

Estimating the Infectiousness of a TB Patient

Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings, 2005, pp. 42 – 44

<http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf>

“General Principles

Transmission of *M. tuberculosis* is most likely to result from exposure to persons who have 1) unsuspected pulmonary TB disease and are not receiving antituberculosis treatment, 2) diagnosed TB disease and are receiving inadequate therapy, or 3) diagnosed TB disease and are early in the course of effective therapy. Administration of effective antituberculosis treatment has been associated with decreased infectiousness among persons who have TB disease (292). Effective treatment reduces coughing, the amount of sputum produced, the number of organisms in the sputum, and the viability of the organisms in the sputum. However, the duration of therapy required to decrease or eliminate infectiousness varies (293). Certain TB patients are never infectious, whereas those with unrecognized or inadequately treated drug-resistant TB disease might remain infectious for weeks or months (2,3,87,94,162,294--297). In one study, 17% of transmission occurred from persons with negative AFB smear results (262). Rapid laboratory methods, including PCR-based techniques, can decrease diagnostic delay and reduce the duration of infectiousness (298).

The infectiousness of patients with TB correlates with the number of organisms they expel into the air (299). The number of organisms expelled are related to the following factors: 1) presence of cough lasting >3 weeks; 2) cavitation on chest radiograph; 3) positive AFB sputum smear result; 4) respiratory tract disease with involvement of the lung or airways, including larynx; 5) failure to cover the mouth and nose when coughing; 6) lack of incorrect or short duration of antituberculosis treatment (300); or 7) undergoing cough-inducing or aerosol-generating procedures (e.g., sputum induction, bronchoscopy, and airway suction). Closed and effectively filtered ventilatory circuitry and minimized opening of such circuitry in intubated and mechanically ventilated patients might minimize exposure (see Intensive Care Units [ICUs]).

Persons with extrapulmonary TB disease usually are not infectious unless they have concomitant pulmonary disease, nonpulmonary disease located in the oral cavity or the larynx, or extrapulmonary disease that includes an open abscess or lesion in which the concentration of organisms is high, especially if drainage from the abscess or lesion is extensive, or if aerosolization of drainage fluid is performed (69,72,77, 83,301). Persons with TB pleural effusions might also have concurrent unsuspected pulmonary or laryngeal TB disease. These patients

should be considered infectious until pulmonary TB disease is excluded. Patients with suspected TB pleural effusions or extrapulmonary TB disease should be considered pulmonary TB suspects until concomitant pulmonary disease is excluded (302).

Although children with TB disease usually are less likely than adults to be infectious, transmission from young children can occur (135,137). Therefore, children and adolescents with TB disease should be evaluated for infectiousness by using the majority of the same criteria as for adults. These criteria include presence of cough lasting >3 weeks; cavitation on chest radiograph; or respiratory tract disease with involvement of lungs, airways, or larynx. Infectiousness would be increased if the patient were on nonstandard or short duration of antituberculosis treatment (300) or undergoing cough-inducing or aerosol-generating procedures (e.g., sputum induction, bronchoscopy, and airway suction). Although gastric lavage is useful in the diagnosis of pediatric TB disease, the grade of the positive AFB smear result does not correlate with infectiousness. Pediatric patients who might be infectious include those who are not on antituberculosis treatment, who have just been started on treatment or are on inadequate treatment, and who have extensive pulmonary or laryngeal involvement (i.e., coughing >3 weeks, cavitory TB disease, positive AFB sputum smear results, or undergoing cough-inducing or aerosol-generating procedures). Children who have typical primary TB lesions on chest radiograph and do not have any of these indicators of infectiousness might not need to be placed in an AII room.

No data exist on the transmission of *M. tuberculosis* and its association with the collection of gastric aspirate specimens. Children who do not have predictors for infectiousness do not need to have gastric aspirates obtained in an AII room or other special enclosure; however, the procedure should not be performed in an area in which persons infected with HIV might be exposed. Because the source case for pediatric TB patients might be a member of the infected child's family, parents and other visitors of all hospitalized pediatric TB patients should be screened for TB disease as soon as possible to ensure that they do not become sources of health-care--associated transmission of *M. tuberculosis* (303--306).

Patients who have suspected or confirmed TB disease and who are not on antituberculosis treatment usually should be considered infectious if characteristics include

- presence of cough;
- cavitation on chest radiograph;
- positive 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; and
- undergoing cough-inducing or aerosol-generating procedures (e.g., sputum induction, bronchoscopy, and airway suction).

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 multiple weeks, the risk for infectiousness is reduced.

Suspected TB Disease

For patients placed under airborne precautions because of suspected infectious TB disease of the lungs, airway, or larynx, airborne precautions can 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 negative AFB sputum smear results (109--112). Each of the three consecutive 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.

Hospitalized patients for whom the suspicion of TB disease remains after the collection of three negative AFB sputum smear results should not be released from airborne precautions until they are on standard multidrug antituberculosis treatment and are clinically improving. If the patient is believed to not have TB disease because of an alternate diagnosis or because clinical information is not consistent with TB disease, airborne precautions may be discontinued. Therefore, a patient suspected of having TB disease of the lung, airway, or larynx is symptomatic with cough and not responding clinically to antituberculosis treatment should not be released from an AII room into a non-AII room, and additional sputum specimens should be collected for AFB examination until three negative AFB sputum smear results are obtained (30,31). Additional diagnostic approaches might need to be considered (e.g., sputum induction) and, after sufficient time on treatment, bronchoscopy.

Confirmed TB Disease

A patient who has drug-susceptible TB of the lung, airway, or larynx, who is on standard multidrug antituberculosis treatment, and who has had a substantial clinical and bacteriologic response to therapy (i.e., reduction in cough, resolution of fever, and progressively decreasing quantity of AFB on smear result) is probably no longer infectious. However, because culture and drug-susceptibility results are not usually known when the decision to discontinue airborne precautions is made, all patients with suspected TB disease should remain under

airborne precautions while they are hospitalized until they have had three consecutive negative AFB sputum smear results, each collected in 8--24-hour intervals, with at least one being an early morning specimen; have received standard multidrug antituberculosis treatment (minimum of 2 weeks); and have demonstrated clinical improvement.

Discharge to Home of Patients with Suspected or Confirmed TB Disease

If a hospitalized patient who has suspected or confirmed 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 the positive AFB sputum smear results to negative AFB sputum smear results, if the following parameters have been met:

- a specific plan exists for follow-up care with the local TB control program;
- the patient has been started on a standard multidrug antituberculosis treatment regimen, and DOT has been arranged;
- no infants and children aged <4 years or persons with immunocompromising conditions are present in the household;
- all immunocompetent household members have been previously exposed to the patient; and
- the patient is willing to not travel outside of the home except for health-care--associated visits until the patient has negative sputum smear results.

Patients with suspected or confirmed infectious TB disease should not be released to health-care settings or homes in which the patient can expose others who are at high risk for progressing to TB disease if infected (e.g., persons infected with HIV or infants and children aged <4 years). Coordination with the local health department TB program is indicated in such circumstances.

Drug-Resistant TB Disease

Because the consequences of transmission of MDR TB are severe, certain infection control practitioners might 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. Transmission of drug-resistant organisms to persons with and without HIV infection has been documented (54,307--309). In certain cases, transmission from patients with TB disease caused by drug-resistant organisms might be extensive because of prolonged infectiousness as a result of delays in diagnosis and delays in initiation of effective therapy (53,94,98,101,255,310,311).

HIV-Associated TB Disease

Although multiple TB outbreaks among HIVinfected persons have been reported ([51,52,99](#)), the risk for transmission does not appear to be increased from patients with TB disease and HIV infection, compared with TB patients without HIV infection ([54,312--315](#)). Whether persons infected with HIV are more likely to be infected with *M. tuberculosis* if exposed is unclear; however, after infected with *M. tuberculosis*, the risk for progression to TB disease in persons infected with HIV is high ([316](#)). Progression to TB disease can be rapid, as soon as 1 month after exposure ([51,53,54,101](#))."