Case Study Answers, Continued

8.4 Derrick is a 47-year-old man who has had a severe cough for about two months and started treatment for TB disease three days ago. He lives alone in a small apartment and works the night shift three times a week with two other employees at the convenience store a few blocks away from his home. During the day, Derrick goes to friends' apartments nearby or stays in his apartment to watch TV. He often goes to the local bar in his neighborhood with his friends Reggie and Melvin. He usually eats at one of two restaurants—the Main Street Diner or Susie's Kitchen.

Derrick says that his girlfriend, Tonya, spends the night with him a few times a week, and often brings her 2 year-old son Luke. Derrick also mentions another girlfriend, Kelly, who has stayed over about 10 times in the past three months. Last month, Derrick spent several days at Kelly's house, where she lives with her mother.

Based on this information, who are Derrick's contacts?

- Tonya and her son
- Kelly and her mother
- The two coworkers at the convenience store
- Friends whom Derrick visits at home, and anyone else who lives in their house
- Reggie, Melvin, and other persons who regularly go to the local bar with Derrick
- The bartender
- Waiters, waitresses, or friends at the two restaurants

Which contacts are at higher risk for TB infection and TB disease?

Tonya and her son are probably the most at risk because they frequently stay in Derrick's apartment. Luke is especially at risk because he is younger than 5 years of age. Kelly and her mother are also at risk because Derrick stayed at their house during the time he was probably infectious. In addition, the friends he spends the most time with—probably Reggie and Melvin—would be considered to be at higher risk.

Case Study Answers, Continued

8.5 One week ago, Hector came to the health department complaining of night sweats, weight loss, and a cough that has lasted about a month. His sputum smears were positive and he started a four-drug regimen for TB disease.

When you interviewed Hector, you found out he lives with his 32-year-old wife, Mimi; his two sons, Luis, 2, and Javier, 4; and his mother-in-law, Alma, 65. Hector's cousin, Henry, has stopped by the house a few times in the past month.

Hector rides to work 5 days a week in a car with his friend Joe. The ride lasts about 30 minutes.

Hector works in a mail order packing warehouse. About 100 employees work in the main room with Hector, but the room is divided into several sections. There are 20 persons in Hector's section, and 4 of these persons are assigned to work closely with Hector. Hector eats lunch outside every day with these 4 coworkers.

About twice a week and on weekends, Hector goes to a small neighborhood bar located in the basement of a building. At the bar, Hector spends most of the time talking to the bartender. He notes that the bartender has been coughing a lot lately.

Based on this information, who are Hector's contacts?

- Household members: Mimi, Luis, Javier, Alma
- His friend Joe
- His cousin Henry
- Four coworkers who work closely with Hector
- The bartender at the local bar

Which contacts should be considered a priority?

All of the contacts listed above should be considered a priority. The highest priority should be given to the bartender because he is exhibiting symptoms of TB disease. Because of their young age, Luis and Javier are also at high risk and should be assessed as soon as possible.

Case Study Answers, Continued

8.6 Carmen is a 30-year-old woman who was recently diagnosed with infectious TB disease. She works at the local community college and lives with her aunt.

A contact investigator from the local health department is conducting an interview with Carmen at Carmen's home. Three coworkers and her aunt have been reported to be contacts by Carmen.

Refer back to Figure 8.6 on page 45. Based on what is visible in the photo, is there evidence of any additional contacts in Carmen's home other than her aunt?

The investigator should notice that there are photos of children and others who were not mentioned in the interview. In addition, the investigator should notice the toys and children's shoes on the floor. There is also a pair of men's shoes on the floor. Carmen has not mentioned other contacts in the house. However the photos, shoes, and toys suggest that there may be other persons who live in or visit the house. If additional contacts are identified, they should be considered for assessment.

Case Study Answers, Continued

8.7 Priya is a 34-year-old woman who was diagnosed with infectious TB disease. As part of her contact investigation, you identified the following priority contacts:

- *Naveen (husband, 35 years old)*
- *Sanjay (son, 3 years old)*
- *Asha (close friend, 37 years old)*
- *Paul (co-worker, 52 years old)*
- *Marie (co-worker, 43 years old)*

Five weeks have passed since the contacts were last exposed to Priya while she was infectious. These contacts (a total of 5) have been assessed by the contact investigation team. None of the contacts were found to have TB symptoms.

The TB skin test results were as follows:

- *Naveen: 11 mm*
- *Sanjay: 0 mm*
- *Asha: 5 mm*
- *Paul: 3 mm*
- *Marie: 0 mm*

What follow-up testing and treatment are needed for contacts with a positive skin test?

Both contacts who have a positive TB skin test reaction, Naveen and Asha, should be given a chest x-ray to rule out the possibility of TB disease. If the chest x-ray is normal, they should complete a full course of treatment for LTBI. If the chest x-ray is abnormal, they should be evaluated for TB disease, including a sputum examination.

Should any follow-up testing or treatment be given to contacts with a negative skin test?

Yes. Because he is at high risk of rapidly developing TB disease if infected, Sanjay should start treatment for LTBI if his chest x-rays are normal and he has no TB symptoms. His last exposure to Priya while she was infectious occurred only 5 weeks ago; therefore, his skin-test result may be a false-negative reaction. Sanjay should be given window period prophylaxis until 8 to 10 weeks from his last exposure, when he should have a repeat skin test. If his chest x-rays are abnormal, he should be evaluated for TB disease, including a sputum examination.

Case Study Answers, Continued

Which contacts should receive a repeat skin test? When should the repeat test be performed?

Sanjay should be retested 8 to 10 weeks after he was last exposed to Priya. If Sanjay's second skin test reaction is negative, he can stop taking treatment for LTBI. If his second skin test reaction is positive, Sanjay should complete a full course of treatment for LTBI.

The other contacts who had a negative skin test reaction, Paul and Marie, should be retested 8 to 10 weeks after they were last exposed to Priya while she was still infectious. Anyone who has a positive reaction to the second skin test should complete a full course of treatment for LTBI after TB disease has been ruled out.

Case Study Answers, Continued

8.8 Jung is a 3-year-old child who has been diagnosed with TB meningitis. Jung, his parents, and his paternal grandmother immigrated to the United States from China one year ago.

Should a source case investigation be conducted?

Yes, a source case investigation should be conducted to locate the person who transmitted TB to Jung. When a child has TB infection or disease, it indicates that TB was transmitted relatively recently. In Jung's case, his young age indicates that he must have been exposed to someone with TB disease during the past 3 years. The person who is the source of this exposure is called the source case. In this situation, the source case may be a family member or friend (in the United States or in China) with infectious, possibly untreated, TB disease.

What would be the purpose of conducting a source case investigation for Jung?

The purpose of a source case investigation would be to determine

- Who transmitted *M. tuberculosis* to Jung
- Whether the source case is still infectious
- Whether the source case was reported to the health department
- Whether any other persons were infected by the source case
- The drug susceptibility test results and genotyping results of the source case who transmitted TB to Jung

Appendix For Accessibility

Figure 8.1: This figure is titled Infectious Period Estimate for a Smear Positive Case with TB Symptoms. The figure is an example of determining an initial estimate for the beginning and end of the infectious period for a case with a positive sputum smear result and symptoms of TB disease. In this example timeline, the infectious period begins on August 1. Symptoms start on November 1. Treatment starts on November 15. The case had negative sputum smears, no symptoms, and treatment for 2 weeks or longer by December 1st. Therefore, the end of the infectious period would be December 1st.

Figure 8.2: This figure is titled Infectious Period Estimate for a Smear Negative Case without TB Symptoms and No Cavities on Chest X-Ray. This figure shows how the infectious period is estimated as one month before a healthcare provider first suspects TB. On this timeline, the infectious period begins on August 15. The case was isolated on September 15th, the same date that TB was first suspected. Therefore, the end of the infectious period would be September 15th.

Figure 8.4: An example of a TB interview checklist that can be used during a case interview. By following the checklist, the contact investigator is guided to explain contact investigation, gather information on potential contacts, and answer questions.

Figure 8.5: This figure is titled Refined Infectious Period Estimate for a Smear Positive Case with TB Symptoms. The figure shows the refined infectious period for the case presented in Figure 8.1. In this timeline, the infectious period started on June 1, 3 months before symptom onset. Symptoms started on September 1. Treatment started on November 15. The case had negative sputum smears, no symptoms, and treatment for 2 weeks or longer by December 1st. Therefore, the end of the infectious period would be December 1st.

Figure 8.7: An example of how to determine the prevalence of newly diagnosed infection with M. tuberculosis among contacts.

- Eleven contacts were identified for a reported TB case. One contact had a documented previous positive TST result. The other 10 contacts did not have documented previous TST results. These 10 contacts had a skin test administered; seven had positive TST results and three had negative TST results.
- Step one: Determine the total number of contacts who completed testing for M. tuberculosis infection. Do not include contacts who have a documented previous positive test result, have not completed testing, or who were not tested.
  - For this example, 10 contacts completed testing.
- Step two: Determine the number of contacts with a newly positive TST result.
  - For this example, 7 of the 10 contacts who were tested had a positive TST result.
- Step three: Divide the number of contacts with a newly positive test result by the total number of contacts that completed testing.
  - For this example, 7 is divided by 10 which equals 0.70.
- Step four: Multiply the number from Step 3 by 100%.
  - For this example, 0.70 is multiplied by 100% which equals 70%.
- Answer: The TB infection prevalence for the contacts is 70%.

Figure 8.8: This figure is titled Calculation of the Window Period. The figure shows an example of calculating the window period and determining when a repeat test should occur for contacts with an initial negative test result. The window period is the time between the contact's last exposure to the case and when a TST or IGRA can reliably detect infection, usually 8 to 10 weeks later.

In this timeline, the contact's last exposure to the case is on July 1. An initial TST or IGRA is negative 4 weeks later on August 1st. The contact should have a repeat test 8 to 10 weeks after last exposure. Therefore, the contact should have a repeat TST or IGRA between September 1 and September 15.

Figure 8.9: A complex flow chart that diagrams the assessment and management process of TB contacts. The management and assessment of TB contacts is further explained in the Assessment and Management of TB Contacts section in Module 8.

Notes

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CS329840-C February 2025

Publication Number 99-6206