Section VII.
Infection Control

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Guidelines for Hospital Admission and Outpatient Management of Patients with Suspected or Confirmed Tuberculosis

Diagnostic work-up and treatment of TB can be achieved in an outpatient setting for most individuals. Requirements for successful treatment are:

- Administration of correct medications
- Directly observed therapy (DOT) to ensure compliance with medication regimen
- Patient completion of a minimum number of doses considered necessary for cure

The decision to admit a patient to the hospital should include all relevant aspects of care, including costs generated from unnecessary admissions. Some providers believe that treating patients with TB on an outpatient basis leads to increased TB transmission; however, with the advent of modern anti-TB chemotherapy, hospital admission has been shown to be unnecessary for effective treatment.

Since the main determinant of cost in treating TB is hospital stay, outpatient treatment is more cost-effective. Studies have shown that outpatient treatment achieves cure rates comparable to inpatient care, and is not associated with an increase in TB transmission in the community. The risk of transmitting TB to others is related to prolonged exposure to a case with undiagnosed, **untreated**, infectious TB. By the time a case of TB is identified and treatment is started, virtually all transmission to close contacts has already occurred. Also, outpatient treatment is less disruptive for a patient.

Appropriate treatment of sputum acid fast bacilli (AFB) smear-positive cases can render most of them noninfectious rapidly (generally within 2 weeks) and sometimes in even a few days. The most effective intervention for reducing infectiousness is treatment and providing a mechanism to ensure medication compliance. Therefore, if a patient is being treated and a plan is in place to ensure treatment will continue (i.e., DOT), it is reasonable in most cases to provide outpatient treatment, even if the patient remains sputum AFB smear positive. Patients who are AFB smear/culture positive may be discharged from the hospital as long as certain criteria are met.

The requirements for discharging patients with known or highly suspected multidrug-resistant TB (MDRTB) are more stringent. Since the number of new MDRTB patients in New York City has decreased by over 90% since 1992, there is only a small chance that a patient whose susceptibility results are not yet available upon discharge will have MDRTB.

When to Admit a Patient with Suspected or Confirmed Tuberculosis

Most patients with TB can be diagnosed and treated as outpatients; patients should be admitted to the hospital until they are stable for discharge if they have the following:

- Severe forms of TB, such as:
  - Central nervous system (CNS) and meningeal TB
  - Pericardial TB
  - Disseminated or miliary TB
- Hemodynamic instablility
- Severe hemoptysis
- Severe debilitation with weight loss, severe cough, high fevers and inability to care for themselves
- Advanced AIDS
- Comorbid medical conditions that require treatment in the hospital

When Not to Admit a Patient with Suspected or Confirmed Tuberculosis

An individual who is clinically stable medically and mentally, and meets **all** of the following 8 criteria should **not** be admitted to the hospital:

1. Has a stable residence at a verified address (form of identification with addresses such as a valid driver's license and state-issued personal ID cards may be used to reasonably verify an address; a phone call to the number given by the patient may also be used to indirectly verify an address). The hospital or clinic provider must verify that the patient lives at the address given.
2. Does not reside in a congregate setting such as a shelter, nursing home or single-room-occupancy hotel.
3. Does not have significant contact with immunosuppressed individuals.
4. Is not actively abusing drugs or alcohol.
5. Is ambulatory and can care for self, and does not need professional home care such as visiting nurse services or a home attendant.
6. Is able to observe risk reduction behaviors such as covering mouth when coughing, and staying at home until no longer infectious according to a physician. The patient should avoid public transportation unless absolutely necessary and should wear a mask in public places.
7. Is competent and willing to follow up with outpatient care (i.e., appointments and necessary tests), and can acknowledge the instructions for follow-up; the patient should be on DOT.
8. If there are children in the home less than 5 years of age and there is an expeditious plan (i.e., to evaluate them by the next business day) for latent TB infection (LTBI) and window period prophylaxis.

If an individual does **not** satisfy **all** of the above criteria, hospital admission may be a reasonable initial approach if the physician is uncertain. Also, if there is going to be a delay in evaluating children in the household or the home situation seems unstable, admission may be advisable until further evaluation. (See p. 123, Figure VII-1.)

Airborne Infection Isolation

Initiating Airborne Infection Isolation

Individuals suspected of having infectious pulmonary or laryngeal TB who are admitted to a hospital should be placed in an airborne infection isolation (AII, formerly called negative pressure or AFB isolation) room which, for new or renovated buildings, has negative air pressure relative to the hall and 12 or more air exchanges per hour, at least 2 of which are outside air. Six or more air exchanges per hour are acceptable for existing structures.

Adults must be placed into an AII room if admitted with **any** of the following:

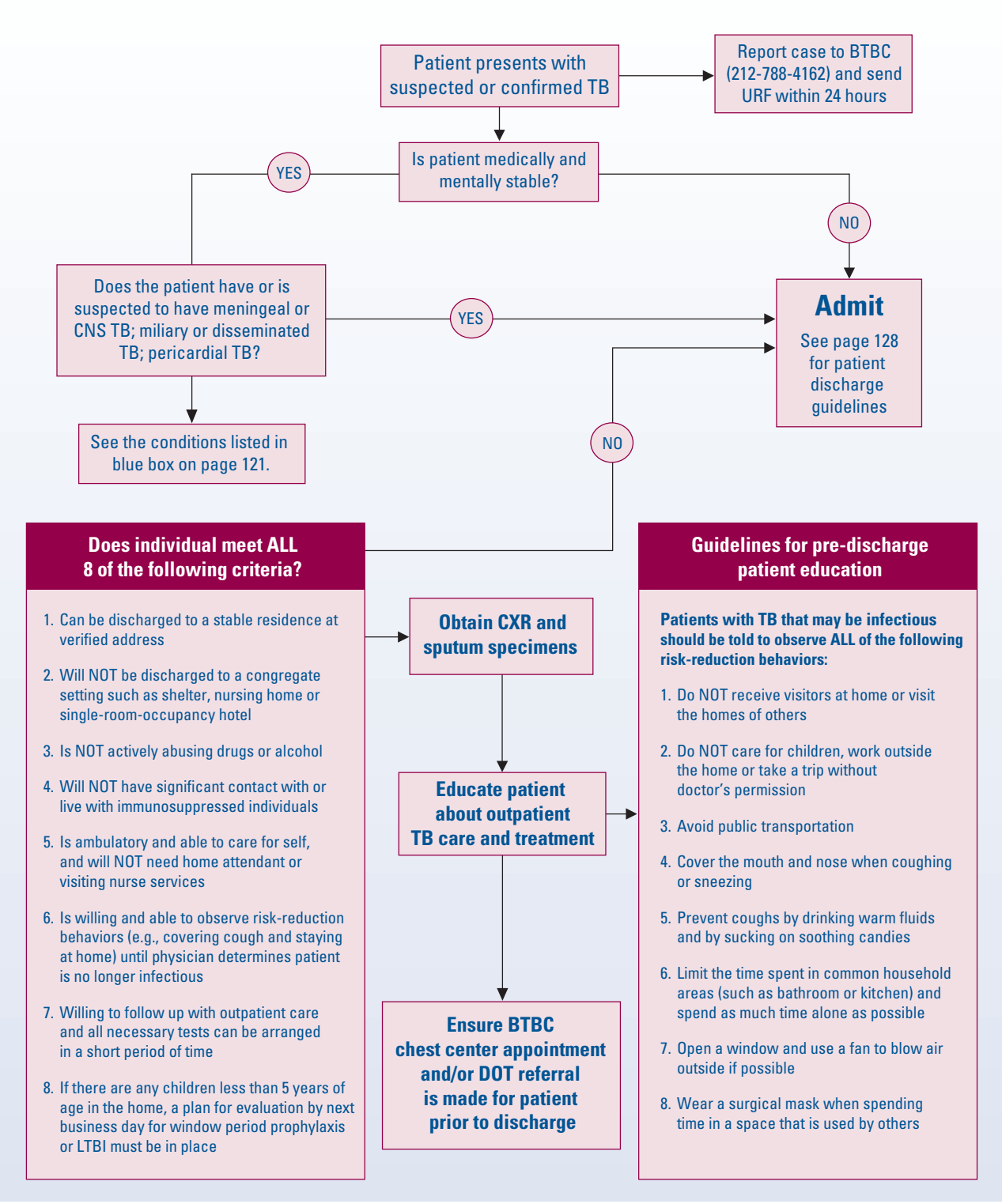
- With or without symptoms of TB and an abnormal chest X-ray (CXR) consistent with TB (i.e., upper lobe infiltrates, miliary pattern, intrathoracic adenopathy, nonresolving infiltrate, pleural effusion; however, almost any parencymal abnormality that can be seen.)
- Cavitary CXR with or without symptoms
- AFB smear positive from a pulmonary source
- Suspected laryngeal involvement (i.e., hoarseness)
- Extrapulmonary TB with abnormal CXR
- Extrapulmonary TB that includes an open abscess or lesion in which the concentration of organisms is high, especially if drainage is extensive or if aerosolization of drainage fluid is performed
- Extrapulmonary TB with a normal CXR if immunocompromised by disease or treatment (e.g., HIV/AIDS, patients with transplants or patients on chemotherapy, prolonged steroids, TNF-alpha blockers, methotrexate or azathioprine)

Most children with TB are not contagious; however, they must also be placed into an AII room if they display any of the following on admission:

- Cavitary CXR
- AFB smear positive from a pulmonary source
- Suspected laryngeal involvement
- Extensive pulmonary infection
- Congenital TB and undergoing procedures involving oropharyngeal airway

Figure VII-1

Criteria for Admitting Patients with Suspected or Confirmed Tuberculosis to the Hospital



Abbreviations: CNS = central nervous system, CXR = Chest X-ray, TB = tuberculosis, URF = Universal Reporting Form

Plans must immediately be implemented to facilitate eventual outpatient care and follow-up. The DOHMH must be notified of this patient and participate in the discharge planning, ideally early in the patient's hospital stay. Individuals do not necessarily have to be sputum AFB smear negative to be released from the hospital and there is no minimum number of days for treatment prior to discharge if discharge is to an appropriate setting.

If arrangements can be made for outpatient follow-up, the patient may be discharged to home if the 8 criteria on p. 122 are met. The patient should be discharged on home isolation on DOT (see p. 129.) If a patient was admitted over the weekend, she/he should remain hospitalized until plans can be made for follow-up and discharge to an appropriate clinic and DOT.

Discharge from Airborne Infection Isolation

Patients in AII may be transferred to a non-isolation hospital bed or may be discharged from the hospital directly. Because other hospitalized individuals may be especially vulnerable to TB infection, the criteria for transferring patients who are smear positive from isolation to a non-isolation room may be more restrictive than the criteria for discharging smear-positive patients from the hospital (e.g., an individual must be smear negative to be considered for transfer from isolation, but not necessarily for discharge from the hospital).

Transfer to a Nonairborne Isolation Area

If a hospitalized patient has a diagnosis other than TB, and symptoms inconsistent with TB, airborne precautions may be discontinued after collecting 3 negative AFB sputum smear results.

If the patient is suspected to have, or is confirmed to have TB, transfer from airborne isolation to a non-isolation area may be considered when the patient demonstrates both bacteriologic and clinical evidence of response to TB treatment and meets **all 3** of the following criteria:

- Resolution of fever and resolution, or near resolution, of cough
- Is on an appropriate anti-TB regimen to which the strain is known or likely to be susceptible; if the patient is confirmed to have TB, she/he should be on standard multidrug anti-TB treatment for a minimum of 2 weeks.
- Three consecutive negative AFB smears from sputum specimens collected over 48 to 72 hours with at least 1 specimen collected in the early morning. Respiratory secretions pool overnight; this method allows patients with negative sputum smear results to be released from airborne precautions in 2 days.

Patients who have drug-susceptible TB of the lung, airway or larynx who are on standard multidrug anti-TB treatment and have substantial clinical and bacteriologic response to therapy are probably no longer infectious. However, because culture and drug-susceptibility results are not usually known when deciding to discontinue airborne precautions, all patients with suspected TB should remain under such precautions until the above preconditions are met.

The decision to transfer a patient from an AII to a non-AII room must be made by the hospital staff; the patient may be transferred to a single non-isolation room or a multiple-bed room with other smear-negative patients whose TB strain has the same drug resistance pattern. Patients transferred to a non-AII room should have a sputum specimen collected for AFB smear every 1 to 2 weeks during their hospitalization.

If possible, patients suspected of having or known to have MDRTB should remain in an AII room throughout their hospitalization if status is smear and/or culture positive.

Patients with pan-sensitive TB who are hospitalized for reasons unrelated to TB should be isolated until their infectiousness has been assessed. If the patient was sputum smear negative as an outpatient, anti-TB therapy can be continued, and the patient does not need to be isolated.

Patients who are unable to take TB medications for a prolonged period of time should be placed on AII. Sputum smears for AFB should be obtained to assess infectiousness.

Influence of Nucleic Acid Amplification on Airborne Infection Isolation

AFB smear-negative hospitalized patient with positive nucleic acid amplification (NAA) test or *M. tb* culture from a respiratory source

Patients admitted to the hospital for suspected TB who are not yet on treatment may have negative AFB smear results and positive NAA test results. This finding is consistent with a diagnosis of *M. tb*, and culture results are expected to be positive. It is recommended by the Bureau of Tuberculosis Control (BTBC) that the individual remain in airborne isolation until **both** of the following criteria are met:

- There has been clinical improvement (resolution of fever and resolution or near resolution of cough).
- The individual has been on an anti-TB treatment regimen for at least 2 weeks.

Patients may and should be discharged to home before 2 weeks of treatment are completed if appropriate criteria are met as listed in next column, and if the individual is not going to be discharged to one of the congregate settings listed on p. 129, is which case culture conversion is required.

The above recommendations also apply to patients who are AFB smear negative but *M. tb* culture positive from a respiratory source.

AFB smear-positive hospitalized patient with negative NAA test

Many patients may be colonized with, or have disease due to, non-TB mycobacterium (NTM) also known as mycobacterium other than tuberculosis (MOTT). This decision needs to be made by the provider. In such situations, if the patient is still suspected of having TB and is being treated for the disease, the same guidelines should be followed as for TB patients who are AFB smear positive.

Positive NAA test after the patient has been on treatment

If the patient has received treatment for TB for more than 7 days, there is no reason to repeat the NAA test if it was initially positive or do an NAA test if one had not been done already. The reliability of a positive NAA in this situation is not known. If the patient has completed a course of treatment in the past, the reliability of a positive NAA in this situation is also not known.

If the patient is on treatment for more than 7 days and an NAA test is subsequently done which is positive, there is no need for isolation provided the patient has been on adequate therapy and is clinically improving.

Guidelines for Returning Suspected or Known Tuberculosis Patients to Home

Patients Who Can be Discharged from the Hospital

The following criteria are recommendations of the New York City BTBC; the New York State Department of Health has the responsibility and the authority for regulating hospitals. The decision to discharge an individual who is sputum AFB smear positive from the hospital must be made by the hospital staff in consultation with the BTBC. The patient should not be discharged unless the provider has been in contact with BTBC staff to discuss discharge planning and referral for DOT.

There is no minimum number of days of anti-TB treatment required before a patient may be discharged from the hospital. Patients who are sputum AFB smear positive (including those who are still symptomatic) who are not suspected of having MDRTB and who are well enough to be discharged from the hospital, may be discharged if they meet **all** of the following criteria:

- Currently treated with an appropriate anti-TB regimen to which the strain is known or likely to be susceptible
- Show clinical improvement (i.e., improvement of fever and resolution or near resolution of cough)
- Agree to DOT and this has been arranged in conjunction with NYC DOHMH or a New York State designated DOT program
- An appropriate treatment regimen has been devised, initiated and tolerated.

- Suitable arrangements have been made for the treatment regimen to be continued and properly monitored on an outpatient basis, specifically by DOT.
- Patient agrees to home isolation while still infectious and signs home isolation agreement.
- All 8 of the criteria listed on p. 128 are met.

In compliance with New York State Sanitary Code, Part 2, Section 2.6, the patient and family members should be given written instructions to follow in order to reduce the risk of TB transmission. These instructions are available in several languages at http://healthweb.health.nycnet/pdf/tb/cpm/tb-cpm-protocol-1.04.pdf. (See pp. 245, 246, Appendices III-E and III-F.)

Patients Who Should not be Discharged from the Hospital while Still AFB Smear Positive or Moved to a Nonairborne Isolation Room

An individual who is sputum AFB smear positive should not be directly discharged from the hospital to any of the following:

- A congregate living site (e.g., shelter, single-room-occupancy hotel, nursing home, jail, prison, group home, another hospital, etc.)
- A living situation where infants and young children also reside if those children have not been placed on a suitable window period prophylaxis or treatment for LTBI, or there is not an expeditious plan to have them evaluated (less than 1 business day)
- A living situation where immunosuppressed persons (e.g., persons who are HIV infected, persons receiving cancer chemotherapy) also reside if these persons have not been placed on a window period prophylaxis or treatment for LTBI, or there is not an expeditious plan to have them evaluated (less than 1 business day)
- 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 a family member

These patients should be on 2 weeks of standard antituberculosis treatment, clinically improving, and demonstrate sputum AFB smear conversion before they can be discharged from the hospital.

In situations in which an individual will have visitors in the home, refuses to wear a mask or cover his/her mouth when coughing, and/or is less likely to adhere to an anti-TB treatment regimen because of drug or alcohol addiction, it may be prudent to be more conservative and keep the patient in the hospital until sputum is AFB smear negative.

The individual may be transferred to another facility while still sputum AFB smear positive, as long as it is to an AII room. The individual should be transported with appropriate respiratory precautions.

Even after 2 to 3 months of treatment, some patients with advanced pulmonary TB and initially positive smears and cultures may continue to excrete what are believed to be dead mycobacteria. Thus, sputum specimens from these patients may be persistently AFB smear positive and yet culture negative. After discharge from the hospital, these patients should have monthly sputum smears and cultures in order to document the persistence of negative cultures and, ultimately, the appearance of a negative smear.

Discharge of an AFB Smear-Negative Individual Directly from the Hospital (Suspected Non-MDRTB)

Patients with AFB smear-negative pulmonary TB can be discharged to home anytime once clinically stable. However, such suspected and confirmed TB patients should not be discharged to a congregate setting such as a nursing home or a shelter until **both** of the following criteria are met:

- There has been clinical improvement (resolution of fever and resolution or near resolution of cough).
- The individual has been on an anti-TB treatment regimen for at least 2 weeks.

Discharge of an Individual with Known or Suspected MDRTB

For an individual with known or suspected MDRTB, the patient should remain hospitalized in airborne isolation until **all** of the following criteria are met:

- Three consecutive sputum smears are AFB negative taken over at least 48 to 72 hours with at least 1 specimen collected in the early morning.
- Current treatment with an appropriate anti-TB regimen to which the strain is known or likely to be susceptible is started and tolerated.
- There is clinical improvement (lowering of fever and resolution or near resolution of cough).
- The patient agrees to DOT and it has been arranged in conjunction with NYC DOHMH or a New York State-designated DOT program.
- Suitable arrangements have been made for the treatment regimen to be continued and properly monitored on an outpatient basis, specifically by DOT.
- The patient agrees to home isolation while still infectious and signs the home isolation agreement.
- All 8 of the criteria listed on p. 128, Figure VII-2 are met.

These patients may be discharged to home if sputum is AFB smear positive using the same guidelines as on p. 125. The BTBC must evaluate the home so that contacts have been evaluated, and on treatment and environmental controls may be instituted.

If the patient is going to a congregate setting, then AFB culture conversion must be documented; (see p. 129).

Guidelines for Returning Patients to Work, School or Other Congregate Settings

Determining when an individual with TB (class III) or suspected TB (class V) can safely return to work or school is made after reviewing the following:

- Evaluation of the individual with TB (e.g., whether the individual has followed instructions, especially adherence to the anti-TB regimen)
- Characteristics of TB itself (MDR vs. drug-susceptible TB, respiratory AFB smear positive vs. smear negative, cavitary vs. non-cavitary, pulmonary vs. extrapulmonary)
- The work or school environment to which the person will be returning (outdoor work, congregate setting)
- The characteristics of those who may be exposed (i.e., immunocompromised or on chemotherapy)

Sputum AFB Smear-Positive Patients Known or Likely to Have Drug-Susceptible Tuberculosis

Most Class III or Class V (High) patients known or likely to have drug-susceptible pulmonary TB may be considered for return to work (but not school) if they meet **all 3** of the following criteria:

- There is clinical improvement (i.e., improvement of fever and the resolution, or near resolution, of cough).
- Evidence that the number of AFB on consecutive sputum smears taken on different days is consistently decreasing (e.g., from 3+ to rare over 2 weeks).
- Current treatment for 2 weeks with an anti-TB regimen to which the strain is known to be susceptible.
- The worksite or congregate setting to which they are returning is appropriate; patients who work alone or outdoors may return earlier.

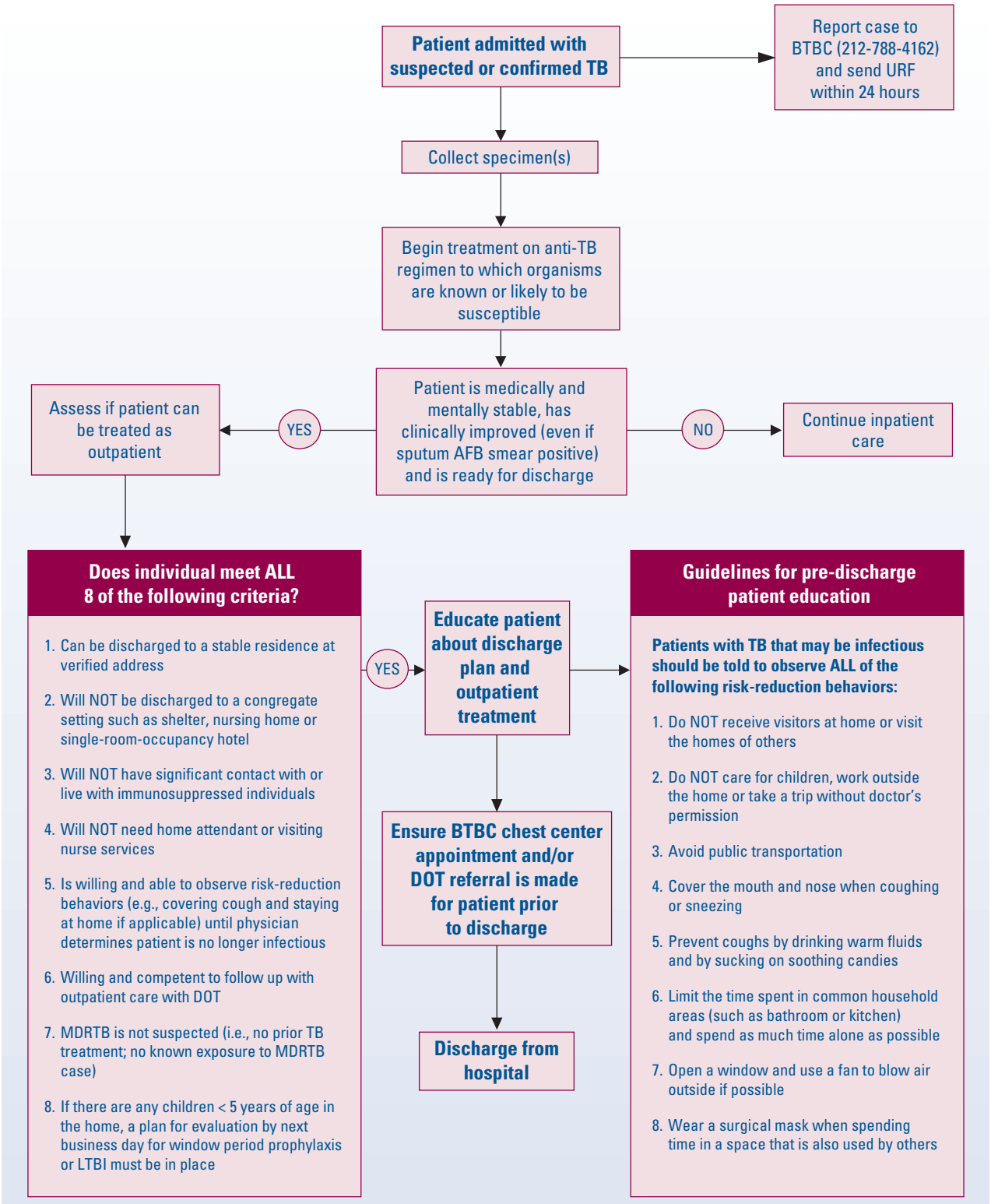
Sputum AFB Smear-Negative Patients Known or Likely to Have Drug-Susceptible Tuberculosis

Individuals with suspected or confirmed AFB smear negative pulmonary TB may return to work or school if **both** of the following criteria are met:

- There has been clinical improvement (i.e., resolution of fever and resolution or near resolution of cough)
- The individual has been on an anti-TB treatment regimen for at least 2 weeks

Figure VII-2

Criteria for Discharging Patients with Suspected or Confirmed Tuberculosis from the Hospital



KEY: URF, Universal Reporting Form; AFB, acid-fast bacilli; DOT, directly observed therapy; MDRTB, multidrug-resistant TB; LTBI, latent tuberculosis infection

The following is a list of work sites where individuals with drug-susceptible and drug-resistant TB should be excluded until culture conversion is confirmed:

- Settings where patients who are HIV positive or other immunocompromised patients are present
- Neonatal intensive care units
- Patient care areas
- Nursing homes
- Day care or any setting where there are young children under 5 years of age.

Patients Known or Likely to Have Multidrug-Resistant Tuberculosis

For a known or suspected case of pulmonary MDRTB, the patient should be kept from returning to work or school, and from living or having contact with immunocompromised persons, or transferring to another congregate setting such as a shelter or nursing home until culture conversion is confirmed (i.e., 2 consecutive negative cultures at least 2 weeks apart). Culture conversion is necessary unless the patient will be transferred to a negative pressure isolation room in the congregate setting. (See paragraph above.)

However, exceptions can be made for certain types of work settings. This should be decided in consultation with BTBC Office of Medical Affairs staff.

Home Isolation

The patient who is at home while still sputum AFB smear positive should be on home isolation until at least 2 weeks of treatment are completed, and there is clinical improvement and decrease in AFB on smear. Criteria for return to work or school may be more stringent than the criteria for discontinuation of home isolation. However, for MDRTB patients, home isolation is usually prolonged until culture conversion.

The purpose of home isolation is to provide an alternative to voluntary or compulsory hospitalization (while continuing to prevent transmission of the disease) for patients who remain infectious after appropriate treatment measures have been implemented. Such patients should also be on home DOT until no longer infectious. Patients should wear a mask when going for medical visits. Exceptions can be made for patients to receive clinic-based DOT while infectious if they use private transportation and wear a mask while in public. Patients pre-discharge information should include education about home isolation. (See p. 128, Figure VII-2.) They should also sign a "Home Isolation Patient Agreement;" a copy should be given to the patient and a copy placed in the patient's medical record. (See p. 246, Appendix III-G.)

For patients who remain infectious for prolonged periods of time, the BTBC can make arrangements to have environmental controls installed in their home. This is particularly useful for patients with MDRTB who may remain infectious for very long periods of time and for whom isolation is often necessary until culture conversion is documented. Environmental controls make the home safer for individuals living with the patient as well as for staff administering DOT.

In order to be on home isolation with a high-efficiency particulate air (HEPA) filter, the following requirements must be met:

- Patient is capable of self-care and does not require hospitalization for other medical condition(s).
- Patient is cooperative and willing to follow infection control practices.
- Patient is not sharing living quarters with immunocompromised persons or children who are negative for TB infection as determined by a tuberculin skin test (TST) or blood-based test for TB infection (TTBI). In this setting, a plan for close follow-up of these individuals must be in place.
- Environmental assessment by the BTBC environmental consultant should indicate that effective isolation would be feasible in the home.
- Patient agrees to DOT in the home while infectious.
- Patient should agree to sign the "Home Isolation Patient Agreement" and to adhere to the conditions of the Agreement.

Adhering to the preceding guidelines will ensure that patients do not remain hospitalized unnecessarily and that members of the public are protected from TB infection.

Infection Control Issues in Pregnancy and the Peripartum Period

Pregnant Women with Latent Tuberculosis Infection

A pregnant woman with risk factors for TB infection should receive a TTBI (either a TST or a blood-based test during pregnancy. See p. 173 and p. 189 for risk factors, determination of a positive result and treatment for LTBI). A pregnant woman with a positive TTBI should have a physical exam and CXR to rule out active TB. For most pregnant women, the CXR can be done with lead shielding after the first trimester to minimize radiation exposure to the fetus **except** in patients who are HIV positive, close contacts of an active TB case or immunocompromised. Treatment of LTBI should be per BTBC policy (see p. 189).

If the medical evaluation and CXR are normal, separation of the mother and the infant at delivery is not indicated since latent TB is not infectious. If there is a contagious family member, that person should be separated until noninfectious from both mother and baby.

Pregnant women with positive TTBI and abnormal CXR not consistent with TB. Chances are low that the mother will transmit tuberculosis to her infant; separation at delivery is not necessary. The mother should be assessed for treatment for LTBI and, if appropriate, given treatment (see p. 193).

Pregnant women with positive TTBI and no CXR during pregnancy. The mother should undergo CXR as soon as she is admitted for delivery; portable CXR is acceptable.

- If CXR is normal, separation of the infant from the mother is not indicated
- If CXR is abnormal and consistent with TB, the mother should deliver the baby under airborne precautions and immediately postpartum be separated from the infant and undergo evaluation for active TB; the infant should simultaneously undergo evaluation for congenital TB. (See p. 38.)

Pregnant women with positive TTBI and no CXR prior to delivery. The mother should be separated from the infant after delivery and CXR obtained immediately. Airborne precautions should be taken if possible during the delivery and until CXR result is available; at minimum the mother should wear a mask during delivery.

- If CXR is normal, she may be reunited with the baby.
- If CXR is abnormal and consistent with TB, the mother should be separated from the infant and undergo evaluation for active TB; the infant should simultaneously undergo evaluation for congenital TB. (See p. 38.)

Pregnant woman with active TB. If a pregnant woman is being treated for TB during pregnancy and has been compliant with therapy, infectiousness should be assessed at the time of delivery. If the mother was confirmed culture-negative for at least 1 month prior to delivery, there is little risk of infection to the newborn. Three sputa should be analyzed for AFB if culture conversion is not documented or the patient was nonadherent. Specimens should be collected over 48 to 72 hours in the last 2 weeks before delivery. If the mother is not infectious, the infant does not need to be separated from her; however, if the mother is taking rifampin, prophylactic vitamin K is recommended in the infant (there may be an association between rifampin and hemorrhagic disease in newborns).

Pregnant women suspected of having not adequately treated TB at the time of delivery, or who are on treatment but still infectious. Separation of the newborn from the mother may be necessary until the mother is noninfectious (i.e., after at least 3 consecutive negative sputum smears over 48-72 hours). The relative risks vs. benefits of this separation are disputed, but the baby should sleep in a separate room until the mother is noninfectious; the mother should wear a mask when with the baby.

All family members of a mother with active TB should themselves be assessed for active TB before being allowed contact with the infant (including visiting the baby in the hospital). If active untreated TB is found in a family member, that person, until noninfectious, should have no contact with the newborn.

Infection Control in Chest Centers

Triage

All individuals entering a BTBC chest center for diagnostic evaluation or clinical services should be rapidly assessed for the likelihood that they may have infectious TB. As part of this assessment, staff should:

- Evaluate the individual for signs and symptoms of infectious TB as soon as he or she enters the chest center.
- Search for the individual's name (and unique identifiers) on the TB Registry (initial visit only).

For infection control purposes, it is important to determine whether the patient has had previous incomplete treatment for TB. Individuals who have been incompletely treated for TB in the past should be suspected of having infectious TB, pending clinical evaluation. Infection control measures should be considered even if the patient does not appear to be symptomatic.

All individuals identified as likely to be infectious must be seen by a physician as quickly as possible. If a physician cannot see the person immediately, the person must be temporarily isolated from others until he or she is seen.

Temporary Isolation

All individuals identified as possibly infectious must be separated from others while awaiting clinical and diagnostic evaluation or referral. A designated isolation room or a sputum induction room or booth (when not in use) is the most appropriate area for temporarily isolating patients awaiting services.

- Staff should carefully explain to isolated patients the reason for their separation.

Masks and Particulate Respirators

Any individual who is coughing should be provided with a mask and instructed to wear it for the duration of the chest center visit. Also, individuals who have been identified as being likely to be infectious by reason of history, the TB registry or reported symptoms should be given a mask and instructed to wear it, regardless of whether or not they are coughing.

- Most masks are acceptable, except those with an escape valve (e.g., type 3M9970).
- Staff should explain to the patient the reason for wearing the mask.
- To reduce patient discomfort, every effort must be made to limit the amount of time a patient is required to spend in the chest center while wearing a mask.
- Patients who cannot tolerate a mask should be provided with tissues and instructed to cover mouth when coughing. All staff must keep a supply of paper tissues readily available in their work areas.
- Staff should strongly encourage patients to wash their hands after coughing.
- Signs instructing anyone who is coughing to cover his/her mouth should be prominently displayed in all chest center areas.

Physicians and others in contact with a potentially infectious patient should consider the following:

- If the patient suspected of being infectious is seen in a consultation room, the patient should be instructed to wear a mask (staff does not need to wear a particulate respirator while attending a patient who is wearing a mask). However, if the patient cannot tolerate the mask during the examination, the patient should be seen only in an isolation room or a sputum induction booth. Staff attending to a patient in an isolation room or sputum induction booth must use appropriate respiratory protection (e.g., respirator type N95).
- Staff member(s) who have reason to believe that air in a room is contaminated with *M. tb* should wear an appropriate particulate respirator.
- After use by a potentially infectious patient, an isolation room or sputum induction booth should not be used for a certain amount of time (see p. 134). A sign should be posted on the door indicating the time after which the room or booth can be reused.

- Individuals who are temporarily isolated should be instructed to keep their masks on if possible; individuals who cannot tolerate a mask should be provided with tissues and instructed to cover their mouths when coughing.
- Staff attending to a patient who is isolated in the sputum induction room must wear appropriate respiratory protection.
- While a patient is isolated in the sputum induction room, staff should obtain a sputum specimen.
- Clinic staff should frequently check on patients who are being temporarily isolated to ensure these patients are comfortable and compliant with isolation protocols.

Sputum Induction

Sputum induction is a procedure for obtaining sputum from patients who have difficulty producing it spontaneously. In this procedure, patients inhale a mist of nebulized, sterile water (many facilities use hypertonic saline) which irritates their airways, causing them to cough and produce respiratory secretions.

Staff Involved in Sputum Induction

Sputum induction must be ordered by a physician and supervised by a trained staff member.

Equipment

The following equipment is required for sputum induction:

- A room, booth or enclosed area that meets environmental control standards for high-risk procedures, including:
  - Negative pressure relative to other areas (air flow must be from the corridor into the sputum induction room or booth; from there it should be exhausted to the outside or appropriately filtered and safely discharged)
  - 12 or more complete air exchanges per hour
  - For rooms, ultraviolet germicidal irradiation (UVGI)
- Nebulizer and table to support nebulizer
- Disposable tubing with cup and lid
- Sterile sputum collection jar, properly labeled
- Bacteriology slips (TN50)
- Clear plastic biohazard specimen bag and paper bag
- Paper tissues and bag for disposal of tissues
- Sterile water
- Solution of 10% bleach, 90% water
- Disposable gloves
- Refrigerator
- Disposal bags for biohazardous waste
- Disposable drinking cups
- Chair for ambulatory patients

Preparing Equipment and the Sputum Induction Room

Equipment and room should be prepared as follows:

- Assemble and organize the following equipment in quantities sufficient for the anticipated number of patients to be seen that day:
  - Sputum jars
  - Plastic biohazard bags and brown paper bags
  - Disposable plastic nebulizer tubing with cup and lid
  - Sterile water
  - 10% bleach solution, mixed at the start of the shift in an amount sufficient for that shift only
  - Disposable drinking cups
- Check that the ultraviolet light and exhaust fan are on and are functional
- Prepare the nebulizer as follows:
  - Inspect it for cleanliness.
  - If necessary, wipe the nebulizer surfaces with 10% bleach solution.
  - Place sterile water in the nebulizer chamber to the level marked on the chamber.
  - Place a small amount of sterile water in the cup portion of the disposable nebulizer tubing.
  - Insert the cup into the nebulizer.

- Test to make sure the nebulizer is functional by turning it on and checking to see whether it produces a mist.

- Before beginning sputum induction:
  - Label the sputum jar in pencil with the patient's name and address, and the date. Place the completed bacteriology form (TN50) in the lab slip pocket of a biohazard bag with the patient's name facing out. Include the TB Registry number of patients with suspected or confirmed TB on the bacteriology form.

Preparing the Patient

The nurse, public health advisor or public health assistant should prepare the patient for sputum induction by:

- Explaining the purpose of the procedure
- Orienting patients to the nebulizer and demonstrating how it functions; reassure patients that the equipment is clean
- Showing the sputum jar and instructing patients not to open the jar until ready to expectorate into it and telling them to close the jar tightly as soon as the specimen is collected
- Providing water in a disposable cup and explaining that drinking it will help with the procedure
- Explaining not to begin the sputum induction procedure until the staff member has left the room and the door is firmly closed
- Telling patients to:
  - Inhale the aerosol by taking 3 or 4 deep, slow breaths through the mouth without placing his/her mouth on the tubing (the patient is not to demonstrate deep breathing during the instruction).
  - Cough vigorously if they do not cough spontaneously in response to the mist. Ask them to cover their mouth with a tissue when coughing unless expectorating into the sputum jar.
  - Continue trying to cough and to expectorate after inhaling the mist.
  - Expectorate all sputum into the sputum jar, without spilling it outside the jar.
  - Cover the jar tightly after collecting about 1 tablespoon of sputum.
  - Place sputum specimens in the biohazard bag, then the brown paper bag, and give the plastic to the chest center staff.
  - Stay in the sputum induction room, remaining in the anteroom until coughing has completely stopped.
  - Shut the door after leaving the sputum induction room.

Role of Chest Center Staff during the Induction Procedure

Staff must remain near, but not inside, the sputum induction room during the procedure in order to be available to assist patients if necessary and to ensure that patients remain in the sputum induction room until coughing has stopped.

If a staff member must enter the sputum induction room during the procedure, a properly fitted, National Institute for Occupational Health and Safety (NIOSH)-approved HEPA respirator (e.g., respirator type N95) must be worn.

Handling of Specimen

While in the sputum induction room or booth, patients should place the sputum jar in the ziploc section of the biohazard bag and put the biohazard bag in a brown paper bag. The patient should give the brown paper bag to chest center staff, who should place the bag in the refrigerator until it is delivered to the laboratory.

Care of Equipment and Area Between Uses

The equipment and sputum induction room should be cleaned and restored as follows:

- Before re-entering the sputum induction room, make sure that the door to the room remains closed for the specific amount of time listed in the Box below.

Clinic	Time Door Should Remain Closed
Bedford:	9 minutes
Bushwick:	9 minutes
Chelsea:	13 minutes
Corona:	11 minutes
Fort Greene:	9 minutes
Jamaica:	20-21 minutes
Morrisania:	11 minutes
Richmond:	17 minutes
Washington Hts.:	13 minutes
30th St. Shelter:	9 minutes

These clearance times are calculated for 99% clearance of the sputum induction booth/room with the door closed and the Isol-Aide unit functioning at low fan speed, 150 cubic feet per minute (CFM).

The above clearance times are subject to change based on renovation in the chest center and other factors. Current clearance times are posted in each center.

Clearance times are calculated as follows:

- Determine the cubic volume of the chamber: cubic volume = length x width x height
- Calculate air changes per hour (ACH): ACH = (CFM x 60) / cubic volume
- Determine air mixing factor: Isol-Aide sputum induction booths/rooms have an effective mixing factor of 1.81 as determined by the manufacturer.
- Extrapolate clearance time from Centers for Disease Control and Prevention's "Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in Health-Care Facilities, 2005" Table 11, available at www.cdc.gov/MMWR/PDF/rr/rr5417.pdf.

- Put on a properly fitted, NIOSH-approved HEPA particulate respirator and disposable gloves before entering the sputum induction room. Do not remove the respirator until after leaving the room. Close the door after entering the sputum induction room.
- Remove the nebulizer tubing with cup and lid and discard it into the disposal bag for biohazardous waste.
- Wipe the nebulizer and table surfaces with a 10% bleach solution and discard any litter in the treatment area.
- Remove gloves, wash hands and prepare the equipment for the next patient.

Care of Room and Nebulizer at the End of the Day

At the end of the day, the nebulizer and the sputum induction room should be restored as follows:

- Before entering the sputum induction room, wait at least 10 minutes after the last patient leaves.
- Put on disposable gloves and a properly fitted, NIOSH-approved particulate respirator prior to entering. Close the door after entering.
- Remove and discard the nebulizer tubing with cup and lid.
- Empty the nebulizer chamber.
- Clean the nebulizer chamber and all exposed surfaces with a 10% bleach solution and wipe the chamber dry.
- Discard the bleach solution.
- Remove and discard the disposable gloves and wash hands.
- Leave the ultraviolet light and the fan on.
- Remove the personal respirator after leaving the room.

Documentation

Document all relevant information in the log book.

Key Sources

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