

TB disease who were treated or examined at the setting should be reviewed to identify possible problems in TB infection control. The review should be based on the factors listed on the TB Risk Assessment Worksheet (Appendix B).

- Time interval from suspicion of TB until initiation of airborne precautions and antituberculosis treatment.
 - suspicion of TB disease and patient triage to proper AII room or referral center for settings that do not provide care for patients with suspected or confirmed TB disease;
 - admission until TB disease was suspected;
 - admission until medical evaluation for TB disease was performed;
 - admission until specimens for AFB smears and polymerase chain reaction (PCR)-based nucleic acid amplification (NAA) tests for *M. tuberculosis* were ordered;
 - admission until specimens for mycobacterial culture were ordered;
 - ordering of AFB smears, NAA tests, and mycobacterial culture until specimens were collected;
 - collection of specimens until performance and AFB smear results were reported;
 - collection of specimens until performance and culture results were reported;
 - collection of specimens until species identification was reported;
 - collection of specimens until drug-susceptibility test results were reported;
 - admission until airborne precautions were initiated; and
 - admission until antituberculosis treatment was initiated.
- Duration of airborne precautions.
- Measurement of meeting criteria for discontinuing airborne precautions. Certain patients might be correctly discharged from an AII room to home.
- Patient history of previous admission.
- Adequacy of antituberculosis treatment regimens.
- Adequacy of procedures for collection of follow-up sputum specimens.
- Adequacy of discharge planning.
- Number of visits to outpatient setting from the start of symptoms until TB disease was suspected (for outpatient settings).

Work practices related to airborne precautions should be observed to determine if employers are enforcing all practices, if HCWs are adhering to infection-control policies, and if patient adherence to airborne precautions is being enforced. Data from the case reviews and observations in the annual risk assessment should be used to determine the need to modify 1) protocols for identifying and initiating prompt airborne

precautions for patients with suspected or confirmed infectious TB disease, 2) protocols for patient management, 3) laboratory procedures, or 4) TB training and education programs for HCWs.

Environmental Assessment

- Data from the most recent environmental evaluation should be reviewed to determine if recommended environmental controls are in place (see Suggested Components of an Initial TB Training and Education Program for HCWs).
- Environmental control maintenance procedures and logs should not be reviewed to determine if maintenance is conducted properly and regularly.
- Environmental control design specifications should be compared with guidelines from the American Institute of Architects (AIA) and other ventilation guidelines (117,118) (see Risk Classification Examples) and the installed system performance.
- Environmental data should be used to assist building managers and engineers in evaluating the performance of the installed system.
- The number and types of aerosol-generating or aerosol-producing procedures (e.g., specimen processing and manipulation, bronchoscopy, sputum induction, and administration of aerosolized medications) performed in the setting should be assessed.
- The number of AII rooms should be suitable for the setting based on AIA Guidelines and the setting risk assessment. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has adapted the AIA guidelines when accrediting facilities (118).

Suggested Components of an Initial TB Training and Education Program for HCWs

The following are suggested components of an initial TB training and education program:

1. Clinical Information

- Basic concepts of *M. tuberculosis* transmission, pathogenesis, and diagnosis, including the difference between LTBI and TB disease and the possibility of reinfection after previous infection with *M. tuberculosis* or TB disease.
- Symptoms and signs of TB disease and the importance of a high index of suspicion for patients or HCWs with these symptoms.
- Indications for initiation of airborne precautions of inpatients with suspected or confirmed TB disease.
- Policies and indications for discontinuing airborne precautions.

- Principles of treatment for LTBI and for TB disease (indications, use, effectiveness, and potential adverse effects).

2. Epidemiology of TB

- Epidemiology of TB in the local community, the United States, and worldwide.
- Risk factors for TB disease.

3. Infection-Control Practices to Prevent and Detect

M. tuberculosis Transmission in Health-Care Settings

- Overview of the TB infection-control program.
- Potential for occupational exposure to infectious TB disease in health-care settings.
- Principles and practices of infection control to reduce the risk for transmission of *M. tuberculosis*, including the hierarchy of TB infection-control measures, written policies and procedures, monitoring, and control measures for HCWs at increased risk for exposure to *M. tuberculosis*.
- Rationale for infection-control measures and documentation evaluating the effect of these measures in reducing occupational TB risk exposure and *M. tuberculosis* transmission.
- Reasons for testing for *M. tuberculosis* infection, importance of a positive test result for *M. tuberculosis* infection, importance of participation in a TB screening program, and importance of retaining documentation of previous test result for *M. tuberculosis* infection, chest radiograph results, and treatment for LTBI and TB disease.
- Efficacy and safety of BCG vaccination and principles of screening for *M. tuberculosis* infection and interpretation in BCG recipients.
- Procedures for investigating an *M. tuberculosis* infection test conversion or TB disease occurring in the workplace.
- Joint responsibility of HCWs and employers to ensure prompt medical evaluation after *M. tuberculosis* test conversion or development of symptoms or signs of TB disease in HCWs.
- Role of HCW in preventing transmission of *M. tuberculosis*.
- Responsibility of HCWs to promptly report a diagnosis of TB disease to the setting's administration and infection-control program.
- Responsibility of clinicians and the infection-control program to report to the state or local health department a suspected case of TB disease in a patient (including autopsy findings) or HCW.
- Responsibilities and policies of the setting, the local health department, and the state health department to ensure confidentiality for HCWs with TB disease or LTBI.

- Responsibility of the setting to inform EMS staff who transported a patient with suspected or confirmed TB disease.
- Responsibilities and policies of the setting to ensure that an HCW with TB disease is noninfectious before returning to duty.
- Importance of completing therapy for LTBI or TB disease to protect the HCW's health and to reduce the risk to others.
- Proper implementation and monitoring of environmental controls (see Environmental Controls).
- Training for safe collection, management, and disposal of clinical specimens.
- Required Occupational Safety and Health Administration (OSHA) record keeping on HCW test conversions for *M. tuberculosis* infection.
- Record-keeping and surveillance of TB cases among patients in the setting.
- Proper use of (see Respiratory Protection) and the need to inform the infection-control program of factors that might affect the efficacy of respiratory protection as required by OSHA.
- Success of adherence to infection-control practices in decreasing the risk for transmission of *M. tuberculosis* in health-care settings.

4. TB and Immunocompromising Conditions

- Relationship between infection with *M. tuberculosis* and medical conditions and treatments that can lead to impaired immunity.
- Available tests and counseling and referrals for persons with HIV infection, diabetes, and other immunocompromising conditions associated with an increased risk for progression to TB disease.
- Procedures for informing employee health or infection-control personnel of medical conditions associated with immunosuppression.
- Policies on voluntary work reassignment options for immunocompromised HCWs.
- Applicable confidentiality safeguards of the health-care setting, locality, and state.

5. TB and Public Health

- Role of the local and state health department's TB-control program in screening for LTBI and TB disease, providing treatment, conducting contact investigations and outbreak investigations, and providing education, counseling, and responses to public inquiries.
- Roles of CDC and of OSHA.

- Availability of information, advice, and counseling from community sources, including universities, local experts, and hotlines.
- Responsibility of the setting's clinicians and infection-control program to promptly report to the state or local health department a case of suspected TB disease or a cluster of TST or BAMT conversions.
- Responsibility of the setting's clinicians and infection-control program to promptly report to the state or local health department a person with suspected or confirmed TB disease who leaves the setting against medical advice.

Managing Patients Who Have Suspected or Confirmed TB Disease: General Recommendations

The primary TB risk to HCWs is the undiagnosed or unsuspected patient with infectious TB disease. A high index of suspicion for TB disease and rapid implementation of precautions are essential to prevent and interrupt transmission. Specific precautions will vary depending on the setting.

Prompt Triage

Within health-care settings, protocols should be implemented and enforced to promptly identify, separate from others, and either transfer or manage persons who have suspected or confirmed infectious TB disease. When patients' medical histories are taken, all patients should be routinely asked about 1) a history of TB exposure, infection, or disease; 2) symptoms or signs of TB disease; and 3) medical conditions that increase their risk for TB disease (see Supplements, Diagnostic Procedures for LTBI and TB Disease; and Treatment Procedures for LTBI and TB Disease). The medical evaluation should include an interview conducted in the patient's primary language, with the assistance of a qualified medical interpreter, if necessary. HCWs who are the first point of contact should be trained to ask questions that will facilitate detection of persons who have suspected or confirmed infectious TB disease. For assistance with language interpretation, contact the local and state health department. Interpretation resources are also available (119) at <http://www.atanet.org>; <http://www.languageline.com>; and <http://www.ncihc.org>.

A diagnosis of respiratory TB disease should be considered for any patient with symptoms or signs of infection in the lung, pleura, or airways (including larynx), including coughing for >3 weeks, loss of appetite, unexplained weight loss, night sweats, bloody sputum or hemoptysis, hoarseness, fever, fatigue, or chest pain. The index of suspicion for TB disease will vary by geographic area and will depend on the popula-

tion served by the setting. The index of suspicion should be substantially high for geographic areas and groups of patients characterized by high TB incidence (26).

Special steps should be taken in settings other than TB clinics. Patients with symptoms suggestive of undiagnosed or inadequately treated TB disease should be promptly referred so that they can receive a medical evaluation. These patients should not be kept in the setting any longer than required to arrange a referral or transfer to an AII room. While in the setting, symptomatic patients should wear a surgical or procedure mask, if possible, and should be instructed to observe strict respiratory hygiene and cough etiquette procedures (see Glossary) (120–122).

Immunocompromised persons, including those who are HIV-infected, with infectious TB disease should be physically separated from other persons to protect both themselves and others. To avoid exposing HIV-infected or otherwise severely immunocompromised persons to *M. tuberculosis*, consider location and scheduling issues to avoid exposure.

TB Airborne Precautions

Within health-care settings, TB airborne precautions should be initiated for any patient who has symptoms or signs of TB disease, or who has documented infectious TB disease and has not completed antituberculosis treatment. For patients placed in AII rooms because of suspected infectious TB disease of the lungs, airway, or larynx, airborne precautions may be discontinued when infectious TB disease is considered unlikely and either 1) another diagnosis is made that explains the clinical syndrome or 2) the patient has three consecutive, negative AFB sputum smear results (109–112,123). Each of the three sputum specimens should be collected in 8–24-hour intervals (124), and at least one specimen should be an early morning specimen because respiratory secretions pool overnight. Generally, this method will allow patients with negative sputum smear results to be released from airborne precautions in 2 days.

The classification of the risk assessment of the health-care setting is used to determine how many AII rooms each setting needs, depending on the number of TB patients examined. At least one AII room is needed for settings in which TB patients stay while they are being treated, and additional AII rooms might be needed depending on the magnitude of patient-days of persons with suspected or confirmed TB disease (118). Additional rooms might be considered if options are limited for transferring patients with suspected or confirmed TB disease to other settings with AII rooms. For example, for a hospital with 120 beds, a minimum of one AII room is needed, possibly more, depending on how many TB patients are examined in 1 year.