Chapter 2
Infection Control

CONTENTS

Introduction

Purpose

Use this section to understand and follow national and Nevada guidelines for:

- Reviewing the hierarchy of infection control measures and knowing where to go for further information.
- Explain the basic differences between masks and respirators.
- Estimating patients' infectiousness and determine when patients are noninfectious.
- Determining when to isolate patients, when to discharge them from hospitals, and when to permit them to return to work, school, or other settings.
- Reviewing how to implement infection control measures in residential settings, patient care facilities, and transportation vehicles.
- Consulting with facilities that are implementing infection control measures, including two-step testing.

In the 2005 guidelines, "Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America," one of the recommended strategies to achieve the goal to reduce tuberculosis (TB) morbidity and mortality is the identification of settings in which a high risk exists for transmission of *Mycobacterium tuberculosis* and the application of effective infection control measures.[1]

As TB continues to decline in most areas of the U.S., it is crucial that state and local public health agencies provide facilities with epidemiological data on TB; as well as, education and guidance in developing effective TB infection control programs.

For more information regarding epidemiological data, refer to the Chapter 10, *Surveillance.*

Infection control measures are fundamental to reducing the spread of communicable diseases such as TB. Transmission of *M. tuberculosis* from person to person can occur in many locations, such as home, work, school, and healthcare facilities.[2] It is impossible to prevent all exposure; however, the goal is to reduce the amount of transmission.

Each agency's or facility's TB infection control program should include a hierarchy of administrative controls, environmental controls, and personal respiratory protection. Because each patient care setting and patient's home is different, each program will incorporate a different combination of control activities. The extent to which each agency or facility implements control activities is based on the results of their risk assessment. In areas where TB rates are lower, the TB risk is lower. This should affect which elements of the TB infection control plan are utilized.

Policy

Three main areas of Tuberculosis infection control that need to be addressed by state and local public healthcare agencies are:

1. Healthcare facilities, where persons with infectious TB disease would seek care[3,4]
2. Congregate settings and residential facilities, where residents are at increased risk for TB disease[5,6]
3. The patient's home

To accomplish TB control activities, each local public healthcare agency should do the following:

1. Familiarize staff with the current Centers for Disease Control and Prevention (CDC) infection control guidelines for healthcare providers and settings, found at: http://www.cdc.gov/tb/publications/guidelines/infectioncontrol.htm
2. Develop an infection control program focusing on:
   a. Assignment of responsibility for the program
   b. Risk assessment and classification, available at: http://www.cdc.gov/tb/publications/guidelines/AppendixB_092706.pdf
   c. Persons who need baseline testing, including TB screening and counseling
   d. Education and training
   e. Case management (if direct patient care is provided)
3. Designation of a staff person to guide facilities that may need to set up TB infection control programs.

For roles and responsibilities, refer to Chapter 1, *Introduction*, section "Roles, Responsibilities, and Contact Information", pages 1.14 – 1.20.

State Laws and Regulations

Nevada Administrative Code addresses state mandated infection control measures for Correctional Facilities, Medical Facilities, and Facilities for the dependent or individual residential care.

For Nevada Administrative Code details see NAC 441A.370 – 441A.380, found at: https://www.leg.state.nv.us/NAC/NAC-441A.html

Hierarchy of Infection Control Measures

There are three types of infection control measures. The first are administrative controls, which are primarily aimed at early identification, isolation, and appropriate treatment of infectious patients. The second are environmental controls, which focus on preventing the spread and reducing the concentration of infectious droplet nuclei in the air.[7] The third is personal respiratory protection, which provide additional protection for healthcare workers in high-risk settings such as isolation rooms and cough-inducing or aerosol-generating suites.

The activities described below are more relevant to infection control in healthcare or residential facilities. Home settings are discussed separately in the "Residential Settings" topic in this section.

Administrative Controls

Administrative controls are the first level of infection control measures designed to reduce the risk of tuberculosis (TB) transmission. They include a variety of activities to identify, isolate, and appropriately treat persons suspected of having TB disease.

An effective TB infection control plan contains measures for reducing the spread of TB that are appropriate to the risk of a particular setting.[8] Every healthcare setting should have a TB infection control plan that is part of an overall infection control program.[9] A written TB infection control plan helps to ensure: prompt detection, timely airborne precautions implementation, and treatment of persons who have suspected or confirmed TB disease.[10]

- **In TB infection control programs for settings in which patients with suspected or confirmed TB disease are expected to be encountered,** develop a written TB infection control plan that outlines a protocol for the prompt recognition and initiation of airborne precautions for persons with suspected or confirmed TB disease and review/update it annually.[11]
- **In TB infection control programs for settings in which patients with suspected or confirmed TB disease are NOT expected to be encountered,** develop a written TB infection control plan that outlines a protocol for the prompt recognition and transfer of persons who have suspected or confirmed TB disease to another healthcare setting. The plan should indicate procedures to follow to separate persons with suspected or confirmed infectious TB disease from other persons in the setting until the time of transfer. Evaluate the plan annually, to ensure that the setting remains one in which persons who have suspected or confirmed TB disease are not typically encountered, and that they are promptly transferred when identified.[12]

Administrative Activities[13]

Key activities to reduce the risk of transmission include the following:

1. **Assign responsibility** to a specific person for designing, implementing, evaluating, and maintaining a TB infection control program for that facility.
2. **Conduct a risk assessment.** The risk level of a particular facility will affect the extent of all other activities and will result in each facility having a different plan.
3. **Develop, implement, and enforce policies and procedures** to ensure early identification, evaluation, and treatment of infectious cases of TB.
4. **Provide prompt triage** and management in the outpatient setting of patients who may have infectious TB.
5. **Initiate promptly and maintain TB isolation** for persons who may have infectious TB and are admitted to an inpatient setting.
6. **Plan effectively for the discharge** of the patient, coordinating between the local public health agency and the healthcare provider.
7. **Implement environmental controls.** Develop, install, maintain, and evaluate the effectiveness of engineering controls.
8. **Implement a respiratory protection program.** Develop, initiate, install, maintain, and evaluate the effectiveness of the respiratory protection program.
9. **Implement precautions for cough-inducing procedures.** Develop, implement, and enforce policies and procedures to ensure adequate precautions when performing cough-inducing procedures.
10. **Educate and train healthcare workers** about TB.
11. **Counsel and screen healthcare workers.** Develop and implement counseling and screening program for healthcare workers about TB disease and latent TB infection (LTBI).
12. **Evaluate possible episodes of TB transmission promptly.**
13. **Coordinate activities** between the state and local public healthcare agencies.

Environmental Controls

TB is caused by an organism called *Mycobacterium tuberculosis.* When a person with infectious TB disease coughs or sneezes, tiny particles called droplet nuclei that contain *M. tuberculosis* are expelled into the air.[14] Environmental controls are used to prevent the spread and reduce the concentration of infectious droplet nuclei.[15] Each facility should use different combinations of environmental controls, based on the results of its risk assessment.

It is important to note, however, that without strong, appropriate administrative controls, environmental controls are ineffective because cases may not be recognized promptly or managed appropriately.

Table 1 describes the three main types of environmental controls.

Table 1: THREE TYPES OF ENVIRONMENTAL CONTROLS

Most Effective Control	**Ventilation** ▪ Controls direction of air flow to prevent contamination of air in areas surrounding a person with infectious tuberculosis (TB) ▪ Dilutes and removes contaminated air ▪ Exhausts contaminated air to the outside
Supplementary Controls	**High-efficiency particulate air (HEPA) filtration** ▪ Cleans the air of infectious droplet nuclei **Ultraviolet germicidal irradiation (UVGI)** ▪ Kills or inactivates TB bacilli in the air

Personal Respiratory Protection

Although administrative controls and environmental controls are most effective in controlling the spread of TB, they do not eliminate the risk of transmission entirely. Personal respiratory protection, the third level of infection control, is also used in high-risk settings.

The purpose of a respirator is to reduce exposure by filtering out TB bacilli from the room air before the air is breathed into a person's lungs. Respirators used for TB control should be approved for TB use by the National Institute for Occupational Safety and Health (NIOSH).

It is recommended that healthcare provider staff and visitors use personal respiratory protective equipment in settings that may have a high risk for TB transmission, such as the following:

- Rooms where infectious TB patients are being isolated
- Areas where cough-inducing or aerosol-generating procedures are performed
- Other areas, which should be identified in the facility's risk assessment, where administrative and environmental controls are not likely to protect persons from inhaling infectious droplet nuclei

It is important to note that the precise level of effectiveness (of respiratory protection) in protecting healthcare workers from *M. tuberculosis* transmission in healthcare settings has not been determined.[16]

Surgical-type masks are to be used by persons who are infectious or are being evaluated for TB disease when they are out of TB respiratory isolation. The purpose of the mask is to reduce transmission by reducing the number of TB bacilli coughed out into the room air. The infectious patient should not wear a respirator. For more information, see Table 2: **Using Masks and Respirators.**

When TB respirators are used, a respiratory protection program should be developed and enforced.[1,17] For more information on respiratory protection programs, see the Centers for Disease Control and Prevention's (CDC's) "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005" (*MMWR* 2005;54[No. RR-17]:75–79) available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm?s_cid=rr5417a1_e

CDC guidelines recommend that healthcare facilities conduct annual training regarding multiple topics for healthcare workers (HCWs), including the nature, extent, and hazards of TB disease in the healthcare setting. Training can be conducted in conjunction with other related training regarding infectious disease associated with airborne, as well as, bloodborne transmission.

In addition, training topics should include the following:

1. Risk assessment process and its relation regarding the use of personal protective equipment (PPE), including signs and symbols used to indicate that PPE is required in certain areas, which PPE are required for those areas (airborne vs. contact isolation) and the reasons for using PPE.
2. Environmental controls used to prevent the spread and reduce the concentration of infectious droplet nuclei.
3. Selection of a particular respirator for a given hazard (See "Selection of Respirators" on p. 78 of the CDC guidelines, http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf).

Trainees should be provided opportunities to handle and wear a respirator until they become proficient. Trainees should also be provided with copies or summaries of lecture materials for use as references and instructions to refer all respirator problems immediately to the respiratory program administrator.[18]

4. Operation, capabilities, and limitations of personal protective equipment (PPE).
5. Cautions regarding facial hair and respirator use.
6. Occupational Health and Safety Administration (OSHA) regulations regarding personal protective equipment (PPE), including assessment of employees' knowledge.

A **fit test** is used to determine which respirator fits the user adequately and to ensure that the user can don and knows how to use the respirator properly. Periodic fit testing for respirators used in TB environments can serve as an effective training tool in conjunction with the content included in employee training and retraining.[19]

The CDC recommends that, after a risk assessment to validate the need for respiratory protection, a healthcare facility should perform fit testing during the initial respiratory protection program training and periodically thereafter in accordance with federal, state, and local regulations.[20] The frequency of periodic fit testing should be determined by the occurrence of 1) risk for transmission of *M. tuberculosis,* 2) changes in facial features of the wearer, 3) medical condition that would affect respiratory function, 4) physical characteristics of respirator, or 5) model or size of the assigned respirator.[21]

OSHA has addressed TB in their general respiratory protection requirements, and includes the need for the following:

- Respiratory protection program
- Amended medical evaluation
- Training and recordkeeping
- Annual fit testing
- Fit checking

For regulations in your area, refer to state and local regulations and contact your local OSHA office. A directory of OSHA offices in Nevada may be found at http://www.osha.gov/dcsp/osp/stateprogs/nevada.html.[22]

Who Should Use a Mask or Respirator?

Using masks and respirators properly can reduce transmission of *Mycobacterium tuberculosis* and exposure to TB. Refer to Table 2: **Using Masks and Respirators** to determine when to use masks and respirators.

Table 2: USING MASKS AND RESPIRATORS[23]

Mask (a regular "surgical" mask*)	Respirator (NIOSH-approved, N-95 or higher*)
Purpose To reduce transmission by capturing infectious droplet nuclei that an infectious patient releases before they get into the air.	**Purpose** To reduce exposure by filtering infectious droplet nuclei out of the air, before the wearer breathes the air into their lungs.
Who should wear a mask? ▪ Patients with or suspected to have infectious TB	**Who should wear a respirator?** ▪ Staff working with persons with or suspected to have infectious TB ▪ Visitors to TB isolation rooms (keep these visitors to a minimum)
A patient should wear a mask in a hospital setting when: ▪ Suspected of having infectious TB and not yet placed in respiratory isolation ▪ Leaving a respiratory isolation room for any reason **Note:** Infectious patients should NOT wear masks when in their TB isolation rooms. **In a health clinic setting when:** ▪ Not in a TB isolation room ▪ Returning to the clinic for evaluation	**A staff person or visitor should wear a respirator in a hospital or clinic setting when:** ▪ Entering a TB isolation room ▪ Performing cough-inducing or aerosol-generating procedures ▪ Unlikely to be protected by administrative or environmental controls
A patient should wear a mask in a transportation setting when: ▪ Traveling in a vehicle with other persons	**A staff person or visitor should wear a respirator in some transportation settings when:** ▪ Riding in a vehicle with a patient with infectious TB
In the patient's home: ▪ Infectious patients do NOT need to wear a mask while they are in their homes. ***Note:** There should NOT be any visitors (excluding protected healthcare workers) to the home until the patient is released from TB isolation.	**A staff person or visitor* should wear a respirator in a patient's home when:** ▪ Visiting the infectious patient inside a home/residence ***Note:** There should NOT be any visitors (excluding protected healthcare workers) to the home until the patient is released from TB isolation.
Definition of abbreviations: NIOSH = National Institute for Occupational Safety and Health; TB = tuberculosis. * There are some devices, such as the 3M 1860, which are both N95 respirators and surgical masks.	

Source: CDC. Guidelines for preventing the transmission *of Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):38–40.

Tuberculosis Infection Control in Patient Care Facilities

Patients with suspected tuberculosis (TB) may present for care in many different settings. The Centers for Disease Control and Prevention (CDC) has written a comprehensive set of guidelines for TB infection control in acute care hospitals and other medical settings.[24] Which is available at:
Ihttp://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm?s_cid=rr5417a1_e

The main goals in establishing a TB infection control program at a patient care facility is to:

1. Assign responsibility for managing the program to a designated staff position;
2. Perform and establish a TB risk assessment for the facility; and
3. Develop the TB infection control plan based on the level of TB risk identified in the assessment.

The main purpose for having an effective TB infection control plan in a facility is to assure that the activities necessary for TB control are addressed and that policies and procedures are developed to protect the healthcare workers, other patients, and visitors in the facility.

Table 3: Guidelines for Tuberculosis Infection Control lists references that provide the information needed to conduct a TB risk assessment and write a TB infection control plan that establishes policies and procedures for TB control activities for inpatient care facilities.

Call the TB Control Department at the local health district or the Nevada DPBH TB Program if you have any questions when consulting with institutions on infection control measures. (see table 4, page 2.15, for contact information)

Table 3: GUIDELINES FOR TUBERCULOSIS INFECTION CONTROL

Guidelines for Tuberculosis Infection Control
The following settings are addressed in the "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Facilities, 2005" (MMWR 2005;54[No. RR-17]) at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm?s_cid=rr5417a1_e Some settings have additional guidelines as noted below. **Inpatient Settings** ▪ Emergency departments and urgent care settings ▪ Intensive care units ▪ Surgical suits ▪ Laboratories ▪ Bronchoscopy suites ▪ Sputum induction and inhalation therapy rooms ▪ Autopsy suites and embalming rooms **Outpatient Settings** ▪ Tuberculosis (TB) treatment facilities ▪ Medical settings in correctional facilities: Prevention and Control of Tuberculosis in Correctional Facilities. (ACET) (*MMWR* 1996;45[No. RR-8]) at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5509a1.htm ▪ Medical offices and ambulatory care settings ▪ Dialysis units **Nontraditional Facility-Based Settings** ▪ Homeless shelter clinics: Prevention and Control of Tuberculosis Among Homeless Persons (ACET) (*MMWR* 1992;41[No. RR-5]) at http://www.cdc.gov/mmwr/preview/mmwrhtml/00019922.htm ▪ Emergency medical services ▪ Home-based healthcare and outreach settings ▪ Long-term care facilities (e.g., hospices, skilled nursing facilities): Prevention and Control of Tuberculosis in Facilities Providing Long-Term Care to the Elderly (*MMWR* 1990;39[No. RR-10]) at http://www.cdc.gov/mmwr/preview/mmwrhtml/00001711.htm

Isolation

The most effective means of reducing disease transmission of TB is to isolate or restrict activities of patients with, or suspected to have, infectious TB.

Isolation: Isolation separates people who have a specific illness from healthy people and restricts their movement in order to stop the spread of that illness. Isolation allows for the focused delivery of specialized healthcare to people who are ill, and it protects healthy people from becoming infected. People in isolation may be cared for in their homes, in hospitals, or at designated healthcare facilities. Isolation is a standard procedure used in hospitals today for patients with TB and certain other infectious diseases. In most cases, isolation occurs voluntarily; however, many levels of government (federal, state, and local) have the basic legal authority to compel isolation of those who have infectious TB in order to protect the public.[25]

Restricted Activities: Until determined to be noninfectious, the patient is not permitted to return to work, school, or any social setting (such as stores, restaurants, or church) where the patient could expose individuals to airborne bacteria.

An exclusion letter may be provided, detailing the isolation requirement period. When isolation is no longer required, the patient may be provided with a clearance letter (see the Forms section, Chapter 17, for an example.) To maintain confidentiality, exclusion and clearance letters do not identify TB as the reason for isolation.

Quarantine: Although TB control programs have used the word “quarantine” interchangeably with “isolation” and “restricted activities,” the word “quarantine” properly used is not a term applicable to TB control. Quarantine applies to people who have been exposed and may be infected but are not yet ill. Separating exposed people and restricting their movements is intended to stop the spread of illness. Quarantine is not an appropriate TB control measure for asymptomatic, exposed individuals. [26]

For information on diagnosis and laboratory tests, refer to Chapter 3, *Diagnosis of Tuberculosis Disease*, and Chapter 5, *Diagnosis of Latent Tuberculosis Infection.*

For information on guidelines for infection control in the patient’s residence, group settings, and during the transportation of a patient, see the subtopics that follow in this chapter, section “Residential Settings,” pages 2.21 – 2.24.

Estimating Infectiousness

In general, patients who have suspected or confirmed TB disease and who are not on antituberculosis treatment should be considered infectious if characteristics include the following:

- Presence of cough
- Cavitation on chest radiograph
- Positive acid-fast bacilli (AFB) sputum smear result
- Respiratory tract disease with involvement of the lung or airways, including larynx
- Failure to cover the mouth and nose when coughing
- Undergoing cough-inducing or aerosol-generating procedures (e.g., sputum induction, bronchoscopy, airway suction) [27]

If a patient with one or more of these characteristics is on standard multidrug therapy with documented clinical improvement, usually in connection with smear conversion over several weeks, the risk of infectiousness is reduced.[28]

A negative reaction to the tuberculin skin test does not exclude the diagnosis of TB, especially for persons with severe TB illness, infection with HIV, or other immunocompromised condition(s).

Determining Noninfectiousness

Use the following criteria as general guidelines to determine when during therapy a patient with pulmonary TB disease has become noninfectious. Decisions about infectivity of a person on treatment for TB should depend on the extent of illness and the specific nature and circumstances of the contact between the patient and exposed persons. These guidelines can and should be modified on a case-by-case basis by a qualified public health officer or health provider.

- Patient has negligible likelihood of multidrug-resistant TB (no known exposure to multidrug-resistant tuberculosis and no history of prior episodes of TB with poor compliance during treatment).
- Patient has received standard multidrug antituberculosis therapy for at least two weeks.
- Patient has demonstrated complete adherence to treatment (e.g., is receiving directly observed therapy).
- Patient has demonstrated evidence of clinical improvement (e.g., reduction in the frequency of cough or reduction of the grade of the AFB sputum smear result).

- All close contacts of the patient have been identified, evaluated, advised, and, if indicated, started on treatment for latent TB infection. This criterion is critical, especially for children younger than 5 years of age and persons of any age with immunocompromising health conditions such as human immunodeficiency virus (HIV) infection.
- While hospitalized for any reason, patients with pulmonary TB should remain in airborne infection isolation until they:
  - Are receiving standard multidrug antituberculosis therapy;
  - Have demonstrated clinical improvement and,
  - Have had three consecutive AFB-negative smear results of sputum specimens collected 24 hours apart, with at least one being an early morning specimen.

Hospitalized patients returning to a congregate setting (e.g., a homeless shelter or detention facility) should have three consecutive AFB-negative smear results of sputum specimens collected 24 hours apart before being considered noninfectious.[29]

Airborne Infection Isolation in a Healthcare Facility

In airborne infection isolation (AII), the patient is placed in an AII room, usually within a hospital or healthcare facility. The main characteristics of an AII room (for new or renovated buildings) are that it has negative air pressure relative to the hall and 12 or more air exchanges per hour, of which at least two exchanges are outside air. For existing structures, six or more air exchanges per hour are acceptable.[30]

The decisions to initiate and discontinue isolation should be made in consultation with the Infection Control Officer or Designee, or the TB Control Department at the local health agency or the State TB Control Officer. Isolation decisions should be made on a case-by-case basis.

Table 4: TB CONTROL CONTACT INFORMATION

County or Service Area	Contact
Clark County	Southern Nevada Health District TB Prevention and Control Program 702-759-1369
Washoe County	Washoe County Health District TB Prevention and Control Program 775-785-4785
Carson City, Douglas and Lyon Counties	Carson City Health and Human Services 775-887-2190
Churchill, Elko, Esmeralda, Eureka, Humboldt, Lander, Lincoln, Mineral, Nye, Pershing, Storey, and White Pine Counties	Frontier and Rural Public Health Program See complete list, Chapter 1, *Introduction*, "Regional Contact Information", pages 1.20 -1.21.
Nevada Division of Public and Behavioral Health TB Program	Nevada Division of Public and Behavioral Health, TB Program Coordinator 775-684-5936
Nevada Administrative Code (NAC) and Nevada Revised Statutes (NRS) Assistance	Division of Public and Behavioral Health, Bureau of Health Care Quality and Compliance 775-687-4475

When to Initiate Airborne Infection Isolation (AII)

Suspected cases of laryngeal or pulmonary TB should be isolated immediately, before AFB sputum smear results are available.

Initiate TB airborne infection isolation (AII) precautions for any patient who meets the criteria in Table 5.

Table 5: INITIATION OF AIRBORNE INFECTION ISOLATION[31]

Criteria for Initiation of Airborne Infection Isolation		
The patient has signs or symptoms of pulmonary, laryngeal, or multidrug-resistant tuberculosis (MDR-TB) disease	**OR**	▪ The patient has documented infectious pulmonary, laryngeal tuberculosis (TB) disease or MDR-TB disease **AND** ▪ The patient has not started or completed at least two weeks of treatment

Source: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):16, 44.

Patients with suspected or confirmed MDR-TB should remain in an airborne infection isolation (AII) room throughout their hospitalization or until *culture conversion* is documented, regardless of sputum smear results.

When to Discontinue Airborne Infection Isolation

Prior to discontinuing isolation, call the local health agency or consult with the infection control officer. High-risk patients should be carefully evaluated before discontinuing isolation. Hospitalized patients with suspected or confirmed MDR-TB should remain in an AII room throughout their hospitalization or until *culture conversion* is documented, regardless of sputum smear results.

Suspected Tuberculosis Disease

For patients placed in AII due to suspected infectious TB disease of the lungs, airway, or larynx, aII can be discontinued when the criteria in Table 6 are met.

Table 6: DISCONTINUATION OF AIRBORNE INFECTION ISOLATION OF SUSPECTED CASES OF TUBERCULOSIS[32]

Criteria for Discontinuing Airborne Infection Isolation: Suspected Case of Tuberculosis of the Lungs, Airway, or Larynx		
Infectious tuberculosis (TB) disease is considered unlikely	**AND**	**Either** ▪ Another diagnosis is made that explains the clinical syndrome **OR** ▪ The patient has 3 negative acid-fast bacilli (AFB) sputum smear results* has been on treatment delivered as directly observed therapy, and has demonstrated clinical improvement

* Each of the 3 sputum specimens should be collected 8 to 24 hours apart, and at least 1 should be an early morning specimen (because respiratory secretions pool overnight). Generally, this will allow patients with negative AFB sputum smear results to be released from AII in 2 days.[33]

NOTE: Nevada Administrative Code requires specimens to be collected on 3 separate days.

While hospitalized for any reason, patients with pulmonary TB should remain in airborne infection isolation until they (1) are receiving standard multidrug antituberculosis therapy; (2) have demonstrated clinical improvement; and (3) have had 3 consecutive AFB-negative smear results of sputum specimens collected 8 to 24 hours apart, with at least 1 being an early morning specimen.[34] NOTE: Nevada Administrative Code requires specimens to be collected on 3 separate days.

Because patients with TB disease who have negative AFB sputum smear results can still be infectious, patients with suspected disease who meet the above criteria for release from AII should not be released to an area where other patients with immunocompromising conditions or children <5 years are housed.[35]

Sources: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):16, 43; ATS, CDC. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9

Confirmed Tuberculosis Disease

A patient with drug-susceptible TB of the lung, airway, or larynx who is on standard multidrug antituberculosis treatment and who has had a significant clinical and bacteriologic response to therapy (e.g., reduction in cough, resolution of fever, and progressively decreasing quantities of AFB on smear results) is probably no longer infectious. However, because culture and drug susceptibility results may not be known when the decision to discontinue AII is made, all patients with confirmed TB disease should remain in AII while hospitalized until all the criteria in Table 7 are met.[36]

Table 7: DISCONTINUATION OF AIRBORNE INFECTION ISOLATION OF CONFIRMED CASES OF TUBERCULOSIS[37]

Criteria for Discontinuing Airborne Infection Isolation: Hospitalized Patients with Confirmed Tuberculosis of the Lungs, Airway, or Larynx
▪ The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 24 hours apart, with at least 1 being an early morning specimen **AND** ▪ The patient has received standard multidrug antituberculosis treatment by directly observed therapy (DOT) **AND** ▪ The patient has demonstrated clinical improvement

Source: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):43.

Hospital Discharge

The decisions to discharge an AFB sputum smear-positive patient or an MDR-TB patient should be made in consultation with the Local Health District TB Control Program. (For contact information, refer to table 4, page 2.15)

Drug-Susceptible Tuberculosis Disease

If a hospitalized patient who has suspected or confirmed drug-susceptible TB disease is deemed medically stable (including patients with positive AFB sputum smear results indicating pulmonary TB disease), the patient can be discharged from the hospital before converting AFB sputum smear results to negative if **all** the criteria in Table 8 are met.[38]

Table 8: HOSPITAL DISCHARGE OF DRUG-SUSCEPTIBLE CASES OF TUBERCULOSIS[39]

Criteria for Hospital Discharge to Home: Patients with Suspected or Confirmed Drug-Susceptible Tuberculosis
▪ A specific plan exists for follow-up care with the local TB control program (the patient has confirmed outpatient appointment). **AND** ▪ The patient has been started on a standard multidrug antituberculosis treatment regimen and directly observed therapy (DOT) has been arranged **AND** ▪ No children aged <5 years or persons with immunocompromising conditions are present in the household **AND** ▪ All immunocompetent household members have been previously exposed to the patient **AND** ▪ The patient is willing to not travel outside the home except for healthcare-associated visits until the patient has the required negative acid-fast bacilli (AFB) sputum smear results

Source: CDC. Guidelines for preventing the transmission *of Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):43–44.

Prior to hospital discharge, a copy of the patient's medical records needs to be provided to the local TB Control Program to whom that the patient was referred. Required documentation includes: the medication record, laboratory and microbiology reports, diagnostic test results including chest x-ray and CT scan reports, and the physicians' orders. All patient demographics should be included with the patient's records.

Patients who are moving to or spending greater than one month in Mexico while on TB treatment need to be referred to CURE-TB. CURE-TB is a US/Mexico Bi-national referral system operated by the San Diego County TB Control Program. The primary priority of CURE-TB is to improve continuity of care for patients moving between Mexico and the United States during their treatment. This will enable completion of treatment, decrease transmission, and prevent the development of drug-resistant TB.

Contact one of the CURE-TB staff by faxing a completed CURE-TB referral form to (619) 692-8020 or call (619) 542-4015, (619) 542-4011

For more information and to obtain CURE-TB referral forms go to Cure TB Referral Program page at:
https://www.sandiegocounty.gov/hhsa/programs/phs/cure_tb/

Multi-Drug Resistant Tuberculosis Disease

The consequences of transmission of MDR TB are severe, some infection control practitioners may choose to keep persons with suspected or confirmed MDR TB disease under airborne precautions during the entire hospitalization or until culture conversion is documented, regardless of sputum smear results. The role of drug resistance in transmission is complex, due to prolonged infectiousness as a result of delays in diagnosis and initiation of an effective drug regimen. [40]

See California Tuberculosis Controller's Association Algorithm for additional guidance:
https://ctca.org/filelibrary/Appendix-3_Algorithm_for_MDR-TB_Cases.pdf

Release Settings

Patients with suspected or confirmed infectious TB disease should not be released to healthcare settings or homes where the patient can expose others who are at high risk for progressing to TB disease if infected, such as HIV-infected persons or young children under 5 years.[41] Hospitalized patients returning to a congregate setting (e.g., a homeless shelter or detention facility) should have three consecutive AFB-negative smear results of sputum specimens collected 24 hours apart before being considered noninfectious.[42]

Patients who have positive AFB sputum smear results should **not** be directly discharged from the hospital to **any** of the following living environments:

- Congregate living site (e.g., shelter, nursing home, jail, prison, group home, another hospital)
- Living situation where infants and young children under 5 years also reside
- Living situation where immunosuppressed persons (e.g., HIV-infected persons or those taking cancer chemotherapy) also reside
- Living situation where home health aides or other social service providers will be present in the home for several hours a day to care for the person or family member

Residential Settings

Patients suspected of having infectious TB either are diagnosed during an outpatient workup, or if admitted to a hospital, are often sent home after starting treatment. Patients are sent home, even though they may still be infectious, because they are most likely to transmit TB to household members **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 until the patient becomes noninfectious.[43,44]

Administrative Controls in the Patient's Home

Have a policy and procedure for managing infectious patients at home. To standardize care, the following information should be included:

1. **Definition of key terms:** Infectious person and noninfectious person
2. **Treatment of persons at home whenever possible:** Treat patients at home if their condition does not otherwise require hospitalization.
3. **Window period treatment policy:** Ensure that candidates for window period treatment[†] in the home have completed their evaluation and are on medication before the patient is discharged home (or as soon as possible if they were not hospitalized).
4. **Education:** Educate infectious patients, family, care providers, and close contacts regarding the purpose of isolation, their responsibility to adhere to the isolation requirements, and the consequences of not voluntarily complying with isolation.
5. **Home isolation agreements:** Have infectious persons in isolation sign a home isolation agreement. This document should include any legal consequences should they fail to voluntarily comply.

Refer to the example "Home Isolation Agreement" in the Forms section, Chapter 17.

Environmental Controls in the Patient's Home

Generally, there are no special engineering recommendations. However, patients and their families can be advised to do the following:

- Have tissues available for patients to cover their mouths and noses when coughing or sneezing.

[†] High-risk contacts (young children under 5 years, HIV positive person or someone with another immunocompromised condition) are placed on preventive treatment as soon as they are identified as a contact to a person with infectious TB. They continue to receive treatment until infection has been ruled out (the window period) or if diagnosed with LTBI until an adequate course of treatment has been completed. The "window period" is considered 8-10 weeks after the last exposure.

- Keep windows and doors open (weather permitting) to increase the ventilation and dilution of infectious droplet nuclei in the house.
- Open curtains during the day to maximize sunlight in the home (sunlight kills TB bacteria).
- If a sputum sample needs to be collected at home, do so in a well-ventilated area away from other residents (e.g., bathroom with an exhaust fan). If possible, collect the sputum in an outdoor area away from open windows or doors.

Respiratory Protection in the Patient's Home

Patient: Mask

- Patients do not need to wear masks at home.
- Do not give patients respirators (N-95 or higher).
- Give patients regular surgical-type masks and advise them to wear them at medical appointments until they are no longer infectious.

For more information on the criteria for noninfectiousness, see the "Determining Noninfectiousness" topic in this chapter, page 2.13. Also see table 2: Using Masks and Respirators, page 2.9.

Healthcare Worker: Respirator

- Healthcare workers should wear respirators (N-95 or higher) when entering the home or a closed area to visit with infectious patients.
- The respirators should be National Institute for Occupational Safety and Health (NIOSH)-approved (N-95 or higher).
- Healthcare workers should be provided with respirators after appropriate education and fit testing.

Other Residential Settings

Motels

Homeless persons with infectious TB may be housed in a motel that has outside access to rooms (not via hallways).

The motel manager must be advised of the following:

1. The patient is in respiratory isolation.
2. The manager should report to local public health agency staff if the manager becomes aware that the patient does not stay in the room and/or has guests.

3. The manager should advise motel staff that they are not to enter the room while the patient resides at the motel. (Arrangements should be made that once a week, the patient sets out linens that need to be replaced. The staff can knock on the door and leave the linens for the patient to make his or her own bed.)
4. Upon release from isolation, the room should be aired out for one day before staff enters to clean. Afterwards, routine cleaning done between guests is sufficient, and there are no additional special cleaning requirements.
5. Local public health agency staff will be delivering medication to the patient (specify the frequency).
6. Arrangements will have to be made for food delivery to the patient.

Healthcare Facilities or Residential Settings

1. Patients with infectious TB should be in appropriate respiratory isolation (airborne infection isolation rooms) when housed in healthcare facilities or residential settings.
2. If a facility does not have the capability to provide appropriate respiratory isolation, the patient should be transferred to a facility that can accommodate respiratory isolation until the patient is noninfectious. Once noninfectious, the person may return to the original facility.

Return to Work, School, or Other Social Settings

The decision of when to allow a patient to return to work, school, or other social settings should be made in accordance with the CDC guidelines, Nevada law, and in consultation with the Local Health District TB Control Department in the jurisdiction that the patient resides or the Division of Public and Behavioral Health TB Control Program.

The decision to permit a patient to return to work, school, or other social settings is based on the following:

- The characteristics of the patient with TB disease (e.g., whether the patient is likely to adhere to the regimen and follow treatment instructions)
- The characteristics of the TB disease itself (e.g., multidrug-resistant versus drug-susceptible TB, AFB sputum smear-positive versus smear-negative, cavitary versus noncavitary)
- The duration of current treatment (e.g., the patient has received standard multidrug antituberculosis therapy for two-to-three weeks or, if the patient AFB sputum smear that are negative or rarely positive, the threshold for treatment is four-to-seven days)[45]
- The patient is responding to therapy, decreased cough, improved appetite, increasing weight, etc.
- The environment(s) to which the patient will be returning

Consultation is available through the TB Control Programs at the local health Districts or the Nevada DPBH TB Program. (see table 4, p.2.15, for contact information)

Drug-Susceptible Tuberculosis Disease

Patients with drug-susceptible TB are no longer considered infectious if they meet all the criteria in Table 10.

Table 10: RETURN TO WORK, SCHOOL, AND OTHER SETTINGS OF DRUG-SUSCEPTIBLE CASES OF TUBERCULOSIS[46]

Criteria for Return to Work, School, or Other Social Settings: Patients with Suspected or Confirmed Drug-Susceptible Tuberculosis
▪ The patient is on adequate therapy **AND** ▪ The patient has had a significant clinical response to therapy **AND** ▪ The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 24 hours apart, with at least 1 being an early morning specimen

Source: CDC. Infectiousness. *Core Curriculum on Tuberculosis (2000)* November 2001.

Multidrug-Resistant Tuberculosis (MDR-TB) Disease

Regardless of their occupation, patients known or likely to have pulmonary MDR-TB may be considered for return to work or school only if they meet at a minimum **all** four of the criteria in Table 11.

Table 11: RETURN TO WORK, SCHOOL, AND OTHER SETTINGS OF MULTIDRUG-RESISTANT CASES OF TUBERCULOSIS

Criteria for Return to Work, School, or Other Social Settings: Patients with Suspected or Confirmed Multidrug-Resistant TB
▪ The resolution of fever and the resolution, or near resolution, of cough has occurred **AND** ▪ The patient is on current treatment with an antituberculosis regimen to which the strain is known or likely to be susceptible* **AND** ▪ The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 24 hours apart, with at least 1 being an early morning specimen **AND** ▪ The patient has had a negative culture for *Mycobacterium tuberculosis*

*Additional requirements may be necessary depending on the severity of disease and the patient's resistance pattern and response to therapy.

See California Tuberculosis Controller's Association Algorithm for additional guidance: https://ctca.org/filelibrary/Appendix-3_Algorithm_for_MDR-TB_Cases.pdf

Transportation Vehicles

To prevent the transmission of *M. tuberculosis* while transporting patients, follow the respiratory precautions identified below.

Patient -Transport

1. The car windows should be opened, and any recirculating air controls should be turned off. If weather requires the use of the heater or air conditioner, the back windows should be opened slightly (one-two inches).
2. If possible, only household members should accompany the patient. Any members of the patient's household who accompany the patient do not need to, but should consider wearing an N95 disposable respirator.
3. If the only source for transport is a friend or relative who is not a member of the patient's household:
   a. The person accompanying the patient should wear a respirator (N95) to wear during transport (due to the confined space and lack of ongoing exposure).
   b. The patient should sit in the back seat and wear a surgical mask.
   c. The car windows should be opened, and any recirculating air controls should be turned off.
   d. The heater or air conditioner may be run, vent by slightly opening the rear windows one – two inches.

Transport by Healthcare Workers

1. Healthcare workers should wear respiratory protection (N95) while in the vehicle.
2. The patient should wear a surgical mask and sit in the back seat.
3. The car windows should be opened, and any recirculating air controls should be turned off. [47]
   a. The heater or air conditioner may be run, vent by slightly opening the rear windows.

Transport by Emergency Medical Services

Emergency medical services staff have specialized vehicles that may have the ability to separate the driver's compartment from the transport compartment and rear exhaust fans. Recommendations for these vehicles and staff are addressed in the Centers for Disease Control and Prevention (CDC) "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Facilities, 2005" (*MMWR* 2005;54[No. RR-17]:25–26, 88, 127) at http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf .

Resources

- CDC. "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings, 2005" (*MMWR* 2005;54[No. RR-17]) at http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf
- CDC. "Guidelines for Environmental Infection Control in Health-Care Facilities" (*MMWR* 2003;52[No. RR-10]) at http://www.cdc.gov/mmwr/PDF/rr/rr5210.pdf
- CDC. *Interactive Core Curriculum on Tuberculosis* at http://www.cdc.gov/tb/webcourses/corecurr/index.htm
- CDC. "Respiratory Protection in Health-Care Settings" (*TB Elimination Fact Sheet* April 2006) at http://www.cdc.gov/tb/pubs/tbfactsheets/rphcs.htm
- CDC. Module 4: "Treatment of TB Infection and Disease" (*Self-Study Modules on Tuberculosis 1999*) at https://www.cdc.gov/tb/education/ssmodules/default.htm
- CDC. Module 5: "Infectiousness and Infection Control" (*Self-Study Modules on Tuberculosis 1999*) at https://www.cdc.gov/tb/education/ssmodules/default.htm
- NIOSH. "Respiratory Protection" [Web page] at https://www.cdc.gov/niosh/topics/respirators/default.html
- OSHA. "Tuberculosis: OSHA Standards" [Web page] at http://www.osha.gov/SLTC/tuberculosis/standards.html

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