

in the setting until the time of transfer. Evaluate the plan annually, if possible, to ensure that the setting remains one in which persons who have suspected or confirmed TB disease are not encountered and that they are promptly transferred.

3. Conduct a problem evaluation (see Problem Evaluation) if a case of suspected or confirmed TB disease is not promptly recognized, separated from others, and transferred.
4. Perform an investigation in collaboration with the local or state health department if health-care–associated transmission of *M. tuberculosis* is suspected.
5. Collaborate with the local or state health department to develop administrative controls consisting of the risk assessment and the written TB infection-control plan.

TB Risk Assessment

Every health-care setting should conduct initial and ongoing evaluations of the risk for transmission of *M. tuberculosis*, regardless of whether or not patients with suspected or confirmed TB disease are expected to be encountered in the setting. The TB risk assessment determines the types of administrative, environmental, and respiratory-protection controls needed for a setting and serves as an ongoing evaluation tool of the quality of TB infection control and for the identification of needed improvements in infection-control measures. Part of the risk assessment is similar to a program review that is conducted by the local TB-control program (42). The TB Risk Assessment Worksheet (Appendix B) can be used as a guide for conducting a risk assessment. This worksheet frequently does not specify values for acceptable performance indicators because of the lack of scientific data.

TB Risk Assessment for Settings in Which Patients with Suspected or Confirmed TB Disease Are Expected To Be Encountered

The initial and ongoing risk assessment for these settings should consist of the following steps:

1. Review the community profile of TB disease in collaboration with the state or local health department.
2. Consult the local or state TB-control program to obtain epidemiologic surveillance data necessary to conduct a TB risk assessment for the health-care setting.
3. Review the number of patients with suspected or confirmed TB disease who have been encountered in the setting during at least the previous 5 years.
4. Determine if persons with unrecognized TB disease have been admitted to or were encountered in the setting during the previous 5 years.

5. Determine which HCWs need to be included in a TB screening program and the frequency of screening (based on risk classification) (Appendix C).
6. Ensure the prompt recognition and evaluation of suspected episodes of health-care–associated transmission of *M. tuberculosis*.
7. Identify areas in the setting with an increased risk for health-care–associated transmission of *M. tuberculosis*, and target them for improved TB infection controls.
8. Assess the number of AII rooms needed for the setting. The risk classification for the setting should help to make this determination, 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 cases of suspected or confirmed TB disease. Additional AII rooms might be considered if options are limited for transferring patients with suspected or confirmed TB disease to other settings with AII rooms.
9. Determine the types of environmental controls needed other than AII rooms (see TB Airborne Precautions).
10. Determine which HCWs need to be included in the respiratory-protection program.
11. Conduct periodic reassessments (annually, if possible) to ensure
 - proper implementation of the TB infection-control plan,
 - prompt detection and evaluation of suspected TB cases,
 - prompt initiation of airborne precautions of suspected infectious TB cases,
 - recommended medical management of patients with suspected or confirmed TB disease (31),
 - functional environmental controls,
 - implementation of the respiratory-protection program, and
 - ongoing HCW training and education regarding TB.
12. Recognize and correct lapses in infection control.

TB Risk Assessment for Settings in Which Patients with Suspected or Confirmed TB Disease Are Not Expected To Be Encountered

The initial and ongoing risk assessment for these settings should consist of the following steps:

1. Review the community profile of TB disease in collaboration with the local or state health department.
2. Consult the local or state TB-control program to obtain epidemiologic surveillance data necessary to conduct a TB risk assessment for the health-care setting.
3. Determine if persons with unrecognized TB disease were encountered in the setting during the previous 5 years.

4. Determine if any HCWs need to be included in the TB screening program.
5. Determine the types of environmental controls that are currently in place, and determine if any are needed in the setting (see Environmental Controls; Appendices A and D).
6. Document procedures that ensure the prompt recognition and evaluation of suspected episodes of health-care-associated transmission of *M. tuberculosis*.
7. Conduct periodic reassessments (annually, if possible) to ensure 1) proper implementation of the TB infection-control plan; 2) prompt detection and evaluation of suspected TB cases; 3) prompt initiation of airborne precautions of suspected infectious TB cases before transfer; 4) prompt transfer of suspected infectious TB cases; 5) proper functioning of environmental controls, as applicable; and 6) ongoing TB training and education for HCWs.
8. Recognize and correct lapses in infection control.

Use of Risk Classification to Determine Need for TB Screening and Frequency of Screening HCWs

Risk classification should be used as part of the risk assessment to determine the need for a TB screening program for HCWs and the frequency of screening (Appendix C). A risk classification usually should be determined for the entire setting. However, in certain settings (e.g., health-care organizations that encompass multiple sites or types of services), specific areas defined by geography, functional units, patient population, job type, or location within the setting might have separate risk classifications. Examples of assigning risk classifications have been provided (see Risk Classification Examples).

TB Screening Risk Classifications

The three TB screening risk classifications are low risk, medium risk, and potential ongoing transmission. The classification of low risk should be applied to settings in which persons with TB disease are not expected to be encountered, and, therefore, exposure to *M. tuberculosis* is unlikely. This classification should also be applied to HCWs who will never be exposed to persons with TB disease or to clinical specimens that might contain *M. tuberculosis*.

The classification of medium risk should be applied to settings in which the risk assessment has determined that HCWs will or will possibly be exposed to persons with TB disease or to clinical specimens that might contain *M. tuberculosis*.

The classification of potential ongoing transmission should be temporarily applied to any setting (or group of HCWs) if

evidence suggestive of person-to-person (e.g., patient-to-patient, patient-to-HCW, HCW-to-patient, or HCW-to-HCW) transmission of *M. tuberculosis* has occurred in the setting during the preceding year. Evidence of person-to-person transmission of *M. tuberculosis* includes 1) clusters of TST or BAMT conversions, 2) HCW with confirmed TB disease, 3) increased rates of TST or BAMT conversions, 4) unrecognized TB disease in patients or HCWs, or 5) recognition of an identical strain of *M. tuberculosis* in patients or HCWs with TB disease identified by deoxyribonucleic acid (DNA) fingerprinting.

If uncertainty exists regarding whether to classify a setting as low risk or medium risk, the setting typically should be classified as medium risk.

TB Screening Procedures for Settings (or HCWs) Classified as Low Risk

- All HCWs should receive baseline TB screening upon hire, using two-step TST or a single BAMT to test for infection with *M. tuberculosis*.
- After baseline testing for infection with *M. tuberculosis*, additional TB screening is not necessary unless an exposure to *M. tuberculosis* occurs.
- HCWs with a baseline positive or newly positive test result for *M. tuberculosis* infection (i.e., TST or BAMT) or documentation of treatment for LTBI or TB disease should receive one chest radiograph result to exclude TB disease (or an interpretable copy within a reasonable time frame, such as 6 months). Repeat radiographs are not needed unless symptoms or signs of TB disease develop or unless recommended by a clinician (39,116).

TB Screening Procedures for Settings (or HCWs) Classified as Medium Risk

- All HCWs should receive baseline TB screening upon hire, using two-step TST or a single BAMT to test for infection with *M. tuberculosis*.
- After baseline testing for infection with *M. tuberculosis*, HCWs should receive TB screening annually (i.e., symptom screen for all HCWs and testing for infection with *M. tuberculosis* for HCWs with baseline negative test results).
- HCWs with a baseline positive or newly positive test result for *M. tuberculosis* infection or documentation of previous treatment for LTBI or TB disease should receive one chest radiograph result to exclude TB disease. Instead of participating in serial testing, HCWs should receive a symptom screen annually. This screen should be accomplished by educating the HCW about symptoms of TB disease and instructing the HCW to report any such symptoms immediately to the occupational health unit. Treat-

ment for LTBI should be considered in accordance with CDC guidelines (39).

TB Screening Procedures for Settings (or HCWs) Classified as Potential Ongoing Transmission

- Testing for infection with *M. tuberculosis* might need to be performed every 8–10 weeks until lapses in infection control have been corrected, and no additional evidence of ongoing transmission is apparent.
- The classification of potential ongoing transmission should be used as a temporary classification only. It warrants immediate investigation and corrective steps. After a determination that ongoing transmission has ceased, the setting should be reclassified as medium risk. Maintaining the classification of medium risk for at least 1 year is recommended.

Settings Adopting BAMT for Use in TB Screening

Settings that use TST as part of TB screening and want to adopt BAMT can do so directly (without any overlapping TST) or in conjunction with a period of evaluation (e.g., 1 or 2 years) during which time both TST and BAMT are used. Baseline testing for BAMT would be established as a single step test. As with the TST, BAMT results should be recorded in detail. The details should include date of blood draw, result in specific units, and the laboratory interpretation (positive, negative, or indeterminate—and the concentration of cytokine measured, for example, interferon-gamma [IFN- γ]).

Risk Classification Examples

Inpatient Settings with More Than 200 Beds

If less than six TB patients for the preceding year, classify as low risk. If greater than or equal to six TB patients for the preceding year, classify as medium risk.

Inpatient Settings with Less Than 200 Beds

If less than three TB patients for the preceding year, classify as low risk. If greater than or equal to three TB patients for the preceding year, classify as medium risk.

Outpatient, Outreach, and Home-Based Health-Care Settings

If less than three TB patients for the preceding year, classify as low risk. If greater than or equal to three TB patients for the preceding year, classify as medium risk.

Hypothetical Risk Classification Examples

The following hypothetical situations illustrate how assessment data are used to assign a risk classification. The risk classifications

are for settings in which patients with suspected or confirmed infectious TB disease are expected to be encountered.

Example A. The setting is a 150-bed hospital located in a small city. During the preceding year, the hospital admitted two patients with a diagnosis of TB disease. One was admitted directly to an AII room, and one stayed on a medical ward for 2 days before being placed in an AII room. A contact investigation of exposed HCWs by hospital infection-control personnel in consultation with the state or local health department did not identify any health-care–associated transmission-. Risk classification: low risk.

Example B. The setting is an ambulatory-care site in which a TB clinic is held 2 days per week. During the preceding year, care was delivered to six patients with TB disease and approximately 50 persons with LTBI. No instances of transmission of *M. tuberculosis* were noted. Risk classification: medium risk (because it is a TB clinic).

Example C. The setting is a large publicly funded hospital in a major metropolitan area. The hospital admits an average of 150 patients with TB disease each year, comprising 35% of the city burden. The setting has a strong TB infection-control program (i.e., annually updates infection-control plan, fully implements infection-control plan, and has enough AII rooms [see Environmental Controls]) and an annual conversion rate (for tests for *M. tuberculosis* infection) among HCWs of 0.5%. No evidence of health-care–associated transmission is apparent. The hospital has strong collaborative linkages with the state or local health department. Risk classification: medium risk (with close ongoing surveillance for episodes of transmission from unrecognized cases of TB disease, test conversions for *M. tuberculosis* infection in HCWs as a result of health-care–associated transmission, and specific groups or areas in which a higher risk for health-care–associated transmission exists).

Example D. The setting is an inpatient area of a correctional facility. A proportion of the inmates were born in countries where TB disease is endemic. Two cases of TB disease were diagnosed in inmates during the preceding year. Risk classification: medium risk (Correctional facilities should be classified as at least medium risk).

Example E. A hospital located in a large city admits 35 patients with TB disease per year, uses QFT-G to measure *M. tuberculosis* infection, and has an overall HCW *M. tuberculosis* infection test conversion rate of 1.0%. However, on annual testing, three of the 20 respiratory therapists tested had QFT-G conversions, for a rate of 15%. All of the respiratory therapists who tested positive received medical evaluations, had TB disease excluded, were diagnosed with LTBI, and were offered and completed a course of treatment for LTBI. None of the respiratory therapists had known exposures to

M. tuberculosis outside the hospital. The problem evaluation revealed that 1) the respiratory therapists who converted had spent part of their time in the pulmonary function laboratory where induced sputum specimens were collected, and 2) the ventilation in the laboratory was inadequate. Risk classification: potential ongoing transmission for the respiratory therapists (because of evidence of health-care–associated transmission). The rest of the setting was classified as medium risk. To address the problem, booths were installed for sputum induction. On subsequent testing for *M. tuberculosis* infection, no conversions were noted at the repeat testing 3 months later, and the respiratory therapists were then reclassified back to medium risk.

Example F. The setting is an ambulatory-care center associated with a large health maintenance organization (HMO). The patient volume is high, and the HMO is located in the inner city where TB rates are the highest in the state. During the preceding year, one patient who was known to have TB disease was evaluated at the center. The person was recognized as a TB patient on his first visit and was promptly triaged to an ED with an AII room capacity. While in the ambulatory-care center, the patient was held in an area separate from HCWs and other patients and instructed to wear a surgical or procedure mask, if possible. QFT-G was used for infection-control surveillance purposes, and a contact investigation was conducted among exposed staff, and no QFT-G conversions were noted. Risk classification: low risk.

Example G. The setting is a clinic for the care of persons infected with HIV. The clinic serves a large metropolitan area and a patient population of 2,000. The clinic has an AII room and a TB infection-control program. All patients are screened for TB disease upon enrollment, and airborne precautions are promptly initiated for anyone with respiratory complaints while the patient is being evaluated. During the preceding year, seven patients who were encountered in the clinic were subsequently determined to have TB disease. All patients were promptly put into an AII room, and no contact investigations were performed. The local health department was promptly notified in all cases. Annual TST has determined a conversion rate of 0.3%, which is low compared with the rate of the hospital with which the clinic is associated. Risk classification: medium risk (because persons infected with HIV might be encountered).

Example H. A home health-care agency employs 125 workers, many of whom perform duties, including nursing, physical therapy, and basic home care. The agency did not care for any patients with suspected or confirmed TB disease during the preceding year. Approximately 30% of the agency's workers are foreign-born, many of whom have immigrated within

the previous 5 years. At baseline two-step testing, four had a positive initial TST result, and two had a positive second-step TST result. All except one of these workers was foreign-born. Upon further screening, none were determined to have TB disease. The home health-care agency is based in a major metropolitan area and delivers care to a community where the majority persons are poor and medically underserved and TB case rates are higher than the community as a whole. Risk classification: low risk (because HCWs might be from populations at higher risk for LTBI and subsequent progression to TB disease because of foreign birth and recent immigration or HIV-infected clients might be overrepresented, medium risk could be considered).

Screening HCWs Who Transfer to Other Health-Care Settings

All HCWs should receive baseline TB screening, even in settings considered to be low risk. Infection-control plans should address HCWs who transfer from one health-care setting to another and consider that the transferring HCWs might be at an equivalent or higher risk for exposure in different settings. Infection-control plans might need to be customized to balance the assessed risks and the efficacy of the plan based on consideration of various logistical factors. Guidance is provided based on different scenarios.

Because some institutions might adopt BAMT for the purposes of testing for *M. tuberculosis* infection, infection-control programs might be confronted with interpreting historic and current TST and BAMT results when HCWs transfer to a different setting. On a case-by-case basis, expert medical opinion might be needed to interpret results and refer patients with discordant BAMT and TST baseline results. Therefore, infection-control programs should keep all records when documenting previous test results. For example, an infection-control program using a BAMT strategy should request and keep historic TST results of a HCW transferring from a previous setting. Even if the HCW is transferring from a setting that used BAMT to a setting that uses BAMT, historic TST results might be needed when in the future the HCW transfers to a setting that uses TST. Similarly, historic BAMT results might be needed when the HCW transfers from a setting that used TST to a setting that uses BAMT.

HCWs transferring from low-risk to low-risk settings. After a baseline result for infection with *M. tuberculosis* is established and documented, serial testing for *M. tuberculosis* infection is not necessary.

HCWs transferring from low-risk to medium-risk settings. After a baseline result for infection with *M. tuberculosis* is established and documented, annual TB screening (includ-