

# *Self-Study Modules on Tuberculosis*

## **Infectiousness and Infection Control**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Centers for Disease Control and Prevention**

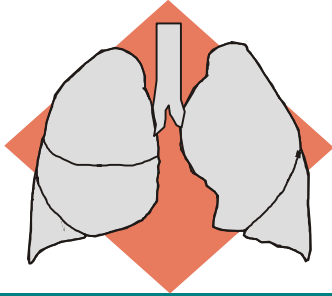
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Atlanta, Georgia  
March 1995





# Infectiousness and Infection Control



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## **BACKGROUND**

*In this module, you will learn about the factors that determine the infectiousness (contagiousness) of a person with TB disease. This will help you and others decide whether a particular patient should be considered infectious. You will also learn about the precautions you should take if you come in contact with patients who are considered infectious. These precautions, called infection control precautions, are meant to prevent the spread of TB in hospitals, clinics, and communities.*

## **OBJECTIVES**

After working through this module, you will be able to:

1. Describe the factors that determine the infectiousness of a TB patient.
2. Explain when a TB patient can be considered noninfectious.
3. Describe the main goal of an infection control program.
4. List the three types of controls in an effective infection control program.
5. Describe how TB can be detected in a health care facility and explain what should be done when a patient is suspected of having TB.
6. Describe the purpose and the characteristics of a TB isolation room.
7. Describe the three types of engineering controls.
8. Describe the circumstances when personal respirators should be used.
9. Describe the role of the health department in infection control.
10. Describe the precautions that health care workers should take when visiting the home of a TB patient who may be infectious.



## *NEW TERMS*

Look for the following new terms in this module and in the glossary.

**administrative controls** – guidelines for promptly detecting patients who have TB, placing them in an area away from other patients, giving them a diagnostic evaluation as soon as possible, and treating them if they are likely to have TB disease

**cough-inducing procedures** – procedures that make a patient cough, such as sputum induction, bronchoscopy, and the administration of aerosolized pentamidine

**diagnostic evaluation** – an evaluation used to diagnose TB disease; includes a medical history, a chest x-ray, the collection of specimens for bacteriologic examination, and possibly a tuberculin skin test

**engineering controls** – engineering systems used to prevent the transmission of TB in health care facilities, including ventilation, high-efficiency particulate air (HEPA) filtration, and ultraviolet germicidal irradiation

**HEPA filters** – special filters that can be used in ventilation systems to help remove droplet nuclei from the air

**isolation room** – a room with special characteristics to prevent the spread of droplet nuclei expelled by a TB patient, including negative-pressure ventilation

**negative pressure** – a ventilation system designed so that air flows from the corridors into an isolation room, ensuring that contaminated air cannot escape from the isolation room to other parts of the facility

**personal respirators** – special masks designed to filter out droplet nuclei; used in health care facilities and other settings where TB may be spread

**ultraviolet germicidal irradiation** – the use of special lamps that give off ultraviolet light, which kills the tubercle bacilli contained in droplet nuclei

**ventilation systems** – air systems designed to maintain negative pressure and to exhaust the air properly; designed to minimize the spread of TB in a health care facility



# READING MATERIAL

## Infectiousness

.....  
The infectiousness of a TB patient is directly related to the number of tubercle bacilli that he or she expels into the air.

.....

.....  
Usually, only people with pulmonary or laryngeal TB are infectious.

.....

.....  
Patients who have a cavity in the lung may be expelling tubercle bacilli if they are coughing.

.....

.....  
Patients expel more tubercle bacilli if they have a cough that produces a lot of sputum.

.....

### **What Factors Affect the Infectiousness of a TB Patient?**

The infectiousness of a TB patient is directly related to the number of tubercle bacilli that he or she expels into the air. Patients who expel many tubercle bacilli are more infectious than patients who expel few or no bacilli. The number of tubercle bacilli expelled by a TB patient depends on the following factors.

### **What is the site of the disease?**

Usually, only people with pulmonary or laryngeal TB (TB of the larynx) are infectious. This is because these people may be coughing and expelling tubercle bacilli into the air. People with extrapulmonary TB only (no pulmonary TB) generally are not infectious. This is because tubercle bacilli usually cannot be expelled into the air from an extrapulmonary site.

### **Does the chest x-ray show that the patient has a cavity in the lung?**

Because there are many tubercle bacilli in a cavity, patients who have a cavity in the lung may be expelling tubercle bacilli if they are coughing.

### **Is the patient coughing? If so, how often and how forcefully?**

Patients expel more tubercle bacilli if they have a cough that produces a lot of sputum. Also, they may expel tubercle bacilli if they are undergoing medical procedures that cause them to cough (cough-inducing procedures).



.....  
Patients who do not cover their mouth when they cough are more likely to expel tubercle bacilli.

.....  
The presence of tubercle bacilli on a sputum smear indicates that the patient may be expelling tubercle bacilli.

.....  
Patients who have not been receiving adequate treatment are much more likely to be infectious than patients who have been receiving adequate treatment.

**Does the patient cover his or her mouth when coughing?**

Patients who do not cover their mouth when they cough are more likely to expel tubercle bacilli.

**Are there acid-fast bacilli on the sputum smear?**

The presence of acid-fast bacilli on a sputum smear indicates that the patient may be expelling tubercle bacilli.

**Is the patient receiving adequate treatment?**

Patients who have NOT been receiving adequate treatment are much more likely to be infectious than patients who have been receiving adequate treatment for 2 to 3 weeks or longer. Patients who have been receiving adequate treatment usually respond to treatment; in other words, their symptoms improve and eventually go away.

Also, patients who have drug-resistant TB are more likely to be infectious than patients who have drug-susceptible TB. This is because patients with drug-resistant TB may not respond to the initial drug regimen, and they may remain infectious until they receive proper drugs.

These factors are summarized in Table 5.1.



**Table 5.1**  
**Infectiousness of People Known to Have**  
**or Suspected of Having TB Disease\***

<b>Factors Associated with Infectiousness</b>	<b>Factors Associated with Noninfectiousness</b>
TB of the lungs or larynx	Most extrapulmonary TB
Cavity in the lung	No cavity in the lung
Cough or cough-inducing procedures	No cough or cough-inducing procedures
Patient not covering mouth when coughing	Patient covering mouth when coughing
Acid-fast bacilli on sputum smear	No acid-fast bacilli on sputum smear
Not receiving adequate treatment	Receiving adequate treatment for 2-3 weeks

\* Infectiousness depends on a variety of factors. Clinicians should consider all of these factors when determining whether a TB patient should be considered infectious.

.....  
 Young children with TB disease are much less likely than adults to be infectious.  
 .....

Young children with pulmonary or laryngeal TB disease are much less likely than adults to be infectious. This is because children generally do not produce sputum when they cough. However, it is possible for children to transmit TB to others.

.....  
 Infectiousness appears to decline very rapidly after adequate treatment is started, but how quickly it declines varies from patient to patient.  
 .....

Infectiousness appears to decline very rapidly after adequate treatment is started, but how quickly it declines varies from patient to patient. Some patients may stop being infectious on the day they begin treatment. Others may remain infectious for weeks or even months. Patients with drug-resistant TB may not respond to the initial drug regimen, and they may remain infectious until they receive proper drugs.



Patients can be considered noninfectious when they meet **all** of the following criteria:

- # They have been receiving adequate treatment for 2 to 3 weeks
- # Their symptoms have improved (for example, coughing less and no longer have a fever)
- # They have **THREE** consecutive negative sputum smears from sputum collected on different days





**Study Questions 5.1-5.3**

- 5.1. Why does the site of disease affect the infectiousness of a TB patient?**
- 5.2. List five other factors that affect the infectiousness of a TB patient.**
- 5.3. When can a TB patient be considered noninfectious? List all three criteria.**

Answers on page 26.



### Case Study 5.1

**For each of the following situations, decide whether the patient should be considered infectious or noninfectious, and explain why.**

- # **Mr. Lopez started TB treatment 7 days ago. He still has a cough. Two weeks ago, he had a sputum smear that was positive; since then no sputum specimens have been tested.**
  
- # **Ms. Nguyen, a patient with pulmonary TB, has been receiving TB treatment for 6 weeks, and she no longer has symptoms of TB. She has had three sputum smears done. The first one was positive, but the last two were negative.**
  
- # **Mr. Martin started treatment for pulmonary TB in April. His symptoms went away and his sputum smears became negative in May. He missed his clinic appointment in June. When he returned to the TB clinic at the beginning of August, he was coughing.**

Answers on page 30.



## Infection Control

.....  
About 30% of people who spend a lot of time with someone who has infectious TB disease become infected with *M. tuberculosis*.

.....

.....  
TB is most likely to be transmitted when health care workers and patients come in contact with patients who have unsuspected TB disease, who are not receiving adequate treatment, and who have not been isolated from others.

.....

.....  
The main goal of an infection control program is to detect TB disease early and to promptly isolate and treat people who have TB disease.

.....

### Where Can TB Be Spread?

TB is a communicable disease. It can be spread in many places, such as homes or worksites. On average, about 30% of people who spend a lot of time with someone who has infectious TB disease (close contacts) become infected with *M. tuberculosis*. However, TB patients vary in their infectiousness; some infect most or all their close contacts, whereas others infect few or none of their contacts.

TB can also be transmitted in health care facilities, such as hospitals and clinics. TB is most likely to be transmitted when health care workers and patients come in contact with patients who have unsuspected TB disease, who are not receiving adequate treatment, and who have not been isolated from others. Several recent outbreaks of TB in health care facilities, including outbreaks of multidrug-resistant TB, have heightened concern about the spread of TB in these facilities. The transmission of TB to HIV-infected people is of particular concern because these persons are at high risk of developing TB disease if infected. All health care facilities should take measures to prevent the spread of TB.

### What Are the Parts of an Effective Infection Control Program?

The main goal of an infection control program is to **detect TB disease early** and to **promptly isolate and treat people who have TB disease**. The infection control program should involve three types of controls:

- # Administrative controls
- # Engineering controls
- # Personal respiratory protection



**Administrative controls.** Administrative controls mean establishing and following guidelines for

- # Promptly detecting patients who have TB disease
- # Placing these patients in an area away from other patients and giving them a diagnostic evaluation
- # Treating patients who are likely to have TB disease

Other administrative control measures include

- # Making sure that health care workers are following guidelines for preventing the spread of TB
- # Educating, training, and counseling health care workers about TB
- # Screening health care workers for TB infection and disease

.....  
Clinicians and other health care workers should suspect TB disease in any patient who has a persistent cough, bloody sputum, weight loss or loss of appetite, fever, or night sweats.  
.....

**To detect patients who have TB disease as soon as possible,** clinicians and other health care workers should suspect TB disease in a patient who has any of these symptoms:

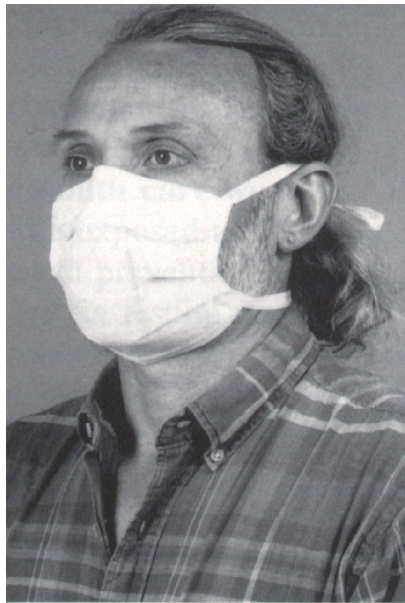
- # A persistent cough
- # Bloody sputum
- # Weight loss or loss of appetite
- # Fever
- # Night sweats

In areas where TB is very common, staff of local health care facilities should be especially alert for TB. Health care workers who admit patients to the facility should be trained to ask appropriate questions to help detect patients who have signs or symptoms of TB disease.



.....  
Patients who have signs or symptoms of TB disease should be placed in an area away from other patients and promptly given a diagnostic evaluation.  
.....

Patients who have signs or symptoms of TB disease should be **placed in an area away from other patients** (preferably in a TB isolation room) and promptly given a **diagnostic evaluation**. These patients should be given a surgical mask (Figure 5.1) and instructed to keep it on. They should also be given tissues and asked to cover their nose and mouth when coughing or sneezing, even when in an area away from others.



*Figure 5.1 TB patient wearing a surgical mask.*



.....  
In hospitals and other inpatient settings, patients known to have TB disease or suspected of having TB disease should be placed in a special TB isolation room right away.

In hospitals and other inpatient settings, patients known to have TB disease or suspected of having TB disease should be placed in a special **TB isolation room** right away. TB isolation rooms are rooms in the facility that have special characteristics to prevent the spread of droplet nuclei expelled by a TB patient. One characteristic of TB isolation rooms is that they are at **negative pressure** relative to other parts of the facility. Negative pressure means that air flows **from the corridors into the isolation room**. This way, contaminated air cannot escape from the isolation room to other parts of the facility. Air from the isolation room can be exhausted directly to the outdoors, where any infectious droplet nuclei will be diluted in the outdoor air and killed by the sunlight. Alternatively, the air can be passed through a special filter that removes all of the droplet nuclei before the air is returned to the general circulation (see HEPA filters, page 16). The room should have at least six air changes per hour. The door must be kept closed in order to maintain negative pressure, and the room must be checked periodically to make sure that it remains at negative pressure.

.....  
The diagnostic evaluation should include a medical history, a tuberculin skin test, a chest x-ray, and the collection of specimens for a bacteriologic examination.

Patients suspected of having TB disease should be given a diagnostic evaluation as soon as possible. This means a medical history, a tuberculin skin test, a chest x-ray, and the collection of specimens for a bacteriologic examination (see Module 3, Diagnosis of Tuberculosis Infection and Disease). It is important that laboratories use the most rapid diagnostic methods available. In outpatient settings where a diagnostic evaluation cannot be completed, patients who have symptoms of TB should be referred to a facility capable of doing the evaluation.

Patients who are likely to have TB should **start appropriate treatment** at once.



.....  
Patients should be educated about the transmission of TB, the reason for TB isolation, and the importance of staying in their room.  
.....

Patients should be educated about the transmission of TB, the reason for TB isolation, and the importance of staying in their room. Every effort should be made to help the patient follow the isolation policy — including the use of incentives, such as providing telephones or televisions or allowing special dietary requests. As few people as possible should be allowed to enter the TB isolation room, and anyone entering should wear respiratory protection (see Personal Respiratory Protection, page 16).

.....  
All health care workers should be educated about TB, infection control, and the importance of skin testing.  
.....

**Training and education.** All health care workers should be educated about the basic concepts of TB transmission and pathogenesis, infection control practices, the signs and symptoms of TB, and the importance of participating in the skin testing program for health care workers.

.....  
Health care workers who may be exposed to TB should be included in a TB screening and prevention program.  
.....

**TB screening for health care workers.** Health care workers who may be exposed to TB should be included in a TB screening and prevention program. This means two-step tuberculin skin testing upon employment and at least once a year thereafter. Any worker who develops symptoms of TB disease or whose tuberculin skin test reaction converts to positive should be evaluated promptly.



**Study Questions 5.4-5.7**

- 5.4. In what circumstances is TB most likely to be transmitted in health care facilities?**
- 5.5. What is the main goal of an infection control program? What three types of controls should this program involve?**
- 5.6. What would make a health care worker suspect that a patient has TB disease?**
- 5.7. What should be done when a health care worker suspects that a patient has TB disease?**

Answers on page 27.





**Study Questions 5.8-5.9**

- 5.8. What is a TB isolation room? What are the important characteristics of an isolation room?**
- 5.9. How often should health care workers who may be exposed to TB be tuberculin skin tested?**

Answers on page 28.

**Case Study 5.2**

**You are checking patients into the TB clinic. An elderly man comes to the desk and says he was told to come and get checked because one of his friends has TB. You notice that he looks sick and is coughing frequently. The waiting room is full of patients, and you know it will probably be more than an hour before the physician can see him.**

**# What should you do?**

Answer on page 31.



.....  
The three types of engineering controls used to prevent the transmission of TB in health care facilities are ventilation, high-efficiency particulate air (HEPA) filtration, and ultraviolet germicidal irradiation (UVGI).  
.....

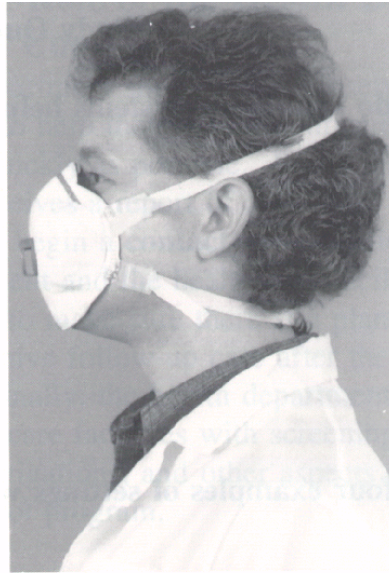
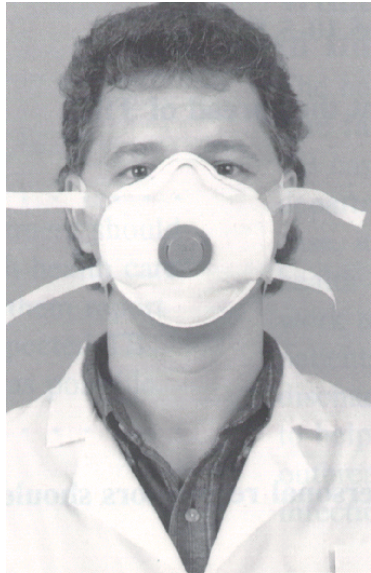
**Engineering controls.** Three types of engineering controls are used to prevent the transmission of TB in health care facilities: ventilation, high-efficiency particulate air (HEPA) filtration, and ultraviolet germicidal irradiation. In isolation rooms, **ventilation systems** are necessary to maintain negative pressure and to exhaust the air properly. These systems can also be designed to minimize the spread of TB in other areas of the health care facility. **HEPA filters** are special filters that can be used in ventilation systems to help remove droplet nuclei from the air. **Ultraviolet germicidal irradiation (UVGI)**, or the use of special lamps that give off ultraviolet light, is used to kill the tubercle bacilli contained in droplet nuclei. However, exposure to ultraviolet light can be harmful to the skin and eyes of humans, so the lamps must be installed in the upper part of rooms or corridors or placed in exhaust ducts. HEPA filters and UVGI should be used in conjunction with other infection control measures.

.....  
Health care workers should use personal respirators in TB isolation rooms, rooms where cough-inducing procedures are done, ambulances transporting infectious TB patients, and homes of infectious TB patients.  
.....

**Personal respiratory protection.** In some settings, administrative and engineering controls may not fully protect health care workers from infectious droplet nuclei. These settings include

- # TB isolation rooms
- # Rooms where cough-inducing procedures are done
- # Ambulances and other vehicles transporting infectious TB patients
- # The homes of infectious TB patients

Health care workers should use **personal respirators**, or special masks designed to filter out droplet nuclei, in these settings (Figures 5.2 and 5.3). Health care workers should be taught how and when to use personal respirators.



Figures 5.2 and 5.3 Health care worker wearing a personal respirator. The personal respirator in these photographs is specially designed to filter out droplet nuclei.

.....  
Cough-inducing procedures  
should be done in special  
isolation rooms or booths.  
.....

**Cough-inducing procedures.** Cough-inducing procedures should be done in special isolation rooms or booths. This will prevent any droplet nuclei that are expelled during the procedure from reaching other parts of the facility. Some examples of cough-inducing procedures are sputum induction, bronchoscopy, and the administration of aerosolized medications (such as pentamidine, which is given to patients with HIV infection to prevent *Pneumocystis carinii* pneumonia).



**Study Questions 5.10-5.12**

- 5.10. How do ventilation systems help prevent the spread of TB?**
- 5.11. Give four examples of settings where personal respirators should be used.**
- 5.12. Where should sputum induction, bronchoscopy, and other cough-inducing procedures be done?**

Answers on pages 28-29.



### **What Is the Role of the Health Department in Infection Control?**

The health department should work closely with health care facilities to help them report confirmed or suspected TB cases as quickly as possible. When the health department receives a report of a TB case or suspected case, it should begin a **contact investigation**. Also, the health department and the health care facilities should work together to make sure there is a plan for TB patients to receive follow-up care after they are discharged. Finally, the health department should be able to help health care facilities with screening, surveillance, outbreak investigations, and other aspects of a TB infection control program.

.....  
The health department should work closely with health care facilities to help them report confirmed or suspected TB cases as quickly as possible.  
.....

### **Infection Control in Residential Facilities**

All residential facilities where TB patients receive care should establish and follow an infection control program. These residential facilities may include nursing homes, correctional facilities, homeless shelters, drug treatment centers, and other places. As in health care facilities, the main goal of the infection control program should be to detect TB disease early and arrange for the isolation and treatment of suspected TB patients. CDC has published guidelines for controlling TB in certain types of residential facilities (see Additional Reading, page 25.)

.....  
All residential facilities where TB patients receive care should establish and follow an infection control program.  
.....



.....  
People with TB disease are most likely to transmit TB to members of their household before TB has been diagnosed and treatment has started.

.....  
TB patients should be instructed to cover their mouth and nose with a tissue when coughing or sneezing.

.....  
Health care workers who visit patients at home should take precautions to protect themselves from the spread of TB.

### **Infection Control in the Home**

Patients who are suspected of having infectious TB are frequently sent home after starting treatment, even though they may still be infectious. This is because people with TB disease are most likely to transmit TB to members of their household **before** TB has been diagnosed and treatment has started. However, TB patients and members of their household can take steps to prevent the spread of TB in their home. For example, TB patients should be instructed to cover their mouth and nose with a tissue when coughing or sneezing.

Health care workers who visit TB patients at home should take these precautions to protect themselves from the spread of TB:

- # Instruct patients to cover their mouth and nose with a tissue when coughing or sneezing
- # Wear a personal respirator when visiting the home of an infectious TB patient or when transporting an infectious TB patient in a vehicle
- # When it is necessary to collect a sputum specimen in the home, collect the specimen in a well-ventilated area, away from other household members; if possible, the specimen should be collected outdoors
- # Participate in a TB screening and prevention program



**Study Questions 5.13-5.14**

**5.13. How can the health department help health care facilities in preventing the spread of TB?**

**5.14. What precautions should a health care worker take when visiting the home of a TB patient who may be infectious?**

Answers on page 29.



### Case Study 5.3

**You are sent to deliver directly observed therapy to a woman who started treatment last week for suspected pulmonary TB. Her sputum smear results are not back yet. You are asked to collect another sputum specimen while you are at the woman's home.**

**# What precautions should you take?**

Answer on page 31.





## SUMMARY

The infectiousness of a TB patient is directly related to the number of tubercle bacilli that he or she expels into the air. Patients who expel many tubercle bacilli are more infectious than patients who expel few or no bacilli. Patients are more likely to be infectious if they

- # Have TB of the lungs or larynx
- # Have a cavity in the lung
- # Are coughing or undergoing cough-inducing procedures
- # Are not covering their mouth when coughing
- # Have acid-fast bacilli on the sputum smear
- # Are not receiving adequate treatment

Infectiousness appears to decline very rapidly after adequate treatment is started, but how quickly it declines varies from patient to patient. Patients who have been receiving adequate treatment for 2 to 3 weeks, whose symptoms have improved (for example, coughing less and no longer have a fever), **and** who have three consecutive negative sputum smears from sputum collected on different days can be considered noninfectious.

TB can be spread in many places, such as homes or worksites. TB can also be transmitted in health care facilities. TB is most likely to be transmitted when health care workers and patients come in contact with patients who have unsuspected TB disease, who are not receiving adequate treatment, and who have not been isolated from others. All health care facilities should take measures to prevent the spread of TB.

The main goal of an infection control program is to detect TB disease early and to promptly isolate and treat people who have TB disease. The infection control program should involve three types of controls — administrative controls, engineering controls, and personal respiratory protection — as well as training and education and TB screening for health care workers.

Patients who have signs or symptoms of TB disease should be placed in an area away from other patients (preferably in a TB isolation room) and promptly given a diagnostic evaluation. Patients who are likely to have TB should start appropriate treatment at once.



In hospitals and other inpatient settings, patients known to have TB disease or suspected of having TB disease should be placed in a special isolation room right away. This isolation room should be at negative pressure relative to other parts of the facility.

Three types of engineering controls are used to prevent the transmission of TB in health care facilities: ventilation, high-efficiency particulate air (HEPA) filtration, and ultraviolet germicidal irradiation (UVGI). HEPA filters and UVGI should be used in conjunction with other infection control measures.

In places where administrative and engineering controls may not fully protect health care workers from infectious droplet nuclei, health care workers should use personal respirators to filter out droplet nuclei.

The health department should work closely with health care facilities to

- # Help them report confirmed or suspected TB cases as quickly as possible
- # Do contact investigations
- # Make sure there is a plan for TB patients to receive follow-up care after they are discharged
- # Help the facilities with screening, surveillance, outbreak investigations, and other aspects of a TB infection control program

People with TB disease are most likely to transmit TB before the disease has been diagnosed and treatment has started. TB patients who are receiving treatment are less likely to be infectious. TB patients who may be infectious should be instructed to cover their mouth and nose with a tissue when coughing or sneezing.

Health care workers who visit TB patients at home should take precautions to protect themselves from the spread of TB. They should instruct patients to cover their mouth and nose with a tissue when coughing or sneezing, wear a personal respirator when visiting the home of an infectious TB patient or when transporting an infectious TB patient in a vehicle, collect sputum specimens in a well-ventilated area (if possible, outdoors), and participate in a TB screening and prevention program.



## Additional Reading

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Centers for Disease Control. Prevention and control of tuberculosis in facilities providing long-term care to the elderly: recommendations of the Advisory Committee for the Elimination of Tuberculosis. *MMWR*. 1990;39(RR-10).

Centers for Disease Control. Prevention and control of tuberculosis in U.S. communities with at-risk minority populations and Prevention and control of tuberculosis among homeless persons: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR*. 1992;41(RR-5).

Centers for Disease Control and Prevention. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 1994. *MMWR*. 1994;43(RR-13).

*Control of Tuberculosis in Correctional Facilities: A Guide for Health Care Workers*. Atlanta: Centers for Disease Control; 1992. A revised version of this document will be available in fall 1995.

*What Drug Treatment Centers Can Do to Prevent Tuberculosis*. Atlanta: Centers for Disease Control; 1991.



## *ANSWERS TO STUDY QUESTIONS*

**5.1. Why does the site of disease affect the infectiousness of a TB patient?** (page 3)

Usually, only people with pulmonary or laryngeal TB (TB of the larynx) are infectious. This is because these people may be coughing and expelling tubercle bacilli into the air. People with extrapulmonary TB only (no pulmonary TB) generally are not infectious.

**5.2. List five other factors that affect the infectiousness of a TB patient.**  
(pages 3-4)

- # Does the chest x-ray show that the patient has a cavity in the lung?
- # Is the patient coughing? If so, how often and how forcefully?
- # Does the patient cover his or her mouth when coughing?
- # Are there acid-fast bacilli on the sputum smear?
- # Is the patient receiving adequate treatment?

**5.3. When can a TB patient be considered noninfectious? List all three criteria.**  
(page 6)

Patients can be considered noninfectious when they meet **all** of the following criteria:

- # They have been receiving adequate treatment for 2 to 3 weeks
- # Their symptoms have improved (for example, coughing less and no longer have a fever)
- # They have **THREE** consecutive negative sputum smears from sputum collected on different days



**5.4. In what circumstances is TB most likely to be transmitted in health care facilities?**  
(page 9)

TB is most likely to be transmitted when health care workers and patients come in contact with patients who have unsuspected TB disease, who are not receiving adequate treatment, and who have not been isolated from others.

**5.5. What is the main goal of an infection control program? What three types of controls should this program involve?** (page 9)

The main goal of an infection control program is to detect TB disease early and to promptly isolate and treat people who have TB disease. The infection control program should involve three types of controls:

- # Administrative controls
- # Engineering controls
- # Personal respiratory protection

**5.6. What would make a health care worker suspect that a patient has TB disease?**  
(page 10)

Clinicians and other health care workers should suspect TB disease in any patient who has a persistent cough, bloody sputum, weight loss or loss of appetite, fever, or night sweats. They should be especially alert for TB in areas where TB is very common. Also, health care workers who admit patients to the facility should be trained to ask appropriate questions to help detect patients who have signs or symptoms of TB.

**5.7. What should be done when a health care worker suspects that a patient has TB disease?** (pages 11-12)

The patient should be placed in an area away from other patients (preferably in a TB isolation room) and promptly given a diagnostic evaluation. The patient should be given a surgical mask and instructed to keep it on; he or she should also be given tissues and asked to cover his or her nose and mouth when coughing or sneezing, even when in an area away from other patients. If the patient is likely to have TB, he or she should start appropriate treatment at once.



**5.8. What is a TB isolation room? What are the important characteristics of an isolation room? (page 12)**

TB isolation rooms are rooms in the facility that have special characteristics to prevent the spread of droplet nuclei expelled by a TB patient. One characteristic of TB isolation rooms is that they are at negative pressure relative to other parts of the facility. Another characteristic is that the air from the isolation room is exhausted directly to the outdoors or passed through a special filter that removes all of the droplet nuclei.

**5.9. How often should health care workers who may be exposed to TB be tuberculin skin tested? (page 13)**

Health care workers who may be exposed to TB should be skin tested upon employment (two-step testing) and at least once a year thereafter.

**5.10. How do ventilation systems help prevent the spread of TB? (page 16)**

Ventilation systems are necessary to maintain negative pressure and to exhaust the air properly. These systems can also be designed to minimize the spread of TB in other areas of the health care facility.

**5.11. Give four examples of settings where personal respirators should be used. (page 16)**

Personal respirators should be used in

- # TB isolation rooms
- # Rooms where cough-inducing procedures are done
- # Ambulances and other vehicles transporting infectious TB patients
- # The homes of infectious TB patients



**5.12. Where should sputum induction, bronchoscopy, and other cough-inducing procedures be done?** (page 17)

These medical procedures should be done in special isolation rooms or booths to prevent any droplet nuclei that are expelled during the procedure from reaching other parts of the facility.

**5.13. How can the health department help health care facilities in preventing the spread of TB?** (page 19)

The health department can

- # Help health care facilities report confirmed or suspected TB cases as quickly as possible
- # Do contact investigations
- # Make sure there is a plan for TB patients to receive follow-up care after they are discharged
- # Help the facilities with screening, surveillance, outbreak investigations, and other aspects of a TB infection control program

**5.14. What precautions should a health care worker take when visiting the home of a TB patient who may be infectious?** (page 20)

Health care workers who visit TB patients at home should take these precautions to protect themselves from the spread of TB:

- # Instruct patients to cover their mouth and nose with a tissue when coughing or sneezing
- # Wear a personal respirator when visiting the home of an infectious TB patient or when transporting an infectious TB patient in a vehicle
- # When it is necessary to collect a sputum specimen in the home, collect the specimen in a well-ventilated area, away from other household members; if possible, the specimen should be collected outdoors
- # Participate in a TB screening and prevention program



## *ANSWERS TO CASE STUDIES*

**5.1. For each of the following situations, decide whether the patient should be considered infectious or noninfectious, and explain why.**

**# Mr. Lopez started TB treatment 7 days ago. He still has a cough. Two weeks ago, he had a sputum smear that was positive; since then no sputum specimens have been tested.**

Mr. Lopez should be considered infectious. He does not meet the criteria for noninfectiousness because (1) he has been receiving treatment for only 7 days, not 2 to 3 weeks, (2) his symptoms haven't improved, and (3) he doesn't have three consecutive negative sputum smears.

**# Ms. Nguyen, a patient with pulmonary TB, has been receiving TB treatment for 6 weeks, and she no longer has symptoms of TB. She has had three sputum smears done. The first one was positive, but the last two were negative.**

Ms. Nguyen meets the first two criteria for noninfectiousness: she has been receiving treatment for at least 2 to 3 weeks and her symptoms have improved. However, she should be considered infectious until she has three consecutive negative sputum smears.

**# Mr. Martin started treatment for pulmonary TB in April. His symptoms went away and his sputum smears became negative in May. He missed his clinic appointment in June. When he returned to the TB clinic at the beginning of August, he was coughing.**

Mr. Martin may have become noninfectious in May, but it appears that he may be infectious again. He is coughing, and the fact that he missed his June appointment may indicate that he has not been adhering to treatment. At this point, Mr. Martin should be considered infectious. He should be evaluated for infectiousness and nonadherence to treatment.





**5.2. You are checking patients into the TB clinic. An elderly man comes to the desk and says he was told to come and get checked because one of his friends has TB. You notice that he looks sick and is coughing frequently. The waiting room is full of patients, and you know it will probably be more than an hour before the physician can see him.**

**# What should you do?**

You should suspect that this man has infectious TB. You should work with the clinical staff to ensure that he is evaluated for TB quickly. In the meantime, the man should be given a surgical mask, instructed to keep it on, and asked to cover his mouth and nose when coughing or sneezing. He should be placed in an area away from other patients right away.

**5.3. You are sent to deliver directly observed therapy to a woman who started treatment last week for suspected pulmonary TB. Her sputum smear results are not back yet. You are asked to collect another sputum specimen while you are at the woman's home.**

**# What precautions should you take?**

First, you should instruct the patient to cover her mouth and nose when she coughs or sneezes. Second, because the patient may be infectious, you should wear a personal respirator when visiting her home. Third, you should collect the sputum specimen in a well-ventilated area (preferably outdoors), away from other household members. (Ideally, sputum specimens should be collected in a special isolation room or booth.) Fourth, because you visit TB patients at home as part of your job, you should participate in a TB screening and prevention program through your employer.