

Chapter XI: Infection Control

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A. Infectiousness

Infectiousness is directly related to the number of tubercle bacilli expelled into the air. In general, persons who have or who are suspected of having pulmonary, pleural, or laryngeal TB should be considered infectious until evaluated. Factors associated with a high degree of infectiousness are:

- Sputa smears containing acid-fast bacilli (AFB)
- Coughing or undergoing cough-inducing or aerosol-generating procedures (e.g., sputum induction, bronchoscopy, airway suction)
- Cavitation on chest x-ray.

Infectiousness begins to decrease within days of the initiation of effective multi-drug therapy. The duration of infectiousness will depend on the severity of disease and may persist for several weeks or months.

In patients with known or suspected MDR TB, the response to treatment is less predictable and measures of infectiousness should be closely monitored. For those patients in institutional settings, TB isolation should be maintained until infectiousness is ruled out. Continued isolation should be considered for patients with MDR TB because these patients are more likely to experience treatment failure or relapse, which may prolong infectiousness.

Persons with extra-pulmonary TB are usually not infectious. However, TB may be transmitted from a draining skin or tissue abscess containing *M. tuberculosis*. Pleural TB is classified as extra-pulmonary but patients with pleural TB may have positive sputa cultures and, in rare situations, may have positive AFB smears. Patients with pleural TB should be considered infectious until evaluated or placed on treatment for TB.

B. Infection Control Measures

Infection control measures are fundamental to reducing the spread of tuberculosis. Transmission of TB from person to person can occur in many locations, such as home, work, school, and healthcare facilities. It is impossible to prevent all exposure, but the goal of an infection control plan is to reduce the risk of transmission by using measures that are appropriate to a specific setting. There are three types of infection control measures: administrative controls, environmental controls, and personal respiratory protection. None of these controls can be fully implemented without detection of infectious TB cases.

1. Administrative Controls

Administrative control measures are the first of three levels of control designed to reduce the risk of TB transmission. They are primarily aimed at early identification, isolation, and appropriate treatment of infectious patients.

a. Triage

The public health nurse who takes the telephone referral should communicate to the clerical staff that precautions should be taken before a patient suspected of having infectious TB arrives. All other individuals entering the public health setting for diagnostic evaluation or clinical services should be quickly assessed for infectious TB if no information is provided beforehand stating they are possibly infectious. The clinic staff should:

- Evaluate the patient for coughing as soon as he or she enters the clinic.
- Ask patients with a cough to wear a surgical mask.
- Determine if referral information has been called in to the clinic (e.g., lab test results, chest x-ray results done prior to coming to referral, symptoms). If any of the referral information causes concern, the staff should put the patient into an empty room away from other patients. A nurse should be consulted with any questions.
- Determine if the patient has had previous treatment for TB. Patients who have been incompletely treated for TB should be suspected of having infectious TB disease pending the clinical evaluation. Infection control measures should be used even if the patient does not exhibit symptoms.

All patients identified as likely to be infectious must be seen as quickly as possible.

b. Surgical masks for patients

In the public health clinic, any patient who is coughing, or has been identified as likely infectious by history, TBdb, or reported symptoms, (regardless of cough), should be provided with a surgical mask and instructed to wear it while in the waiting room. Front desk clerical staff should explain the reason for wearing the mask at the time it is given to the patient. To reduce the patient's discomfort, every effort must be made to limit the amount of time a patient is required to spend in the waiting room while wearing a mask. Patients may be isolated in an empty treatment room while they wait for a nurse so that they do not need to wear a mask while waiting. Patients who cannot tolerate a mask should be provided with tissues and instructed to cover their mouth when coughing. All staff must keep a supply of tissues readily available in their work areas. Staff should encourage patients to wash their hands after coughing. Signs instructing anyone who is coughing to cover his or her mouth should be prominently displayed in all clinic areas.

When transporting patients, outreach workers should have the infectious patient wear a surgical mask and sit in the back seat of the vehicle with windows cracked and **recirculating air control, if available, should be turned OFF.**

c. TB skin testing program for clinic staff

All Public health setting staff will have a two-step tuberculin skin test (TST) or IGRA when hired. If the staff member's TST/IGRA is negative, he or she should be routinely screened with a repeat TST/IGRA every 12 months. Those who were previously TST/IGRA positive should have a chest x-ray at the time of hire (unless they have a film available that is less than 1 year old). They should have a yearly symptom screen and a repeat chest x-ray only if symptoms develop. Any clinic staff member who converts to a positive TST result must be evaluated promptly.

2. Environmental Controls

Environmental controls are meant to reduce the concentration and prevent the spread of infectious droplet nuclei in the air. The three types of environmental controls include:

- Ventilation, which controls air flow to prevent contamination of air in areas surrounding a person with infectious TB, and dilutes and removes contaminated air and exhausts it to the outside.
- High-efficiency particulate air (HEPA) filtration, which cleans the air of infectious droplet nuclei.
- Ultraviolet (UV) germicidal irradiation, which kills or inactivates TB bacilli in the air.

a. Sputa collection (induction booth and in offices)

The sputa induction booth should have negative air pressure relative to the rest of the public health setting.

b. Transporting patients

Car windows should be open as much as weather conditions allow and the **recirculating air control should be turned OFF.**

3. Personal Respiratory Protection

Although administrative and environmental controls are most effective in preventing the spread of TB, they do not eliminate the risk of transmission entirely. Personal respiratory protection may provide additional protection for public health setting staff in high-risk settings. These settings include the patient's home, in a vehicle while transporting a patient when windows can't be opened, or when collecting sputa samples in the clinic setting. The purpose of a respirator (e.g., respirator type Technol PFR95, N95) is to reduce exposure by filtering out TB bacilli from the room air before the air is breathed into the person's lungs. Respirators used for TB control should be approved by the

National Institute for Occupational Safety and Health (NIOSH).

http://www.cdc.gov/niosh/nppt/topics/respirators/disp_part/RespSource.html

a. Fit Testing

A fit test is used to determine which respirator fits the user adequately and to ensure that the user knows when the respirator is on and fitting properly. A fit test should be done when a staff member initially begins working in the public health setting and then again periodically. The frequency of periodic fit testing depends on changes in facial features of the wearer, medical conditions that would affect respiratory function, and the physical characteristics, model, and size of the respirator. A well-fitting respirator is especially important for staff at highest risk for infection because they are transporting patients and doing home visits.

b. In the public health clinic setting

Nurses and physicians attending the patient in the consulting room may or may not choose to wear respiratory protection while the patient is present in the room, but they should consider the following factors:

- If the patient is wearing a surgical mask, and will continue to wear the mask during the consultation, the risk of TB transmission is reduced.
- If the patient is believed to be highly infectious because of his or her history or symptoms, or if the patient is believed to have drug-resistant TB, the risk and consequences of TB transmission is higher.

c. In patient homes

Outreach workers visiting infectious patients in their homes should wear a respirator in the home as long as the individual is considered infectious.

C. State of Colorado TB Statutes and Regulations

State and local health departments have primary responsibility for preventing and controlling TB. To meet this challenge successfully, sections 25-4-503, 506, and 507, Colorado Revised Statutes, allow for the isolation of patients with known or suspected infectious TB who pose a risk to public health. The following is a brief summary of the statutes.

The Chief Medical Health Officer is directed to use every available means to investigate immediately and ascertain sources of known or suspected cases of TB in the infectious stage within his or her jurisdiction.

The Chief Medical Health Officer may issue an order requiring the medical examination of known or suspected cases of TB, regardless of the person's religious denomination or

beliefs, by a licensed physician of the examinee's choice under such terms and conditions as the health officer shall specify.

The Chief Medical Health Officer determines when an isolation order is necessary and shall make an isolation order, in writing, that includes: name of patient to be isolated, initial period of time for isolation (not to exceed six months), place of isolation, and other such terms and conditions that may be necessary to protect the public health.

The patient under an isolation order shall be examined at the time the order expires or at any other time the patient so requests, to ascertain whether or not the individual continues to be infectious.

When it has been medically determined that the patient's disease is no longer infectious or communicable, the patient shall be relieved from all further liability or duty imposed by this statute. State and local medical health officers who are licensed physicians have authority to enact the activities described above.

D. Isolation

To reduce disease transmission, a patient with tuberculosis disease may need to be isolated or have their activities restricted.

Isolation: Isolation is used when a patient is ill and infectious. Isolation of patients who have a specific illness separates them from healthy people and restricts their movement to stop the spread of that illness. Patients in isolation may be cared for in their homes, in hospitals, or at designated health care facilities. Isolation is a standard procedure used in hospitals today for patients with TB and certain other infectious diseases. In most cases, isolation is voluntary; however, federal, state, and local governments have the basic legal authority to compel isolation of sick patients to protect the public. Until determined to be noninfectious, the patient is not permitted to return to work, school, or any social setting where he or she expose other people to airborne bacteria.

Quarantine: Although TB control programs have used the word "quarantine" interchangeably with "isolation", the word quarantine, when properly used, is not a term applicable to TB control. Quarantine is the restriction of movement of people known or suspected to have been in contact with infectious persons and who may become ill and infectious in the future. Quarantine is not an appropriate TB control measure for exposed individuals who are asymptomatic.

1. Estimating Infectiousness

Factors to be considered when evaluating the degree of infectiousness of a patient with suspected or confirmed TB include:

- Acid-fast bacilli (AFB) sputa smear results
- Infiltrates, particularly with cavitation, on chest x-ray

- Involvement of the lung, pleura, or upper airway including larynx
- Symptoms, particularly the frequency and severity of cough
- Failure to cover the mouth and nose when coughing
- Whether the patient is receiving effective treatment and the length of time they have been on therapy.

2. Considerations for Discontinuing Isolation

The discontinuation of isolation and restriction from a patient's daily activities is determined by their risk to the public health (high, moderate, or minimal– see table that follows) and depends on the following factors: how infectious they are considered to be; the risk of transmission within the setting, and the risk that their contacts will develop active TB disease if infected. These three components might be described as follows:

- The characteristics of TB disease itself (e.g., MDR vs. drug-susceptible TB, AFB smear-positive vs. smear-negative, cavitory vs. noncavitory)
- 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 home or work environment to which the patient will be returning (e.g., a small, poorly ventilated apartment with many housemates vs. a large home with only a healthy, adult spouse)
- The immune status of contacts at home, work, or other social settings (e.g., working in neonatal ICU vs. an office building; having a healthy adult housemate vs. an infant or immunocompromised household member).

Once isolation is discontinued, it should be documented that the patient has been notified either in writing or orally that they may return to all activities of daily living without restrictions. Patients must also be advised that the discontinuation of isolation is dependent on their completing anti-TB drug therapy.

| High Public Health Risk | |
|--|---|
| Applies to a patient who has: | Isolation and activity restriction may be lifted when the patient has: |
| <p>An abnormal chest x-ray consistent with TB, particularly if it includes cavitation, <u>and</u> has:</p> <ol style="list-style-type: none"> 1. AFB-positive sputa smears with culture pending, <u>or</u> 2. Culture positive with a high possibility of drug resistant TB disease, 3. <u>And</u> who also meet one of the following criteria: <ul style="list-style-type: none"> ▪ Live or work in a high-risk, congregate setting such as a health care facility, long-term care or correctional care facility, or a homeless shelter. ▪ Are hospitalized ▪ Live or work with infants, young children, or individuals who are immunocompromised. | <ol style="list-style-type: none"> 1. Received directly observed therapy and completed at least 15 daily doses of TB treatment with an appropriate regimen to which the strain is known or likely to be susceptible; <u>and</u> 2. Shown a significant clinical response to treatment (decrease in cough, weight gain, increased appetite, resolution of fever, etc.); <u>and</u> 3. Three consecutive negative AFB smears from sputa specimens on different days, or <p>Tuberculosis has been excluded as the cause of their signs and symptoms.</p> |
| Moderate Public Health Risk | |
| <p>An abnormal chest x-ray consistent with TB and to whom all of the following apply:</p> <ol style="list-style-type: none"> 1. AFB-positive sputum smear (culture positive or pending) 2. Symptomatic, but take precautions to cover their cough 3. At low risk of drug resistance 4. Do not work, live in or attend any of the high-risk settings listed above. | <ol style="list-style-type: none"> 1. Been on adequate treatment for 15 daily doses of TB treatment (10 doses may be considered in special circumstances), <u>and</u> 2. Shown a significant clinical response to treatment (decrease in cough, weight gain, increased appetite, etc.), <u>and</u> 3. At least one negative smear or evidence that the number of AFB on consecutive sputum smears taken on different days is consistently decreasing (e.g., 3+ to rare over 2 weeks). |
| Minimal Public Health Risk | |
| <p>An abnormal chest x-ray consistent with TB and to whom all of the following apply:</p> <ol style="list-style-type: none"> 1. Minimal chest x-ray abnormalities 2. Sputum smear negative (cultures pending) 3. Symptomatic but take precautions to cover their cough 4. At low risk of drug resistance 5. Does not work, live in or attend any of the high-risk settings listed above. | <ol style="list-style-type: none"> 1. Been on adequate treatment for a minimum of 10 doses of TB treatment (5 doses may be considered in special circumstances), <u>and</u> 2. Shown a clinical response to treatment (decrease in cough, weight gain, increased appetite, etc.). |

Note: After 2 to 3 months of treatment, some patients with pulmonary TB and initially positive smears and cultures may continue to excrete what are believed to be dead mycobacterium. Sputum from these patients may be consistently AFB smear-

positive and AFB culture-negative. Patients should have monthly sputum smears and cultures to document persistence of negative cultures and, ultimately, negative smears.

3. Specific Issues in Certain Settings

a. Home

Patients suspected of having infectious TB are diagnosed during an outpatient workup or, after admission to a hospital, are often sent home after starting treatment. Patients are sent home, even though they may still be infectious, because they are more likely to have transmitted TB to household members before TB was diagnosed and treatment 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. The following should be clearly conveyed to all patients regardless of the type of residential setting in which they are living:

- Have tissues available to cover their mouth when coughing or sneezing.
- Keep windows and doors open (weather permitting) to increase ventilation and the dilution of TB germs in the house.
- If a sputum sample is required 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 outdoors, away from open windows and doors.
- Patients do not need to wear masks at home but masks may be recommended or patients may choose to wear them when in close contact with family members.
- Until no longer infectious, patients should not sleep in the same room as children under 5 years of age.

b. Motels

Homeless patients with infectious TB may be housed in a motel that has outside access to rooms (not via hallways). The motel manager must be advised that:

- The patient is in respiratory isolation and should not have visitors.
- The manager should report to public health staff if he or she is aware that the patient does not stay in the room or has visitors in his/her room.
- After the patient checks-out of the motel, the routine cleaning done between guests is sufficient, and that no additional special cleaning is required.
- Public health staff will deliver medication to the patient (specify the frequency).

- Depending on the patient’s public health risk, the patient may eat meals or arrangements may be made by public health staff for food delivery to the patient.

If housing is needed for the patient, please contact the CDPHE TB Program for assistance.

c. Long-term care facilities/homeless shelters

Patients with infectious TB should be in appropriate respiratory isolation (negative air pressure rooms) when housed in any long-term care facility. 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.

d. Locked correctional facility

Incarcerated patients who are thought to be infectious may be kept in a locked correctional facility in a negative air pressure cell. If there is no appropriate cell available, the patient should be transported to one with a negative air rooms. Contact CDPHE for assistance in locating an appropriate negative pressure room.

 See Section E.2. Isolation Civil Arrest Warrant, in this chapter.

Isolation must be maintained until confirmation that the patient is no longer infectious. If it has been documented that a patient has been non-compliant with isolation, legal action may be undertaken to protect the public.

 See Section E.2. Isolation Civil Arrest Warrant, in this chapter.

e. Isolation in a hospital or other health facility

In most cases, TB can be treated entirely in an outpatient setting. However, some patients have at least part of their treatment in the hospital under airborne infection isolation (AII). Any patient admitted to the hospital and suspected of having AFB smear-positive pulmonary, pleural, or laryngeal TB should initially be placed in an AII room as defined by the Center for Disease Control (CDC) guidelines.

 See Guidelines for preventing the transmission of mycobacterium tuberculosis in health-care settings, 2005 *MMWR*. 2005;54 (No. RR-17, 1-141).

If possible, patients suspected of, or known to have, multi-drug-resistant TB (MDR TB) should remain in an isolation room throughout their hospitalization.

Patients with pan-susceptible TB (TB susceptible to all first-line anti-TB medications) who are hospitalized for reasons unrelated to TB should be isolated until their infectiousness has been assessed.

f. Discharge from hospital

There is no minimum number of days of anti-TB treatment required before a patient may be discharged from the hospital. Patients may be discharged from the hospital and restricted from activities based on their public health risk (See table in section D.2. of this chapter)

g. Patients who should not be discharged from hospital

A patient who is AFB sputum smear-positive should not be directly discharged from the hospital to any of the following:

- A congregate living site (e.g., shelter, nursing home, jail, group home, another hospital).
- A living situation with infants or young children who have not been previously exposed to the case, or have not been evaluated and treated.
- A living situation with immunocompromised persons (e.g., HIV-infected persons, persons receiving cancer chemotherapy) who have not been previously exposed to the case, or have not been evaluated and treated.
- A 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, until these workers have been instructed on the necessary precautions.

h. Patients known or likely to have MDR TB

Regardless of their occupation, patients with known or suspected MDR pulmonary, pleural, or laryngeal TB may be considered for return to work or school only if they meet all of the following criteria:

- The resolution of fever and cough
- Current treatment with an anti-TB drug regimen to which the strain is known or likely to be susceptible
- Two consecutive negative AFB smears from sputa specimens taken on different days
- At least one sputum culture for *M. tuberculosis* that is without growth in liquid medium after a minimum of one month.

i. Patients who work in a health care or day care facility

Patients who work in a health care facility or day care center should not return to work until their drug susceptibility results are available and other conditions for lifting isolation have been met

E. Isolation Order Procedures

In order for the local public health clinic to carry out its legal responsibility of controlling tuberculosis in Colorado, it may be necessary to isolate a patient. Please contact CDPHE’s TB Program before proceeding. There are different health orders that may be served. These include:

1. Order for Patient to Submit to Medical Examination

Colorado Statutes : TITLE 25 HEALTH : DISEASE CONTROL : ARTICLE 4 DISEASE CONTROL : PART 5 TUBERCULOSIS : 25-4-507. Isolation order.

(1) Whenever a medical health officer determines on reasonable grounds that an examination of any person is necessary for the preservation and protection of the public health, the health officer shall issue a written order directing medical examination, setting forth the name of the person to be examined, the time and place of the examination, and such other terms and conditions as the health officer may deem necessary. A copy of such order shall be served upon the person. Such an examination may be made by a licensed physician of the person’s own choice under such terms and conditions as the health officer shall specify.

(2) Upon the receipt of information that any examination or isolation order made and served as provided in this part 5, has been violated, the medical health officer shall advise the district attorney of the pertinent facts relating to the violation.

(3) In a case of a patient with multidrug-resistant tuberculosis, the medical health officer may issue an isolation order to such patient if it is determined that the patient has ceased taking prescribed medications against medical advice. Such order may be issued even if the patient is no longer infectious so long as the patient has not completed an entire course of therapy.

Source: L. 67: RE&RE, p. 725, § 1. C.R.S. 1963: § 66-12-7. L. 2002: (3) added, p. 1314, § 3, effective August 7.

2. Isolation Order

When a health officer determines that isolation of a person in a particular TB case is necessary for the preservation and protection of the public health, the health officer shall

make an isolation order in writing. When a health officer is determining whether to issue an isolation order for a person, the health officer shall consider, but is not limited to following factors:

-whether the person has active TB

- If the person is violating the rules promulgated by the Board of Health or the orders issued by the appropriate health officer to comply with rules or orders

-whether the person presents a substantial risk of exposing other persons to an imminent danger of infection.

All isolation orders shall set forth the name of the person to be isolated and the initial period, not to exceed six months, during which the order shall remain effective, the place of isolation and any other terms and conditions as may be necessary to protect the public health. The isolation letter must be served directly to the person. The letter must be read to the person being isolated and the requirements of the letter must be explained in the patient's native language. This may involve having an interpreter along. Contact CDPHE's TB Program for assistance with this process.

Isolation letters serve primarily to inform the patient and to document that they have been informed of their legal responsibility to undergo clinical evaluation, isolation, and treatment for TB. The letter also serves to inform them of the local and state Public Health Departments' legal responsibility to prevent the spread of infectious tuberculosis, usually by curing the patient's tuberculosis.

If a person has been informed of the need to adhere to treatment, been given an isolation letter, and all other attempts at maintaining adherence have been documented to have failed (e.g. home visits to locations convenient for the patient, bus tokens, etc.) , then a civil arrest warrant may be issued. Often just mentioning the possibility of a civil arrest warrant is sufficient to gain the compliance of a person with TB.

Once a person is no longer considered infectious, they will be notified in writing by the nurse case manager that they are no longer on isolation precautions.

3. Isolation Civil Arrest Warrant (Misdemeanor Charge)

If a patient with active tuberculosis remains uncooperative and cannot be located, then a civil arrest warrant may be initiated by the Director of the public health setting, or his or her designee. The City Attorney must obtain the order through a judge. This order is then enforceable by the police. CDPHE will assist with this process if needed.

References

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