Management of Tuberculosis

Federal Bureau of Prisons
Clinical Practice Guidelines

January 2010

What's New in the Document?

This is a targeted revision of the guideline regarding TB screening. Changes since the April 2007 version of the document are highlighted in YELLOW.

1. For non-English speaking inmates, it is critical that TB symptom screening questions be asked via an interpreter (either in-person or via language line).

2. A baseline tuberculin skin test (TST) should generally be obtained on all new intakes to the BOP—regardless of TST results from local jails and regardless of an inmate's history of a prior positive TST—with the following exceptions:

    - The inmate has prior documentation of a positive TST while the inmate was incarcerated within the BOP;
    - The inmate has a history of a severe reaction to a TST, e.g., swollen, blistering, (vesiculated) reaction—either by self-report or clinically documented;
    - The inmate provides a credible history of treatment for latent TB infection, i.e., is able to describe the medication taken, and when, where and how long it was taken.
    - There is a unique reason not to repeat a TST (as approved by the Regional Medical Director), i.e., repeated admissions from local detention facilities over a short period of time.

3. Two-step tuberculin skin testing (see page 5) should be performed on all foreign born inmates who have not been tested in the previous 12 months. An inmate's self-report of being tested within the last year is a sufficient reason not to perform a two-step test.

4. All sentenced inmates should be routinely offered HIV testing at intake, since HIV-infected inmates are at higher risk of developing active TB. Intake TB evaluation of an HIV-infected inmate includes a chest radiograph in addition to a TST.

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1. Purpose

The Federal Bureau of Prisons Clinical Practice Guidelines for the Management of Tuberculosis (TB) provide recommendations for the treatment of federal inmates with TB infection and disease and for the management of contacts to infectious TB cases.

2. Epidemiology, Transmission, and Natural History

TB incidence in the United States decreased during the past decade, largely as a result of more intensive TB control efforts. Nevertheless, TB control remains a public health priority for correctional systems, since TB outbreaks continue to occur in U.S. jails and prisons. Furthermore, a significant proportion of TB cases in the U.S. occur among persons who are over-represented in certain jails or prisons, including racial/ethnic minority populations, persons with human immunodeficiency virus (HIV) infection, and persons born in foreign countries that have high rates of TB.

M. tuberculosis, the organism that causes TB, is transmitted through airborne respiratory droplets when an individual with active pulmonary TB coughs, sneezes, speaks, or sings. Transmission of *M. tuberculosis* depends on the length of time and frequency of the exposure, the degree of contagiousness of the infected person, the environment and airflow in which the exposure occurred, and the intensity of the contact with the TB organism itself. Infection with *M. tuberculosis* usually requires prolonged contact with an infectious case in an enclosed space. The majority of persons who become infected never develop active TB.

The most significant risk factor for LTBI is country of origin. The general U.S. population has an estimated TB infection rate of only 5-10%; whereas foreign born populations have an average estimated TB infection rate of 32%, with rates varying widely throughout the world. Other risk factors for infection with TB include injection drug use; being a resident or employee in congregate settings such as prisons and jails, health care facilities, and homeless shelters; and most notably, being a known contact of an active TB case. On average, 30% of household contacts to infectious TB cases have a positive TST.

Approximately 5% of infected persons develop active TB disease during the first year or two after infection. In another 2-5%, disease will develop later in their lives. Certain medical conditions increase the risk that TB infection will progress to disease, the most important of which is HIV infection. *Appendix 1 (Tuberculosis Risk Factors)* lists conditions associated with a higher risk of TB disease, including evidence of prior TB disease on chest radiograph (CXR), injection drug use, history of organ transplant, immunosuppressive therapy (including steroids and anti-TNF alpha drugs), diabetes mellitus, and chronic renal failure.

3. Screening

Screening for TB in correctional facilities involves both ongoing surveillance for active TB disease and detection of latent TB infection. Early detection and isolation of inmates with suspected pulmonary TB is critical to preventing widespread TB transmission. Identification of latent TB infection provides an opportunity for providing treatment to prevent future

development of TB disease.

TB Symptom Screening

At intake, all inmates should be systematically screened for TB symptoms by a trained health care worker. For non-English speaking inmates, it is critical that TB symptom screening questions be asked via an interpreter (either in-person or via language line). The following questions should be asked:

- *Have you ever been treated for tuberculosis (TB)?*
- *Have you had a cough for more than 2 weeks?*
- *Are you coughing up blood?*
- *Have you recently lost weight?*
- *Do you have frequent fevers or night sweats?*

Inmates who have symptoms suggestive of TB disease should receive a thorough medical evaluation, including a TST, a chest radiograph, and, if indicated, sputum examinations. If TB is suspected, the inmates should be isolated in an airborne infection isolation (AII) room.

Chest Radiograph Screening

The following categories of inmates should have a CXR at intake (in addition to the intake TB symptom screen and a TST):

- TST positive inmates.
- All HIV infected inmates.
- Foreign born inmates who have been in the United States for one year or less *and* for whom there is no documentation of a chest radiograph obtained in the U.S. This screening guideline also applies to inmates who have been out of the United States or Canada for 6 months or more immediately prior to their incarceration in the BOP.

Some facilities, which house inmates with a high incidence of TB, may conduct routine CXR screening of all inmates entering the prison. Decisions about use of routine CXR screening should be made in consultation with the Warden, and Regional and Central Office HSD staff.

Follow-up CXRs

Annual chest radiographs are not ordinarily indicated for inmates with a positive TST. Inmates who decline treatment for LTBI, or have treatment discontinued because of drug side effects, nonadherence, or other reasons, should be monitored in accordance with the following:

- *For inmates with HIV infection (or unknown HIV serostatus) or other immunosuppressive conditions:* semi-annual CXRs and clinician evaluations for symptoms and signs of pulmonary TB, indefinitely.
- *For HIV seronegative inmates who are recent convertors or close contacts of active TB cases:* semi-annual CXRs and clinician evaluations for symptoms and signs of pulmonary TB for a 2 year period.

Screening for Latent TB Infection: The Tuberculin Skin Test (TST)

Currently there are two FDA-approved methods for testing for latent TB infection (LTBI): the TST and a new blood test, QuantiFERON-G®.

The TST is an approved method for diagnosing *M. tuberculosis* infection in persons who do not have TB disease. Persons with LTBI usually are asymptomatic, often unaware of past exposures to TB; yet, they are at future risk of developing infectious TB. Screening high-risk populations, such as inmates, and providing treatment for those with latent TB infection are important public health measures.

The TST has a specificity of approximately 99% in populations that have no other mycobacterial exposures or BCG (Bacillus Calmette-Guerin) vaccination; however, the specificity decreases where cross-reactivity with other mycobacteria is common. Tuberculin skin testing guidelines are outlined in *Appendix 2 (Tuberculin Skin Testing Guidelines).*

Indications for Tuberculin Skin Testing.

Inmates should be evaluated for TB infection with a TST in accordance with BOP policy and the following indications:

- **Intake screening:** A baseline tuberculin skin test (TST) should generally be obtained on all new intakes to the BOP—regardless of TST results from local jails and regardless of an inmate's history of a prior positive TST—with the following exceptions:
  - The inmate has prior documentation of a positive TST while the inmate was incarcerated within the BOP;
  - The inmate has a history of a severe reaction to a TST, e.g., swollen, blistering, (vesiculated) reaction—either by self-report or clinically documented;
  - The inmate provides a credible history of treatment for latent TB infection, i.e., is able to describe the medication taken, and when, where, and how long the medication was taken.
  - There is a unique reason not to repeat a TST (as approved by the Regional Medical Director), i.e., repeated admissions from local detention facilities over a short period of time.

  Two-step tuberculin skin testing (see page 5) should be performed on all foreign born inmates who have not been tested in the previous 12-months. An inmate's self-report of being tested within the last year is a sufficient reason *not* to perform a two-step test.
- **As part of annual screening.**
- **If active TB disease is clinically suspected** (and TST status unknown).
- **As part of a TB contact investigation.**

Special Considerations

- **Reported prior positive TST:** A self-reported, prior positive TST without a millimeter reading is not a contraindication to repeat testing unless a severe reaction (e.g., swollen, blistering reaction) has been documented or described by the inmate or unless a credible

history of treatment for LTBI has been provided. Inmates with a documented positive TST, measured in millimeters, should not be tested repeatedly.

- **Pregnancy:** Pregnancy is not a contraindication to tuberculin testing.
- **BCG vaccination:** BCG vaccination is not a contraindication to tuberculin testing. TST reactivity resulting from BCG vaccination does not correlate with protection against TB. Since there is no reliable method for distinguishing tuberculin reactions caused by BCG from those caused by infection with *M. tuberculosis*, persons with a history of BCG vaccination whose TST is positive should be considered infected with *M. tuberculosis*.
- **Anergy testing:** Anergy testing is not medically indicated as a component of tuberculin skin testing for inmates. HIV infected and other immunosuppressed persons may not mount an immune response to the TST; however, anergy testing does not help determine whether a person will have an adequate cellular immune response to PPD tuberculin.

Administering and Reading TSTs

- **Training:** TSTs should only be performed by health care workers who have had formal training in administering, reading, and interpreting the test. If the TST is placed or read incorrectly, the results may be inaccurate.
- **Product information:** Only BOP Formulary tuberculin solution should be used. To minimize reduction in potency by adsorption, tuberculin should never be transferred from one container to another. Skin tests should be administered as soon as possible once the tuberculin syringe has been filled. The tuberculin test solution should be refrigerated (not frozen) and stored in the dark as much as possible (exposure to strong light should be avoided). Multi-puncture tests (Tine®) are poorly standardized and should not be administered.
- **Administration:** The TST should be administered by the Mantoux method, which consists of intradermal injection of 0.1 ml of purified protein derivative (PPD) tuberculin containing 5 tuberculin units (TU) into the volar or dorsal surface of the forearm, using a disposable tuberculin syringe. Other areas may be used, but the forearm is the preferred site for testing. A skin area away from superficial veins and free of lesions should be selected. A 5 mm tense white wheal should appear at the injection site. If this does not appear, replace the test at least 2 inches away from the initial injection site. Gloves are optional for administering TSTs and can be used on a case by case basis. Wash hands before and after placing and reading a TST. Alcohol-based hand sanitizer can be used.
- **Reading:** The TST should be read by a trained health care worker in 48-72 hours after injection. A positive reaction can be measured up to one week after testing and is considered valid; however, readings after 72 hours tend to underestimate the true size of induration. A negative reaction read after 72 hours is invalid, and the test should be repeated. The test is "read" by measuring in millimeters (mm) the largest diameter of the indurated area (palpable swelling) on the forearm. The diameter of the induration should be measured transversely to the long axis of the forearm for standardization purposes. Erythema (redness) without induration is not significant. The TST results should always be documented in millimeters, not as positive or negative. If there is no reaction (or just erythema), record "0 mm."

Interpreting Skin Test Reactions

Two cut-points for defining a positive TST are indicated in correctional facilities, based on risk factors for TB infection and TB disease in infected inmates (see *Appendix 2*).

- **Positive tuberculin test:** All inmates with a TST of 5 millimeters of induration or greater should be referred for a CXR and promptly evaluated by a physician for evidence of active TB disease. Based on the criteria for TST positivity below, inmates who have a positive TST should be evaluated for LTBI treatment.
  - **5 millimeters or greater with the following concurrent conditions:**
    - Close contact to an active TB case
    - HIV co-infection, or HIV risk factors and unknown HIV status
    - Other immunocompromised condition
    - Systemic corticosteroids (equal to prednisone 15 mg for 1 month or more)
    - History of organ transplantation or other immunosuppressive therapy
    - Fibrotic changes on chest radiograph suggestive of inactive pulmonary TB
    - Radiographic or clinical findings suggesting active TB
    - Persons taking anti-TNF alpha drugs (e.g., infliximab)
  - **10 millimeters or greater:** all other inmates
- **TST reactors vs. convertors:** A TST "reactor" is anyone who has a positive TST. A TST convertor is one whose TST has increased 10 mm or more in a 2 year period. A TST convertor has a higher risk of developing TB disease and is considered high priority for LTBI treatment.
- **Booster phenomenon and two-step testing:** Certain individuals infected with *M. tuberculosis* will have a negative TST when tested many years after their initial infection. This skin test, however, may stimulate or "boost" the immune system's ability to react to tuberculin and cause a positive reaction to subsequent tests. This booster phenomenon can be induced more than a year after an initial test.

  Two-step testing is a technique used to help distinguish between "boosted" reactions and reactions due to new infections. Consider two-step testing for newly sentenced inmates in the following categories who are at high risk for boosting (if they have not received a TST in the last year and if repeated annual testing is anticipated):

  - Foreign born inmates.
  - Inmates with a history of BCG vaccination.
  - Other inmates as medically indicated with suspected previous exposures to *M. tuberculosis*.

  Two-step testing is performed as follows: If the initial TST reaction is negative, a second test is placed 1 to 3 weeks later. If the second test is also negative, the person is considered uninfected. Any subsequent positive test would be considered new infection (skin test conversion). However, if the second test is positive, the person should be classified as infected (but not a convertor) and managed accordingly.

Screening for Latent TB Infection: QuantiFERON-G®

QuantiFERON-G, a blood test licensed by the FDA to test for latent tuberculosis infection, has been demonstrated to be at least as sensitive as the TST in detecting the presence of TB infection in individuals with active TB disease. It is more specific than the TST, i.e., there are fewer "false positive" results. The QuantiFERON-G test is not associated with false positive results related to a history of BCG vaccination (a significant advantage over the TST). Furthermore, there is no need for 2-step testing because false negative results due to the "booster phenomenon" are not associated with QuantiFERON-G. The CDC has stated that QuantiFERON-G can be used in all circumstances in which the TST is currently used, including contact investigations, evaluation of recent immigrants, and sequential-testing surveillance programs for infection control (e.g., those for health care or correctional workers).

QuantiFERON-G test requires only a single encounter for a blood draw. A significant logistical problem associated with the test is that specimens must be processed within 12 hours of collection. The laboratory costs for QuantiFERON-G significantly exceed that of the TST; however, staff time required for testing is significantly reduced given that return visits for reading and two-step testing are unnecessary. While not currently in use within the Bureau of Prisons, QuantiFERON-G will be reevaluated for future use. For inmates entering the Bureau of Prisons, prior documentation of QuantiFERON-G results (positive or negative) should be considered as evidence of the presence or absence of latent TB infection. Record of a prior positive QuantiFERON test result should be considered as evidence of latent TB infection, i.e., equivalent to a positive TST. There generally will be no reasons to perform a TST to confirm it.

HIV Testing at Intake

All sentenced inmates should be routinely offered HIV testing at intake. Because HIV-infected inmates are at higher risk of developing active TB, intake TB evaluation of an HIV-infected inmate includes a chest radiograph, in addition to a TST.

4. Treatment of Latent Tuberculosis Infection

Baseline Evaluation

- **Medical history** should include risk factors for TB (*Appendix 1*), prior treatment for TB or LTBI, review of preexisting medical conditions that may complicate treatment, review of current medications with attention to potential drug interactions, and review of symptoms of active TB disease, hepatitis, liver disease, and pregnancy.
- **Targeted examination** should be performed by a clinician for systemic signs of active TB disease (e.g., fever, weight loss, pulmonary findings), as well as signs of hepatitis.
- **Chest radiographs:** The treatment of LTBI should never be initiated until active TB disease has been eliminated as a potential diagnosis with a posterior-anterior CXR and documented negative assessment for signs and symptoms of TB. A CXR is "good" (for the purpose of ruling out TB prior to starting treatment of LTBI) for 3–6 months in HIV seronegative persons and 1 month in HIV-positive persons.

  CXRs during pregnancy: A CXR should be done immediately utilizing lead shielding,

even during the first trimester for pregnant women who are:

- Presenting with symptoms suggestive of TB disease.
- HIV-positive (TST positive or negative) and had close contact to a TB case.
- TST positive and are a close contact to a smear positive or cavitary case.

A CXR should be performed for lower risk TST positive pregnant women after the first trimester, utilizing lead shielding.

- **Liver transaminases,** i.e., ALT (SGPT) or AST (SGOT) and other laboratory tests, should be obtained as clinically indicated. Although baseline liver transaminases are not routinely recommended prior to initiating LTBI treatment in the general population, screening is recommended for federal inmates because of the high incidence of substance abuse and associated liver disease among incarcerated populations. If liver transaminases are elevated, liver function tests (e.g., bilirubin) should also be assessed.
- **HIV counseling and testing** is strongly recommended for all TST positive persons (if not done previously) since HIV co-infection significantly increases the risk of developing active TB.
- **Sputum evaluation** is not routinely indicated for persons being considered for LTBI treatment. However, for inmates with CXRs suggestive of old healed TB, sputums (if producible) should be obtained for AFB smear and culture to screen for active TB disease. Obtain 3 consecutive sputum samples at least **8** hours apart, including one early morning specimen. Inmates with HIV infection, who have respiratory symptoms, unexplained fever or weight loss, should also have sputums submitted for bacteriologic cultures, since active TB disease in immunocompromised hosts is often difficult to diagnose.

  If sputum smears and cultures are negative and the inmate's symptoms or radiographic findings can not otherwise be clinically explained, further diagnostic evaluations (e.g., bronchoscopy) for active TB disease should be considered. During the diagnostic evaluation, empiric treatment for active TB disease can be considered on a case by case basis depending on the inmate's symptoms and radiographic findings**. Single drug treatment of LTBI should never be instituted while an evaluation for active TB disease is being pursued.**

Indications for Treatment of LTBI

Clinical indications for the treatment of LTBI are based on the inmates' TST reaction in millimeters, the relative risk of developing TB disease, and risk factors for drug side effects. Treatment of LTBI should be considered for all TST positive inmates regardless of age, when no medical contraindications to treatment exist, and previous adequate treatment has not been provided.

Give highest priority to the following inmates (see *Appendix 2*):

- **HIV co-infection** is the most significant risk factor for the development of active TB; therefore, co-infected TST reactors are a very high priority for effectively treating LTBI.

- **Other immunosuppressive conditions or therapy:** Inmates on immunosuppressive therapy (including a history of organ transplantation with immunosuppression, on chronic steroid therapy, or those on anti-TNF alpha therapy) should also receive priority treatment for LTBI.
- **Recent convertors:** Inmates whose TST has increased 10 millimeters or more within the past 24 months are at relatively high risk for developing TB and they are high priority candidates for LTBI treatment.
- **Other high risk medical conditions:** Concurrent conditions that increase the risk of TB disease include, in part: abnormal CXR consistent with old healed TB, injection drug use history, hematologic or reticuloendothelial neoplasms, chronic renal failure, diabetes mellitus (insulin dependent), gastrectomy and other specific conditions resulting in nutritional deficiencies, head and neck malignancies, and silicosis.
- **Detention facilities:** Inmates in detention centers should ordinarily not be prescribed LTBI treatment if their anticipated incarceration is uncertain or is less than several months, unless any of the following high priority indications have been identified: HIV co-infection or other immunocompromised condition, close contact with an active TB case, or recent convertor status.

Treatment Regimens

Two treatment regimens for LTBI have been recommended by the CDC as enumerated in *Appendix 3 (Treatment Regimens for Latent Tuberculosis Infection).* The anti-tuberculosis medications used in these regimens differ in their dosages, potential toxicities, and monitoring requirements. Ingestion of ***all*** doses of medication for treatment of LTBI will be directly observed via pill line.

Medication administration should be documented using the *Federal Bureau of Prisons Tuberculosis Preventive Treatment Program Medication Administration Record.* All doses should be administered in unit doses and directly observed. Effective determination of treatment completion is based upon doses taken, rather than time elapsed.

The two standard options for treatment of LTBI are outlined below.

- **Isoniazid (INH): 6 to 9 months** by mouth is the preferred treatment regimen for LTBI and should be prescribed unless other medical or logistical reasons warrant an alternative regimen. **Nine months of isoniazid should be administered for all HIV co-infected inmates and, whenever feasible, for all other inmates.** INH can be administered daily or twice weekly.
  - **Twice weekly: 15 mg/kg (maximum 900 mg)**, twice weekly, at least 2 days apart

    Total doses: 9 months = **76 doses**
    6 months = **52 doses**
  - **Daily: 5 mg/kg (maximum 300 mg)**, daily (at physician discretion)

    Total doses: 9 months = **270 doses**
    6 months = **180 doses**

  Pyridoxine should ordinarily be prescribed concurrently with isoniazid, usually as 50 mg per

dose of isoniazid. Pyrodixine helps prevent neuropathy and other isoniazid-related side effects in at-risk populations.

Drug interactions between isoniazid and phenytoin increase the serum concentrations of both drugs; therefore, serum levels of phenytoin should be monitored monthly and adjusted as necessary for patients taking both medications.

- **Rifampin (RIF): 4 to 6 months**, administered daily, is an acceptable alternative treatment regimen for LTBI. Efficacy data for this regimen are not as strong as for isoniazid; therefore isoniazid is the preferred regimen. Rifampin interacts with many drugs, including anti-retroviral drugs and coumadin and may reduce the effectiveness of these and other drugs. The prescribing clinician and pharmacy staff should review drug interactions carefully whenever prescribing rifampin. Dosing is as follows:
  - **Daily: 10 mg/kg (maximum 600 mg) daily** (cannot be administered intermittently)

    Total doses: 4 months = **120 doses**
    6 months = **180 doses** (preferred with HIV co-infected)

- **Rifampin and Pyrazinamide:** The use of rifampin and pyrazinamide for treatment of LTBI is ***not*** recommended due to unacceptably high rates of hepatotoxicity.

Special Considerations

Contraindications

Treatment of LTBI should not be initiated if contraindications to treatment exist, including but not necessarily limited to the following:

- **Radiologic or clinical evidence of active TB disease**.
- **Symptoms or signs of active hepatitis** or other medical conditions that would complicate treatment. Some experts recommend that isoniazid be withheld if a patients' transaminase level exceeding 3 times the upper limit of normal, if associated with symptoms, or exceeding 5 times the upper limit of normal, if the patient is asymptomatic. Inmates with significant elevations in liver transaminases should be considered for LTBI treatment only if they are at high risk of developing active TB disease. Consultation with a physician with expertise in treating LTBI is recommended.
- History of adverse reactions to medications prescribed for LTBI.

HIV co-infection

Persons with HIV infection and LTBI are at significant risk of developing active TB disease and are therefore considered priority candidates for treatment. Nine months of isoniazid treatment is recommended. Inmates with HIV infection who are close contacts of a person with infectious TB disease should be considered for treatment, regardless of TST results.

Pregnancy

Pregnancy itself does not significantly influence the pathogenesis of TB or the risk of LTBI progressing to active TB disease; therefore, treatment of LTBI with isoniazid is not routinely

recommended during pregnancy. Daily or twice weekly isoniazid for 6-9 months should be prescribed 1-2 months following delivery in most cases. Pregnant women at high risk of developing TB disease (e.g., positive TST and history of close contact to an active TB case, recent convertors, or with concurrent HIV infection or other immunosuppressive conditions) should be considered for isoniazid treatment of LTBI during pregnancy with close monitoring for hepatitis. No harmful effects on the fetus have been observed with isoniazid therapy.

Old TB

Inmates with abnormal CXRs suggestive of prior TB infection should be evaluated on a case by case basis in consultation with physicians experienced in diagnosing TB. Calcified solitary pulmonary nodules, calcified hilar lymph nodes, and apical pleural capping usually represent primary healed TB, rather than active TB disease. Treatment of LTBI in persons with evidence of primary healed TB depends on the patients' history, TST results, and risk factors for TB disease. Persons with old fibrotic changes on CXR suggestive of previous infection with TB, a positive TST of ≥ 5 millimeters, without evidence of active disease and no history of treatment for TB should be considered for treatment of LTBI. If the person can produce sputum, sputum examination is warranted to rule out active TB disease prior to initiating treatment of LTBI in persons with fibrotic changes on CXR. In some symptomatic cases, clinicians may elect to initiate treatment for TB disease while awaiting sputum culture results for *M. tuberculosis*.

BCG vaccination

A history of BCG vaccination, with or without a BCG scar, should be ignored as a factor in deciding to offer treatment.

Contacts to multiple drug resistant TB (MDR-TB)

Consultation with a TB expert is recommended when treating contacts of persons with MDR-TB.

Anti-TNF alpha drugs (tumor necrosing factor alpha antagonists)

A new class of immunosuppressive drugs utilized for treatment of inflammatory conditions, anti-TNF alpha drugs are associated with increased risk of TB disease. These agents include: infliximab (Remicade®), etanercept (Enbrel®), and adalimumab (Humira®). Whenever clinically feasible, inmates with a history of a positive TST (>5mm) should start treatment for LTBI before commencing TNF-α blocking agents. The preferred regimen is *9 months* of isoniazid. Consider postponing TNF-α antagonist therapy until the conclusion of treatment for LTBI or TB disease.

Monitoring Treatment

Inmate counseling

Inmates should be counseled by health care staff about the importance of adherence to every dose of treatment for LTBI. Pharmacy staff, and other health care staff as appropriate, should educate inmates about potential drug side effects, especially the signs and symptoms of hepatitis and the reason for pyridoxine co-administration. Group counseling or other structured educational efforts should be considered for inmates who refuse treatment for LTBI when treatment is clearly indicated.

Monitoring drug side effects

The risk of hepatitis from isoniazid is low, but may be increased in older persons (>50 years of age), and for women during the third trimester of pregnancy and postpartum. Inmates should be interviewed monthly by a health care provider for symptoms of anorexia, nausea, vomiting, dark urine, icterus, rash, persistent paresthesias of the hands and feet, fatigue or weakness lasting 3 or more days, abdominal pain, easy bruising or bleeding, and arthralgias. Inmates who are nonadherent to treatment, or who report symptoms suggestive of an adverse drug reaction or a serious drug side effect, should have medications held and be immediately referred to a clinician for further evaluation.

All inmates should have baseline liver transaminases measured and should be subsequently monitored for signs and symptoms of hepatitis and other medication side effects. Monitoring liver transaminases is not routinely recommended during treatment of LTBI. However, liver transaminases, and liver function tests as indicated, should be monitored periodically for inmates with the following indications:

- Significant elevations in baseline liver transaminases.
- Chronic liver disease from alcohol, viral hepatitis or other etiologies.
- Other potentially hepatotoxic drugs concurrently prescribed.
- History of previous adverse reactions to the medications used in treating LTBI.
- Pregnancy.

Treatment for LTBI should ordinarily be discontinued if liver transaminases exceed 3 times the upper limit of normal, if associated with symptoms of hepatitis, and 5 times the upper limit of normal, if the inmate is asymptomatic.

The most important measure for preventing severe hepatitis is to *stop* TB medications as soon as signs and symptoms of hepatoxicity occur.

Evaluation of drug side effects for inmates receiving treatment for LTBI should be documented using the *Federal Bureau of Prisons Side Effect Interview and Monitoring Form for LTBI* (available in both English and Spanish). The form requires the inmate's signature upon the initiation of treatment. Health care staff should read the form to illiterate inmates. The form should ordinarily be maintained by pharmacy or nursing staff, made available to clinicians for review, and a copy placed in the inmate's medical record at the completion or discontinuation of treatment.

Clinician follow-up care

Routine follow-up clinician evaluations during treatment of LTBI should be scheduled on a case by case basis as determined by the responsible physician. Inmates with baseline elevations of liver transaminases or other complicating medical conditions should be followed closely. CXRs, other than baseline, are not indicated during treatment of LTBI unless symptoms of TB disease develop during treatment.

Interruption or discontinuation of treatment

Inmates failing to complete a treatment regimen for LTBI on 2 or more occasions should be evaluated to determine if additional retreatment efforts are clinically prudent, based on the inmates' risk factors for TB disease, previous cumulative doses of administered treatment, and anticipated adherence to therapy.

The following practical decision rule should be applied when reinstituting therapy for inmates who have stopped taking their medications for LTBI or who have had therapy interrupted for medical reasons:

- *If 50% or fewer of doses have been missed within the intended treatment period, then add doses onto the end of treatment.*
- *If greater than 50% of doses have been missed within the intended treatment period, then restart therapy.*

In either situation, when therapy is reinstituted after an interruption of more than 2 months, a medical examination to rule out active TB is indicated.

Documentation of treatment regimen

Treatment of LTBI should be documented by the responsible physician and other health care staff as appropriate, using the *Federal Bureau of Prisons Treatment Record for Latent Tuberculosis.* The form should be maintained in the inmate's medical record and documentation updated as follows:

- At the baseline evaluation and initiation of treatment.
- Whenever treatment is interrupted or discontinued.
- At the completion of treatment.

Inmates who refuse treatment for LTBI should sign a refusal form to be kept in their medical record, documenting their declination of treatment.

5. Diagnosis of Active Tuberculosis Disease

The expedient diagnosis of contagious TB is critical for providing effective treatment and for preventing TB transmission in the correctional setting. Diagnosis of active TB disease is summarized in *Appendix 4 (Components of a Tuberculosis Diagnostic Work-Up)* and includes a medical history, physical exam, TST (unless prior positive TST or TB is already culture confirmed), CXR, and bacteriology.

Diagnostic Issues

Although many inmates with active TB disease are symptomatic with a positive TST and characteristic abnormal CXRs (upper lobe/cavitary lesions), correctional health care providers should maintain a high index of diagnostic suspicion for TB and be alerted to the following:

- **A negative TST does not rule out active TB:** The TST is not a sensitive test for detecting TB disease. An estimated 25% of patients with active TB disease will have a negative (0 millimeter) TST, particularly if immunocompromised.
- **Inmates with active TB disease may appear healthy and deny symptoms.**
- **Culture-negative pulmonary TB:** Negative AFB smears and cultures do not rule out a diagnosis of pulmonary TB. Patients with abnormal CXRs and symptoms compatible with TB should be treated presumptively and observed for radiographic and symptomatic improvement. Individuals on anti-tuberculosis treatment with CXR improvement and negative cultures are considered to have culture-negative TB.
- **Important risk factors for TB** are foreign birth, HIV infection, alcoholism, chronic renal failure, diabetes mellitus, neoplastic diseases, anti-TNF alpha drugs, and drug abuse.
- **Extrapulmonary TB** can occur in nearly any organ of the body and should always be considered when an inmate presents with a fever or infection of unknown etiology that does not respond to routine antibiotic therapy. Extrapulmonary TB is usually more difficult to diagnose than pulmonary TB. Presentations may include lymphadenitis (painless swelling of one or more lymph nodes), pleuritis, pericarditis, renal disease (mild dysuria/hematuria/flank pain/sterile pyuria), skeletal disease (arthritis/bone pain/bone deformities), meningitis, peritonitis, and epididymitis.

  At any site, evidence of necrotizing or caseating granuloma on pathology report is presumed to be indicative of TB unless proven otherwise. Co-existent pulmonary disease should be ruled out in all cases of extrapulmonary disease.

Medical History and Physical Exam

- **Medical history** should focus on history of TB exposure, prior TST results, and prior TB infection or disease. Demographic information should include country of origin, occupation, incarceration history, and other factors that might increase the persons' risk of TB. Evaluating health care providers should assess medical conditions that increase the risk for developing TB, if infected (see *Appendix 1*), and assess patients for TB symptoms such as fever, weight loss, cough for greater than 3 weeks, hemoptysis, and chest pain.
- **Physical examination** is not useful for confirming or ruling out a TB diagnosis but can provide valuable information on the extent of TB disease and presence of relevant co-morbid conditions.

Chest Radiograph Manifestations of TB

Below are listed typical radiographic features of pulmonary TB:

- **Location:** apical and/or posterior segment of right upper lobe, apico-posterior segment of left upper lobe, or superior segment of either lobe. (Reactivation pulmonary TB commonly presents with cavitary upper lobe disease.)
- **Infiltrate:** fibronodular, variable coalescence and, cavitation.
- **Cavities:** thick, moderately irregular walls; air-fluid levels uncommon.
- **Volume:** progressive, often rapid loss of volume with the involved segment(s) or lobe(s).

- **Adenopathy:** hilar adenopathy common in HIV infected persons and young children.

Note: *Pulmonary TB, however, may exist even when the CXR is completely normal or mildly abnormal, particularly with HIV co-infection. With advanced HIV infection, other atypical presentations of active TB disease are common, including lower lung zone infiltrates without cavities, and intrathoracic lymphadenopathy without pulmonary infiltrates.*

Diagnostic Microbiology

Specimen collection

Self-induced sputum specimens collected from TB suspects should be obtained in a sputum induction booth or in an airborne infection isolation (AII) room by health care providers wearing adequate personal respiratory protection. Inmates should be instructed prior to coughing that nasopharyngeal discharge and saliva are not sputum; rather the specimen material sought is brought up from the lungs after a deep productive cough. Watery specimens are acceptable. A series of at least 3 specimens should be collected (at least 8 hours apart, including one early morning specimen). Specimens should be transported to the laboratory as soon as possible. A state laboratory or other reliable TB laboratory recommended by the State Health Department should be utilized.

If the patient is unable to produce sputum, sputum induction can be performed utilizing an aerosol of sterile hypertonic saline produced by an ultrasonic nebulizer**. Sputum induction should be performed either in an AII room or in a community-based medical facility where adequate infection control measures can be ensured.** If pulmonary TB disease is suspected, but sputum specimens cannot be obtained, more invasive diagnostic procedures such as bronchoalveolar washes or transbronchial biopsies should be considered.

Laboratory examination

- **AFB smears** can be processed and reported within hours of receiving a sputum specimen and thus provide a rapid diagnostic tool for detecting *M. tuberculosis*. An estimated 50-80% of persons with pulmonary TB have positive sputum smears; however, AFB smear positivity does not confirm the diagnosis of pulmonary TB. Furthermore, AFB smears are not specific for *M. tuberculosis*, since the presence of other nontuberculous mycobacteria can also result in AFB smear positive sputums. Negative AFB smears do not rule out active TB disease.
- **AFB cultures:** All clinical specimens suspected of containing *M. tuberculosis* should be inoculated onto culture media. Culturing is more sensitive than microscopy (AFB smear positivity), allows for the precise identification of the mycobacterial species, and permits drug susceptibility testing and genotyping. Laboratory contamination (resulting in false positive *M. tuberculosis* cultures) should be suspected when the specimen is AFB smear negative, has a single positive culture, a low colony count (on conventional media), and a clinical presentation uncharacteristic of TB.
- **Drug susceptibility testing** should be performed on all positive cultures for *M. tuberculosis*. The use of broth systems for culturing mycobacteria should be utilized whenever possible, since this method permits more rapid detection of organisms (1-3 weeks) than solid media (3-8 weeks).

- **Nucleic acid amplification tests** can detect *M. tuberculosis* within hours and are useful for the rapid diagnosis of TB disease in certain clinical situations. Confirmatory bacterial cultures and sensitivities should also be obtained regardless of the results of nucleic acid amplification (NAA) testing. Two licensed tests are available: MTD® and Amplicor®.

  Interpretation of NAA results: (1) A positive NAA test with either an AFB positive or negative smear is highly predictive of TB disease. (2) A negative NAA test occurring with a positive AFB smear indicates that the AFB are much more likely to be non-tuberculous mycobacteria rather than *M. tuberculosis*; these results may lead the clinician to discontinue isolation, discontinue anti-TB treatment and stop initiation of a contact investigation. The diagnosis in such a case will depend on the overall clinical picture, clinical judgment, and repeat testing by either NAA or other methods of growth and detection. (3) A negative direct NAA test on an AFB smear negative specimen has no clinical relevance.

DNA Fingerprinting

DNA fingerprinting (genotyping) of the organism is indicated for investigating possible TB outbreaks or laboratory contamination in consultation with state health departments and Central Office HSD.

Reporting Suspected/Confirmed Tuberculosis Cases

Any inmate diagnosed with suspected or confirmed TB, who is placed on multi-drug TB treatment, should be promptly reported to Regional and Central Office HSD and to the local health department in the jurisdiction where the facility is located. TB suspects should be reported, even if there is no bacteriologic confirmation of the case. If a Witness Security (WITSEC) case is diagnosed with active TB, this should be reported first to the Inmate Monitoring Section of the Correctional Programs Branch *prior* to reporting the case to local health authorities.

6. Treatment of Tuberculosis Disease

The goal of TB treatment is to interrupt TB transmission, prevent acquisition of drug resistance, and cure the patient. Any deviations to the standard regimen are rarely indicated. Recommended TB treatment regimens and drug doses are outlined in *Appendix 5 (Standard Tuberculosis Treatment Regimen)*, *Appendix 6 (First-Line Tuberculosis Drug Doses)*, and *Appendix 7 (Tuberculosis Treatment Regimens - Special Situations).* The following general principles should be adhered to when treating confirmed or suspected TB patients.

General Principles

- **Four-drug initial therapy** is routinely recommended for all inmates with a clinical or laboratory diagnosis of TB disease. The initial use of 4 drugs is essential to minimize the development of further drug resistance.
- **Never treat active TB with a single drug**.
- **Never add a single drug to a failing TB treatment regimen.**

- **All TB medications should be administered by directly observed therapy (DOT)** to ensure adherence to the prescribed treatment regimen and reduce the emergence of resistant disease. DOT means watching the inmate swallow each dose of TB medication.
- **Seek consultation:** A physician consultant with expertise in TB treatment and the local or state health department should be consulted for any of the following TB cases:
  - Failure of sputum cultures to convert to negative, following 2 months of therapy.
  - Resistance to rifampin, with or without resistance to other drugs.
  - HIV co-infection, drug intolerance, pregnancy, or other situations requiring deviation from a standard treatment regimen.

Standard Tuberculosis Treatment Regimen

Standard TB treatment occurs in two phases and is outlined in *Appendix 5*.

- **Initial phase:** The initial phase consists of 8 weeks of isoniazid (INH), rifampin (RIF), pyrazinamide (PZA), and ethambutol (EMB) and is administered *daily for 2 weeks*; then, therapy is switched to *twice weekly for an additional 6 weeks*.
- **Continuation phase:** The continuation phase consists of 18 weeks of INH and RIF administered twice weekly.

  Never switch to a 2-drug regimen of isoniazid and rifampin before drug sensitivities confirm non-resistant TB.

All TB medications should be prescribed according to the inmate's weight (see *Appendix 6*) and adjusted appropriately with weight changes. In certain cases in which MDR-TB is suspected, alternative treatments with 4 or more drugs may be indicated, but should be prescribed only in consultation with a TB expert and the local or state health departments. TB treatment regimens may require adjustments once drug susceptibility tests become available. Modifications to the standard treatment regimen are necessary in the special situations outlined below.

Special Situations

Culture-negative, pulmonary TB

Clinical and/or radiographic improvement following empiric treatment for pulmonary TB, with negative cultures, is strongly suggestive of culture-negative pulmonary TB. Medications should be continued. If the clinical response to treatment is satisfactory, treatment for culture-negative TB can be usually be discontinued after a total of 16 weeks. HIV infected persons and those with cavitation should be treated with a full 6 months of therapy.

Extrapulmonary TB

Extrapulmonary TB is generally treated using the same drug regimens as pulmonary TB. Treatment is generally extended for bone and joint disease (6 to 9 months) and TB meningitis (9 to 12 months) with the duration of treatment determined individually based upon clinical response. Serial bacteriologic evaluations may be limited by disease location; therefore, treatment response must be judged on the basis of clinical, and/or radiologic findings.

HIV co-infection

Management of HIV-related tuberculosis is complex and requires consultation from experts in the management of both HIV disease and tuberculosis. Persons with TB complicated by HIV co-infection usually respond adequately to the standard, recommended 6-month TB treatment regimen. However, drug side effects are more frequent and bacteriologic response may be less sustained, necessitating careful monitoring and, when necessary, extended treatment.

- **CD4+ T-cells <100/mm^3:** An alternative, more intensive regimen is specifically recommended for patients with HIV infection and a low CD4+ T-cell count, because persons in this category have experienced higher than expected rates of relapse with acquired rifampin-resistant TB during treatment. Standard TB drugs should be prescribed (INH, RIF, PZA, and EMB for 2 months, followed by INH and RIF for 2 months), but they should be administered either *daily* or *thrice (3x) weekly*.
- **Anti-retroviral therapy:** Treatment of TB patients with HIV infection already taking antiretroviral medications is particularly complicated and warrants consultation with an HIV/TB expert. In general, HIV co-infected persons who are taking antiretrovirals when diagnosed with TB should continue them. When anti-retrovirals are medically indicated, their initiation generally should be postponed for 2 to 3 months after starting TB treatment, due to pill burden and potential side effects. Protease inhibitors and non-nucleoside reverse transcriptase inhibitors interact with rifamycins (rifampin and rifabutin), potentially affecting drug selection and dosing for both TB and HIV medications. Treatment recommendations for the treatment of HIV co-infected TB patients on anti-retroviral therapy change rapidly. Consult the CDC website for regularly updated information about TB/HIV drug interactions, regimen options, and dosage adjustments at:

  www.cdc.gov/nchstp/tb/TB_HIV_Drugs/Table1.htm and

  www.cdc.gov/nchstp/tb/TB_HIV_Drugs/Table2.htm

- **Immune reconstitution:** TB disease and its associated systemic symptoms may be paradoxically exacerbated when persons with HIV co-infection are simultaneously treated with highly effective antiretroviral regimens that result in immune reconstitution with increased T-lymphocytes and enhanced cytotoxic activity against *M. tuberculosis*. If signs of clinical worsening on treatment occur, such findings should be attributed to a paradoxical reaction *only* after a thorough evaluation has excluded other possible causes. Changes in anti-TB or antiretroviral therapy are rarely necessary in persons with paradoxical reactions.

Cavitary TB with positive cultures at 2 months

Very high rates of relapse have been reported in patients who present with initially with cavitation on chest radiograph and whose sputum cultures remain positive after 2 months of treatment. Therefore, it is recommended that the continuation phase (INH and RIF) in such patients be extended an additional 3 months for a total of 9 months of treatment.

Renal insufficiency and end-stage renal disease

Renal insufficiency complicates the management of TB because some anti-tuberculosis medications are cleared by the kidneys. Management may be further complicated by the removal of some anti-tuberculosis agents via hemodialysis. For patients with a creatinine

clearance of <30 ml/minute or who are on renal dialysis, the alterations in dosing and frequency outlined in *Appendix 6* should be utilized. For patients on hemodialysis, medications should be given 3 times per week *after* dialysis.

Drug resistance and intolerance

Consultation with a TB expert should be sought when treating TB that is complicated by either drug resistance or intolerance. Generally recommended treatment regimens for drug resistance or intolerance are outlined in *Appendix 7*.

Multiple drug resistant TB (MDR-TB), defined as resistance to at least isoniazid and rifampin, can generally be treated successfully with a prolonged treatment regimen if managed appropriately. There have been recent reports of extensively drug resistant TB (XDR-TB) which is defined as resistance to isoniazid and rifampin *plus* resistance to any fluoroquinolone *and* at least one of 3 injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin). XDR-TB is an emerging global pathogen associated with very poor treatment outcomes which requires expert consultation.

Monitoring Treatment

All inmates with active TB disease should be monitored at least monthly by a physician to evaluate the clinical response to therapy and to monitor side effects of medications. Baseline laboratory studies, TB medication regimens, and monitoring of adverse reactions should be in accordance with the parameters outlined in *Appendix 8 (Monitoring for Tuberculosis Treatment Response and Adverse Reactions)* and the following guidelines:

- **Bacteriologic conversion:** Inmates with sputum cultures positive for *M. tuberculosis* should have **3 adequate morning sputum cultures obtained every month until sputum cultures convert to negative**. Inmates who cannot voluntarily provide a sputum sample at a BOP facility should have sputum induction performed in an AII room or should be sent to an appropriate community health care facility. **A final sputum culture should be obtained at the completion of successful treatment as a reference culture (if the patient can produce sputum). Sputum cultures positive for *M. tuberculosis* after 2 months of drug treatment may indicate ineffective therapy.** For those failing to convert sputum cultures within 2 months, repeat drug sensitivities should be obtained. Inmates with TB disease who do not respond to standard drug therapy by 2 months of treatment may be nonadherent to their medication regimen or may have malabsorption, drug interactions, or other problems resulting in subtherapeutic serum drug levels. Persons with chronic gastrointestinal disease (e.g., Crohn's disease or HIV-related diarrhea) are particularly at risk for drug treatment failure. Serum drug levels should be obtained to document the adequacy of medication delivery for inmates with known malabsorption or who fail to respond to TB treatment.
- **Radiographic monitoring:** CXRs should be obtained at baseline, at the completion of therapy, and during treatment (when clinically indicated). Patients with suspected pulmonary TB and negative sputum cultures at 2 months should have a repeat CXR at that time. CXR improvement on treatment is indicative of culture-negative TB.
- **Monitoring for drug-induced hepatitis:** Three of the first-line TB medications (INH, RIF, and PZA) can cause drug-induced liver injury. Liver transaminases should be obtained at

baseline. Symptom screening for hepatitis (nausea, vomiting, abdominal pain, fatigue) should be reviewed at least monthly, and medications generally should be stopped if they occur. Monthly monitoring of liver enzymes should be considered for inmates with the following conditions:

- Baseline liver transaminases greater than the upper limit of normal.
- Chronic liver disease from alcohol, viral hepatitis or other etiologies.
- Other potentially hepatotoxic drugs prescribed. And
- Pregnancy.

Moderate asymptomatic increases in AST or ALT levels occur in nearly 20% of patients treated with the standard 4-drug regimen and do not indicate hepatic injury. In the absence of symptoms, therapy should *not* be altered because of these modest asymptomatic AST or ALT elevations, but the frequency of clinical and laboratory monitoring should be increased. However, if at any point liver transaminases are greater than 3 times normal (with symptoms) or greater than 5 times normal (without symptoms), hepatotoxic drugs should be stopped immediately and the patient should be evaluated carefully. Liver function studies should be measured. Screening tests for HAV, HBV, and HCV infections should be obtained in non-immune patients. Once the liver enzymes return to normal, the person should be rechallenged with TB medications, after consultation with a TB expert.

- **Monitoring for other TB drug toxicities:** Baseline complete blood count, platelets, and uric acid should be obtained in addition to LFTs. Thrombocytopenia is a rare toxicity associated with rifampin. Elevated uric acid can occur with pyrazinamide, but rarely necessitates a change in regimen. For patients treated with ethambutol, visual acuity (Snellen) and red-green color vision (Isihara) should be assessed at baseline, and monthly thereafter because of the risk of optic neuritis. For patients on prolonged treatment with ethambutol, optometry or ophthalmology evaluations are indicated every 3 months. Baseline and monthly creatinine and audiograms are indicated for inmates receiving streptomycin or other aminoglycosides, due to the risk of nephrotoxicity and ototoxicity.

7. Contact Investigations

The goal of a TB contact investigation is both to identify other active cases of TB (rare) and to identify and completely treat individuals with new latent TB infection, particularly those at high risk for developing the disease. The identification of a potentially infectious TB case in a correctional facility should always provoke a rapid response because of the potential for widespread TB transmission. Numerous outbreaks of TB have been reported in prisons and jails, especially among HIV-infected inmates. A prompt public health response can prevent a TB outbreak.

The decisions involved in planning and prioritizing contact investigations in correctional facilities are seldom clear cut and benefit from multi-disciplinary team input. Shortly after the case is diagnosed, the Clinical Director and the Health Services Administrator should convene a team of professionals who will plan the contact investigation. Ideally, the team should include staff from infection control, medical, nursing and custody. Contact investigations should also involve Regional and Central Office HSD staff. Generally, the local health department should also be consulted while conducting contact investigations, in accordance with pre-established

bilateral arrangements.

Transmission Factors

The following characteristics of the index case, the contacts and the exposure all influence the likelihood that TB transmission will occur.

- **Index case characteristics:** When an index case has either cavitation on CXR or AFB smear positive respiratory specimens, there is a much higher risk of TB transmission than if neither of those characteristics are present.
- **Contact characteristics:**
  - **Immunosuppression:** HIV infection is the greatest single risk factor for progression to TB disease in infected persons. Therefore, HIV-infected contacts should receive the highest priority for evaluation, even if they had shorter duration of exposure than other contacts. Persons receiving prolonged therapy with corticosteroids or other immunosuppressive agents should also be considered high priority for investigation.
  - **Age:** Young children (age ≤ 4) are at high risk for development of active TB disease and should be evaluated promptly. When an inmate identifies a young child (age ≤ 4) as a community contact, a health department referral should be made immediately.
- **Characteristics of the exposure:**
  - **Air volume:** The volume of air shared between an infectious TB patient and susceptible contacts is an important determinant in the risk of TB transmission. The larger the air space, the more infectious particles are distributed and the less likely they are to be inhaled.
  - **Ventilation:** Ventilation is an important factor in the risk of airborne transmission of disease. Exposures in confined air systems with little or no ventilation have been associated with increased TB transmission. The space where airborne infection spreads includes all space sharing the same air. Thus, if air circulates from the room occupied by an infectious patient into other rooms, the occupants of these rooms will also be exposed.
  - **Duration of exposure:** Even though transmission of TB can occur following a brief exposure, the likelihood of infection following exposure to an infectious patient is related to the frequency and duration of exposure. It is impossible to know what constitutes a significant duration of exposure for a given contact in a given environment before conducting contact screening. Priority should be given to inmates and employees who sustained the most exposure to the index case.

Decision to Initiate a Contact Investigation

The decision to initiate a contact investigation should be based upon the characteristics of the presenting case of TB. Contact investigations should be conducted in the following circumstances:

- **Individuals with suspected or confirmed pulmonary, laryngeal or pleural TB** *and*
  - **Cavitary disease on CXR** *or*
  - **Positive AFB smears** (sputum or other respiratory specimens).

    Note: *If the sputum smear is positive and a nucleic acid amplification test is negative, then TB is unlikely and a contact investigation may not be necessary.*
- **Individuals with suspected or confirmed pulmonary (non-cavitary) or pleural TB who have AFB negative smears** (sputum or other respiratory specimens): A more limited investigation should be conducted for AFB smear negative cases.

Contact investigations are generally not indicated for extrapulmonary TB cases (except for laryngeal and pleural) without pulmonary involvement.

Note: *In some patients with pulmonary TB, it may not be possible to collect sputum samples, and other types of respiratory specimens (e.g., those from bronchoscopy) may be collected. In this situation, the AFB smear and the mycobacterial culture results from the bronchoscopy, or other respiratory specimen, should be used as a surrogate for sputum in determining the need for and priority of the contact investigation. However, if the patient can produce sputum, it should always be collected, the result being used to guide the investigation.*

Prioritizing and Structuring the Contact Investigation

Unfortunately, there is no simple formula for deciding which contacts to screen in a correctional facility contact investigation. However, there are several basic principles to guide the contact investigation team in making decisions about structuring the investigation.

- **Promptly screen and initiate treatment for LTBI for all contacts with HIV infection** (regardless of duration/intensity of exposure).
- **Screen an identified group of contacts who are at highest risk for infection** (i.e., greatest duration of exposure or concentrated exposure in a confined space).
- **Calculate the infection rate** individually for each group of exposed persons, i.e., cell-mates, dorm-mates, co-workers, or exposed employees working in a dorm.
- **Decide how to structure investigation based upon the infection rates.**

If there is no evidence of transmission, then generally the investigation should stopped. If there is evidence of transmission, the investigation generally is expanded incrementally to groups with less exposure, until there is a group screened with minimal or no evidence of transmission.

There is no magic formula for determining if an infection rate is “significant” and therefore merits expansion of the investigation. The unique circumstances surrounding an investigation must be taken into account and evaluated in relation to calculated infection rates. Ideally, decisions about structuring the contact investigation should be made by the contact investigation team as a whole, seeking expert opinion from the state or local health department, as needed.

Sometimes, it is necessary to screen a 'convenience sample' first. For example, in jail investigations, many contacts may have been already released, and the only accessible contacts available to screen are those who remain incarcerated. If a significant number of high priority contacts cannot be fully evaluated, then a wider contact investigation may be indicated.

Focus should be placed on identifying the highest risk contacts, completely screening them *and* providing a full course of treatment of LTBI for those who are infected. **In general, avoid mass screening of everyone who has had any contact with the index case.** Such wide-scale investigations divert attention away from the high priority activities necessary to interrupt TB transmission in the facility, i.e., complete screening and appropriate treatment of the contacts who are most likely to have become infected. Very rarely is an index case so infectious that wide-scale expansion of the contact investigation is necessary.

Medical Evaluation of Contacts

The medical evaluation required depends upon both the HIV status of the contact and prior TST results.

- **All contacts** should be personally interviewed for symptoms of active TB and to encourage HIV testing (if status unknown). Symptomatic inmates should receive a CXR and complete medical evaluation by a physician, regardless of TST status, and should be isolated in an AII room if contagious TB is suspected from CXR or clinical findings. Asymptomatic inmate contacts do not require isolation. HIV testing should be recommended for all inmate contacts with unknown HIV status.
- **Inmates with a prior positive TST,** but who are HIV seronegative or unknown and asymptomatic, require no further follow-up. If HIV status is unknown, inmates should be tested for HIV infection.
- **All HIV seropositive contacts** should initiate a complete course of treatment for LTBI after ruling out active TB (by symptom review and CXR). Treatment should be initiated regardless of TST result, even for those with a history of prior treatment for LTBI or active disease, because of the possibility of re-infection. Those with a history of a negative TST should have a TST placed at baseline and again in 8 to 10 weeks. The results of the TST, while not affecting treatment decisions, provides important information for the whole contact investigation.
- **Prior TST negative inmates** (HIV seronegative): Mandatory tuberculin skin testing of all previously TST negative inmate contacts should be conducted at baseline (unless previously tested within 1 to 3 months of exposure) and repeated 8 to 10 weeks from the last contact with the source case. TST convertors (TST $\geq$ 5 mm) should be prescribed treatment for LTBI unless medically contraindicated. If inmate contacts refuse medically indicated isoniazid prophylaxis, they should be monitored by CXRs every 6 months for 2 years, if HIV seronegative, and every 6 months indefinitely, if HIV seropositive.

Contact Investigation Stepwise Procedures

Note: *See Appendix 10 (Tuberculosis Contact Investigation Checklist).*

(1) **Notify correctional management officials:** Identification of a TB case in a correctional setting can be alarming for inmates, correctional staff, and the community. Promptly notify the Warden through appropriate chains of command that a TB case has been identified in the institution, so that briefing and educational efforts can begin. Subsequently notify Regional and Central Office HSD staff.

(2) **Clinical assessment of case:** A clinical assessment of the case and case interview should be accomplished within one working day for inmates with AFB smear positive respiratory specimens or cavitary CXRs, and within 3 days for all others. The assessment should include a medical evaluation and retrospective chart review to help establish duration of symptoms. The following available data should be collected: history of previous exposure to TB, onset and history of TB symptoms (cough, fever, night sweats, weight history, i.e., documented weight loss), CXR reports, prior TST results, bacteriology results (AFB smears, cultures, susceptibilities), nucleic acid amplification tests, HIV status, and other medical risk factors *(Appendix 1).*

(3) **Case interview:** The case should be interviewed as soon as possible, probing about TB symptom history with a particular focus on duration of cough. Prompt with questions associating cough with particular holidays and events. Also interview the patient regarding common places of daily activity to identify groups of exposed contacts, beyond those in the housing unit. Ask about friends or close associates. Those who were incarcerated during the infectious period should also be interviewed to identify community contacts. Specifically question the inmate about any contact with HIV-infected persons or young children (age ≤ 4). Obtain locating information for community contacts. The case should be re-interviewed for contacts within 7 to 14 days.

(4) **Determine the infectious period:** The infectious period is determined to identify how far back in time the investigation of contacts should go. The infectious period should be determined as follows:

- **Generally:** onset of cough or 12 weeks prior to TB diagnosis (whichever is longer).
- **Exception:** 4 weeks prior to date of suspected TB diagnosis if no TB symptoms, with AFB smear negative and non-cavitary CXR.

(5) **Convene a contact investigation team:** Clearly identify a team leader, as well as the roles and responsibilities of each team member; establish a schedule of regular meetings with written minutes. Develop a communication plan and a plan for handling contact investigation data.

(6) **Update correctional management officials**, including the Warden, Regional staff, and Central Office HSD staff, regarding the strategy for beginning the contact investigation.

(7) Obtain index case inmate traffic history: Obtain the dates and locations of where the TB case was housed during the infectious period. Also obtain work and education assignment history.

(8) Tour exposure sites: Conduct a tour of each place where the suspect TB case lived, worked or spent time during the infectious period. The assistance of a facility engineer is often necessary to help characterize the ventilation system. The following information should be collected for each site: the number of inmates housed together, the housing arrangement (e.g., cells vs. dorms), the general size of the air space, the basics of the ventilation system (e.g., recirculated air), the pattern of daily inmate movement (eating, working, recreating), and the availability of data on potential inmate contacts.

(9) Prioritize contacts: Group contacts based upon duration/intensity of exposure. Those with the most exposure and those who are HIV infected or immunosuppressed (regardless of duration of exposure) are considered highest priority. Make urgent referrals to the local health department for community contacts who are HIV infected or young children.

(10) Develop contact lists: Obtain rosters of inmate and employee contacts from each location and research their current location. Generate lists of exposed contacts grouped by their current location, i.e., remaining incarcerated, transferred, or released.

(11) Conduct a medical record review on each high priority contact: Record TST history, CXR history, history of treatment for latent TB infection, HIV status, and other high risk medical conditions, reported respiratory symptoms, and country of origin.

(12) Initiate medical evaluation of contacts by first evaluating contacts who are HIV-infected. Both inmates and employees who are considered high priority contacts should be evaluated.

(13) Referral for contact evaluation should be made to the local health department for inmate contacts who have been released or transferred to another facility.

(14) Determine the infection rate by exposure site: The infection rate is calculated by dividing the number of inmates with TST conversions by the total number of skin tested inmates. If the initial contact investigation indicates that significant transmission of TB infection has occurred to other inmates or correctional staff, the contact investigation should be expanded to contacts with less exposure to the index case. The decision about whether or not to expand the investigation should be guided by the contact investigation team, in consultation with state or local health department investigators and the Central Office HSD.

(15) Follow-up TSTs on contacts to tuberculosis cases can be placed as soon as 8 weeks, and generally less than 12 weeks, after exposure to the index case ended. A record search should be done to determine current location of inmate contacts. Testing should be conducted for inmates and employees, and referrals made for those in need of a follow-up TST who have been either released or transferred.

(16) Determine the infection rate from the second round of testing. Decide if the investigation needs to be expanded.

(17) Write a summary report: Briefly summarize the circumstances of the investigation, what occurred, and the results of the investigation including associated cases and infection rates; forward the report through the Warden to the Regional and Central Offices HSD.

8. Infection Control Measures

Early Detection

The most important measure to prevent TB transmission in a correctional facility is to maintain a high index of suspicion for TB. Early identification and isolation of TB cases is critical to prevent further TB transmission. Most TB outbreaks reported from correctional facilities have involved a highly infectious case who remained undetected for a prolonged period.

All inmates should be screened for TB symptoms at intake. They should be counseled during orientation to the institution and, when appropriate, during clinical evaluations to recognize and promptly report symptoms of TB disease, as well as to participate in baseline and annual skin-testing to screen for TB infection. Inmates should be advised of the importance of completing treatment for either TB disease or LTBI if diagnosed. Inmates should be counseled that certain risks and conditions such as HIV infection, taking anti-TNF alpha drugs, diabetes, chronic renal failure, injection drug use history, and close contact with someone who is sick with infectious TB, all pose a greater risk for getting TB disease.

Airborne Infection Isolation (AII)

- **Initiation:** Inmates with suspected TB should be promptly isolated in an AII room (formerly known as a negative pressure isolation room–NPIR). See *Appendix 13 (Airborne Infection Isolation Guidelines)* for specific information about AII rooms and their maintenance. Inmates with suspected or confirmed active TB disease should be managed while incarcerated in accordance with BOP policy. If AFB smears are negative, but TB is suspected based on the clinical presentation and CXR findings, the inmate should be housed in an AII room during initial diagnosis and treatment. The inmate should be instructed to cover his or her mouth when coughing or sneezing.
- **Respiratory protection:** Inmates should be managed using airborne precautions and, personal respiratory protection, designed to prevent transmission of *M. tuberculosis*. All persons entering an AII room or transporting an infectious patient in a closed space should wear appropriate respiratory protection, in accordance with BOP policy and OSHA recommendations. The minimal acceptable form of respiratory protection to protect against TB transmission is an N-95 respirator. Respirators should only be utilized in the context of an OSHA-compatible respiratory protection program, including medical evaluation, fit-testing and training.
- **Maintenance of airborne infection isolation:** Inmates should be managed in an AII room in accordance with BOP policy and current CDC recommendations on ventilation and air change rates per hour for TB isolation (see *Appendix 13*).

Transport

During transport, a potentially infectious inmate should be instructed to wear a surgical mask (*without* an exhalation valve). Movement of the inmate should be limited to those situations where movement is required for medical or security purposes. If the TB suspect is in a confined space (e.g., emergency vehicle), others in the vehicle should wear respiratory protection.

Discontinuation of Isolation

Inmates with contagious TB disease should be assigned to an AII room until no longer infectious. Isolation is ordinarily maintained until all three of the following parameters are achieved:

- Treatment with a 4-drug regimen per these treatment guidelines, or another equally effective regimen, has been administered for at least 2 weeks by DOT; ***and***
- The inmate shows clinical evidence of improvement; ***and***
- Three consecutive sputum smears are negative (which have been obtained at least 8 hours apart, including one early morning specimen).

Special Situations

- **AFB smear negative TB suspects:** If sputum smears are all initially negative without cavitary disease, and the inmate is clinically improving, isolation in an AII room can be discontinued after 7 days of TB treatment on a case by case basis, in consultation with the Medical Director.
- **Suspected or confirmed drug resistance:** If drug resistance is suspected, isolation should be continued until drug sensitivities are documented, appropriate treatment has been initiated (based upon the pattern of drug resistance identified), the patient has had 3 negative AFB smears, and there is evidence of clinical improvement. It may take several weeks to obtain drug sensitivities. If multi-drug resistance is identified (defined as resistance to at least isoniazid and rifampin), then isolation should be continued until reports of 3 negative cultures are obtained. For XDR-TB, isolation should only be discontinued in consultation with the Central Office.
- **TB suspects discharged from a community hospital:** When TB suspects have been isolated in a community hospital and are being discharged back to a correctional facility, they should not be accepted back into general population until they meet all 3 of the standard criteria for discontinuing isolation: 3 negative AFB smears (obtained at least 8 hours apart—including one early morning specimen), on an appropriate treatment regimen for at least 2 weeks, and evidence of clinical improvement. If the patient is initially AFB smear negative and TB is suspected, the inmate can be accepted back into general population after 7 days of TB treatment, on a case by case basis.

Clearance Time for AII Rooms

The room should be appropriately purged of airborne contaminants before the room is used to house another inmate or is occupied without the use of protective respiratory protection. BOP AII rooms should not be entered without respiratory protection, for two hours after they have been exited by a patient with an airborne infectious disease.

9. Discharge Planning

Inmates receiving treatment for LTBI or TB disease should have their treatment plan coordinated with community providers by the time of release to help ensure continuity of care and to maintain public health. All inmates with active TB disease should have a specific plan for continuing treatment with the receiving state health department and local community public health providers. Specific referrals for community-based treatment of LTBI should be coordinated and secured when feasible. The treating physician and other health care providers can improve continuity of care for inmates upon release by initiating the following:

- Coordinating release planning with case managers and community corrections staff in accordance with BOP policy.
- Providing counseling to ensure the inmate understands importance of adherence to treatment and receives specific instructions for seeking care upon release.
- Securing consent for release of medical information in accordance with BOP policy.
- Supplying TB medications in accordance with BOP policy.

Appendix 11 (Tuberculosis Pre-Release Checklist) specifies the steps involved in assuring continuity of care. Utilize the National TB Controller Association *Interjurisdictional Tuberculosis Notification* form (obtain at http://www.ntca-tb.org) for referring those on treatment for active disease or LTBI or contacts in need of follow-up. State health departments will channel TB referrals to the appropriate local health departments. Links to all the state health departments can be found at the CDC website: http://www.cdc.gov/nchstp/tb/pubs/tboffices.htm.

The BOP facility should notify the health department if the inmate is an Immigration and Customs Enforcement (ICE) detainee, providing the date the detainee will be transferred to ICE, Alien (A) number, country of origin and contact information (address, telephone, relative, etc.).

For inmates who are foreign nationals, CURE-TB and TBNet are U.S.-based referral programs that assist mobile patients to access and complete TB treatment. CURE-TB, operated by the San Diego County Health and Human Services Agency TB Control Program, focuses on patients crossing the U.S.-Mexico border. TBNet, operated by the nonprofit Migrant Clinicians Network in Austin, Texas, specializes in migrant populations in the United States, including parolees. The programs are working together and with INS to assist detainees in continuing TB treatment on release from custody. These referral programs can be accessed as follows:

CURE-TB: http://www2.sdcounty.ca.gov/hhsa/ServiceDetails.asp?ServiceID=437

TBNet: www.migrantclinician.org/network/tbnet

10. TB Program Management

The Clinical Director and Health Services Administrator should work collaboratively to ensure that BOP TB policy and these Management of Tuberculosis Clinical Practice Guidelines are fully implemented. Particular attention should be focused on ensuring the following:

- TB symptom screening at intake is occurring according to BOP policy.
- TB suspects are contained and evaluated for contagious TB.
- All inmates with TB disease are treated in accordance with recommended guidelines.
- Contacts to TB cases receive appropriate evaluation and follow-up.
- Annual tuberculin skin testing of inmates is timely and data are evaluated, to detect unrecognized transmission of *M. tuberculosis*.
- Inmates are treated for LTBI in accordance with recommended guidelines.
- TB case reports and referrals are made to health authorities as appropriate.

Strategic measures should be monitored in order to assess the effectiveness of the TB program, such as the following:

- TST conversion rate.
- Completion of isoniazid (INH) therapy.

Definitions

Acid-fast bacilli (AFB) are bacteria that retain certain dyes after being washed in an acid solution. Most acid-fast bacilli are mycobacteria. When AFB are seen on a stained smear of sputum or other clinical specimen, a diagnosis of TB should be suspected; however, the diagnosis of TB is not confirmed until a culture is grown and identified as *M. tuberculosis*.

Airborne exposure is the condition of being subjected to an infectious agent that could have a harmful effect if airborne transmission occurs. A person exposed to *M. tuberculosis* does not necessarily become infected.

Airborne infection isolation (AII) precautions are protective measures used for patients/inmates and situations to prevent the spread of infections that can be transmitted by airborne contact with infectious agents that remain suspended in the air when indoors over a period of time. Precautions include the wearing of appropriate personal respiratory protection (i.e., high efficiency particulate air [HEPA] or N-95 respirator) for persons who come in direct contact with infectious airspace; the isolation of infectious patients/inmates in a private room with monitored, negative air pressure; and the implementation of necessary engineering controls to inform, direct, and protect persons entering the isolation rooms.

Airborne infection isolation rooms are rooms designed to maintain AII (see *Appendix 13*). Formerly called a negative pressure isolation room (NPIR), an AII room is a single-occupancy, patient-care room used to isolate persons with suspected or confirmed infectious TB disease. Environmental factors are controlled in AII rooms to minimize the transmission of infectious agents that are usually spread from person-to-person by droplet nuclei associated with coughing or aerosolization of contaminated fluids. AII rooms should provide negative pressure in the room (so that air flows under the door gap into the room), an air flow rate of 6–12 ACH, and direct exhaust of air from the room to the outside of the building or recirculation of air through a HEPA filter.

Anergy is the inability of a person to react to skin test antigens (even if the person is infected with the organisms tested) because of immunosuppression.

Anti-TNF alpha drugs (tumor necrosing factor alpha antagonists) are immunosuppressive drugs utilized for treatment of inflammatory conditions. They have been demonstrated to increase the likelihood of TB disease in those infected with TB who start on those drugs. These drugs include: infliximab (Remicade®), etanercept (Enbrel®), and adalimumab (Humira®).

BCG (Bacillus Calmette-Guerin) are vaccinations used in many parts of the world to prevent development of TB disease.

Booster phenomenon occurs when persons (especially older adults) many years after initial infection with *M. tuberculosis* have a negative reaction to an initial skin test, followed by a positive reaction to a subsequent skin test. The second positive reaction is caused by a boosted immune response, indicating latent TB infection.

Clearance time is the time between the discharge of an inmate isolated for TB precautions in a negative pressure isolation room and the arrival of another inmate or other person(s) who will occupy the room without the use of airborne precautions.

Clinician is a physician or mid-level provider.

Contact is a person who has shared the same air with a person who has infectious TB for a sufficient amount of time to allow possible transmission of *M. tuberculosis*.

Culture is the process of growing bacteria in the laboratory so that organisms can be identified.

Delayed-type hypersensitivity (DTH) reaction is a cellular immunologic response caused by lymphokines released from T cells that have been sensitized by prior infection with a specific antigen.

Directly observed therapy (DOT) of latent TB infection (LTBI) and TB disease is the practice of administering a unit dose of TB medication to an inmate by a clinician, nurse, pharmacist, or specially trained staff member who directly observes ingestion of each dose.

Drug susceptibility tests are the laboratory tests that determine whether the TB bacteria cultured from a patient are susceptible or resistant to various anti-tuberculosis drugs.

Index case is the initial person with suspected or confirmed infectious TB who may have been in contact with other persons, while sharing the same air space for a sufficient amount of time to allow possible transmission of *M. tuberculosis*.

Intradermal is within the layers of skin.

Latent tuberculosis infection (LTBI) is a condition in which a relatively small number of living tubercle bacilli (*M. tuberculosis*) are present in the body, but are not multiplying or causing clinically active disease. Although persons with LTBI usually have positive tuberculin tests, they have no symptoms or other objective evidence of TB disease and are not infectious to others. Persons with LTBI, however, have a lifelong risk for developing active TB disease.

Mantoux method is the most reliable method of TST, involving the intradermal injection of PPD-tuberculin into the forearm with a needle and syringe.

Multi-drug resistant TB (MDR-TB) is active TB caused by *M. tuberculosis* organisms that are resistant to at least isoniazid and rifampin, with or without resistance to other drugs.

Mycobacterium tuberculosis* (*M. tuberculosis) is the mycobacterial species that is the primary cause of active TB disease in the United States.

Negative pressure isolation room (NPIR) was the former nomenclature for a room designated for the isolation of patients with contagious TB disease, with adequate directional airflow, air exchanges, and exhaust. The new name is an airborne infection isolation (AII) room.

Personal respiratory protection is the use of respirators to protect a person from the transmission of airborne infectious agents. Particulate respirators indicated for protection against *M. tuberculosis* are selected and worn, based on recommendations from the Centers for Disease Control and Prevention and certification criteria from the National Institute for Occupational Safety and Health (NIOSH).

Positive (TST) is the induration measured in millimeters that develops after the intradermal injection of PPD-tuberculin, indicative of previous infection with *M. tuberculosis*. The extent of induration that determines a positive test depends on the medical history and risk factors of the person being tested in accordance with the following BOP policy:

≥5 millimeters is considered positive under the following conditions:

- Close contact to an active TB case
- HIV co-infection, and HIV risk factors with unknown HIV status
- Other immunocompromised conditions
- Systemic corticosteroids (equal to prednisone 15 mg for 1 month or more)
- History of organ transplantation or other immunosuppressive therapy
- Fibrotic changes on chest radiograph suggestive of inactive pulmonary TB
- Radiographic or clinical findings suggesting active TB
- Persons taking anti-TNF alpha drugs (e.g., infliximab, etanercept, and adalimumab)

≥**10 millimeters is considered positive for** all other inmates and correctional staff

Purified protein derivative (PPD) tuberculin is the most common agent used for tuberculin skin testing to evaluate the likelihood that a person is infected with *M. tuberculosis*.

Recent convertor is an individual who has a negative TST reaction that increases in reaction size by >10 millimeters (mm) within a period of 2 years; this is suggestive of recent infection with *M. tuberculosis*.

Smear (AFB smear) is the laboratory technique for visualizing mycobacteria. The specimen is smeared onto a slide and stained, then examined using a microscope. A large number of mycobacteria seen on an AFB smear from a person with TB usually indicates infectiousness. However, a positive smear is not diagnostic of TB because acid-fast organisms other than *M. tuberculosis* may be seen on an AFB smear.

Surgical mask is a disposable paper type mask used to prevent respiratory secretions from the person wearing the mask from entering into the air. Surgical masks should be worn by known or suspected infectious TB patients during transport.

Tuberculosis disease is a clinically active disease caused by organisms of the *Mycobacterium tuberculosis* complex, which are sometimes referred to as tubercle bacilli. Symptoms of TB disease depend on the site of active disease. Pulmonary TB, the most common form of TB, is characterized by chronic cough, hemoptysis, and chest pain. General symptoms of TB include fever, chills, night sweats, malaise, loss of appetite, and weight loss.

Two-step testing is baseline tuberculin testing that, if negative, is repeated to reduce the future likelihood of mistaking a boosted reaction for a new infection with *M. tuberculosis*. If the initial baseline TST result is classified as negative, a second test is repeated 1 to 3 weeks later. If the reaction to the second test is positive, it represents a boosted reaction indicating old latent TB infection. If the second test result is also negative, the person is classified as not infected with *M. tuberculosis*.

XDR-TB (extensively drug resistant TB) is defined as TB resistant to isoniazid and rifampin *plus* resistance to a flouroquinolone *and* resistance to at least one of three second-line injectable drugs, i.e., capreomycin, kanamycin or amikacin. It is an emerging global pathogen associated with very poor treatment outcomes.

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Appendix 1. Tuberculosis Risk Factors

Risk Factors for TB Infection	Risk Factors for TB Disease (if infected)
• Close contacts to infectious TB cases • Foreign born from high-incidence countries* • Injection drug users • Residents/Employees of: – prisons and jails – long term care facilities – hospitals and long term care facilities – homeless shelters • Mycobacteriology laboratory personnel • Children exposed to high risk adults	• HIV infected persons • TST convertors/recently infected • Fibrotic changes on chest x-ray, consistent with old-healed TB • Injection drug users • Certain clinical conditions: – organ transplant recipient – immunosuppressant therapy (equivalent to 15 mg prednisone/day for 1 month) – anti-TNF alpha therapy (e.g., infliximab, etanercept, and adalimumab) – silicosis – diabetes mellitus – chronic renal failure – leukemia/lymphomas – carcinomas of head, neck, lung – underweight (>10% under ideal weight) – gastrectomy/jejuno-ileal bypass
*For information about TB incidence rates by country, see: World Health Organization (home page on the internet). Global TB database. Estimated TB incidence. Available from: http://www.who.int/tb/country/global_tb_database/en/index.html	

Appendix 2. Tuberculin Skin Testing Guidelines

Screening Criteria	TST negative inmates: – Upon incarceration within the BOP* – Annually – When TB is suspected – As part of TB contact investigation	
Prior Positive TST	A baseline tuberculin skin test (TST) should generally be obtained on all new intakes to the BOP—regardless of an inmate's reported history of a prior positive TST—with the following exceptions: prior documentation of a positive TST while the inmate was incarcerated within the BOP; history of a severe reaction to a TST, e.g., swollen, blistering, (vesiculated) reaction; credible history of treatment for latent TB infection.	
Placement	– Specific training for placing and reading tests should be obtained. – Only BOP formulary tuberculin should be used. Keep refrigerated and store in the dark. – Skin tests should be administered as soon as possible after syringe is filled. – 0.1 ml (5 TU) tuberculin should be injected intradermally in the volar or dorsal surface of the forearm. – Tense white wheal (≥5 mm) should appear. If not replace at least 2 inches away.	
Reading	– Read 48 to 72 hours after placement. – Read palpated induration (not redness). – Measure transversely to the long axis of the forearm. – for no reaction, record "0 mm".	
TST Cut-Points	**≥5 mm**	– Close contact to an active TB case. – HIV co-infection (HIV risk factors and unknown status) or other immunocompromised condition. – Systemic corticosteroids, treatment for organ transplantation, or other immunosuppressive therapy (equivalent to15 mg prednisone per day for greater than 1 month). – Fibrotic chest radiograph changes suggestive of inactive TB. – Clinical or radiographic findings suggestive of active TB. – Anti-TNF alpha drugs (i.e., infliximab, etanercept, and adalimumab).
	≥10 mm	All other inmates
Two-Step Testing	Perform two-step testing for newly sentenced, foreign born inmates who have not had a TST in the last year. Procedure: Test as usual. If negative, repeat in 1 to 3 weeks. A positive reaction on the second test is considered a boosted skin test reaction (that is a baseline TST positive) and *not* a TST conversion.	
BCG	BCG vaccine is used in many countries to prevent TB disease in young children and is not a contraindication for a TST. Ignore BCG history when interpreting TST results.	
Pregnancy	Not a contraindication for tuberculin skin testing.	
* A baseline test should be obtained within the BOP unless there is a unique reason not to repeat a TST (as approved by the Regional Medical Director), i.e., repeated admissions from local detention facilities over a short period of time, or if one of the exceptions listed under "Prior Positive TST" are present.		

Appendix 3. Treatment Regimens for Latent Tuberculosis Infection

Regimen	Dosing	Comments / Side Effects	Monitoring (INH & RIF)
Isoniazid (INH) 6 to 9 months A 9 month regimen is recommended if HIV-infected; it is preferred for all others.	**Twice Weekly** 15 mg/kg (max: 900 mg) 6 mos: 52 doses 9 mos: 76 doses **Daily** 5 mg/kg (max: 300 mg) 6 mos: 180 doses 9 mos: 270 doses	**Comments:** Offer 6 months if 9 months is not feasible. If 6 months is not feasible, consider alternative regimen. Give pyridoxine (B6) 50 mg per dose of INH to prevent INH-associated peripheral neuropathy (may increase pyridoxine if neuropathy occurs). **Side Effects:** – anorexia – nausea/vomiting – dark urine – icterus – rash – parasthesias (hands or feet) – fatigue/weakness >3 days	**Baseline:** CXR to rule out active TB. If CXR is suggestive of old healed TB, should obtain 3 consecutive sputums (if possible). - Obtain baseline hepatic enzymes (ALT and AST). Bilirubin/LFTs if baseline hepatic enzymes are elevated. - HIV testing is routine for TST positive inmates. **Ongoing:** Monitor for signs and symptoms of drug side effects monthly. Monitoring of ALT/AST is not routinely necessary, but is indicated periodically if: – baseline LFTs are significantly increased – chronic liver disease – pregnancy – taking other hepatotoxic drugs
Rifampin (RIF) 4 months 6 months for HIV seropositive	**Daily only** 10 mg/kg (max: 600 mg) 4 mos: 120 doses	**Comments:** Efficacy data are not as strong as for isoniazid; therefore isoniazid is preferred. Rifampin has numerous drug interactions, including with anti-retroviral drugs and coumadin, and often reduces the effectiveness of other drugs. **Side Effects:** – hepatitis – fever – thrombocytopenia – GI upset – colors body fluids orange and stains contact lenses	

Clinical Notes:

- ALWAYS rule out active TB prior to starting treatment for LTBI.
- To prevent severe hepatitis, STOP the medications immediately if hepatitis symptoms occur.
- Monitor for side effects monthly. Instruct inmates to report any of the following signs of hepatotoxicity: anorexia, nausea, vomiting, GI upset, or dark urine.
- Consult a TB expert for treatment of contacts to multi-drug resistant TB.
- Refer to clinical guidelines: 'Indications for LTBI treatment' and 'Special Considerations' related to Old TB, HIV Co-infection, and Pregnancy.
- For interruptions in therapy:
  If ≤50% of doses are missed during the intended treatment period, continue therapy.
  If >50% of doses are missed during the intended treatment period, restart therapy.

Appendix 4. Components of a Tuberculosis Diagnostic Work-Up

Medical History	**TB history:** History of TB exposure, prior TSTs, prior TB infection or disease, risk factors for drug resistant TB (history of incomplete treatment, foreign birth, incarceration). **Demographics:** Country of origin, occupation, incarceration history, and other factors which might increase the persons' risk of TB **Medical conditions:** Conditions that increase risk for developing TB if infected (*Appendix 1*) or that may affect ability to tolerate TB treatment. **TB symptom history:** Fever, weight loss, cough >3 weeks duration, hemoptysis, chest pain.
Physical Exam	Cannot be used to confirm or rule out a TB diagnosis, but can provide valuable information about the persons' overall health status
Tuberculin Skin Test	Tests can be negative in the presence of active disease or HIV infection. TST not needed if disease is already confirmed with a positive culture.
Chest Radiograph	Posterior/anterior view initially; others as appropriate.
HIV	Test for HIV infection and, if infected, obtain CD4+ T-cell count and viral load.
Bacteriology	**AFB smear:** Indicates mycobacteria (may or may not be TB). **AFB culture:** Indicates mycobacterial growth (may or may not be TB). **MTB culture:** Indicates growth of *M.tuberculosis.* **MTB complex:** Indicates 1 of 4 mycobacterial organisms, including TB (presume TB). **Susceptibility Testing:** Should be done on all positive MTB cultures **Nucleic Acid Amplification:** - AFB smear positive or negative *and* NAA positive: Presume TB. - AFB smear positive & NAA negative: Generally presume TB is ruled out. - AFB smear negative & NAA negative: Result is not clinically relevant. - Always confirm with culture. **DNA fingerprinting (genotyping):** Useful in suspected outbreaks to help determine if TB cases are related. Contact local health department.
Histology	Pathology reports indicating caseating or necrotizing granuloma are presumed to be TB until proven otherwise.

Appendix 5. Standard Tuberculosis Treatment Regimen-6 Months*

Initial Phase - 2 months	Continuation Phase - 4 months
Drugs: INH, RIF, PZA, EMB **2 weeks daily, *then* 6 weeks twice weekly** (14 daily doses, *then* 12 twice-weekly doses)	**Drugs: INH, RIF** **18 weeks, twice weekly** (36 twice-weekly doses)
INH=isoniazid, RIF=rifampin, PZA=pyrazinamide, EMB=ethambutol	

Clinical Notes:

- Do not wait for confirmation of TB diagnosis to start treatment.
- Report suspected or confirmed cases to local health department.
- Ingestion of *all* drug doses should be directly observed by a health care worker.
- Pyridoxine (B_6) 50 mg should be administered with each dose of TB medication to prevent INH-associated peripheral neuropathy.
- Ethambutol can be discontinued once susceptibilities to INH, RIF, and PZA are known.
- Do not switch to 2 drugs until susceptibilities to both INH and RIF has been demonstrated (culture positive cases only).
- Drugs prescribed twice weekly should be administered 2 to 3 days apart.
- See *Appendix 8* for recommended baseline and monthly medical monitoring.
- Immediately begin discharge planning, particularly if release is anticipated during treatment.

*** Refer to *Appendix 7* for the following exceptions to the standard regimen:**

- culture-negative TB
- HIV infection
- pregnancy
- drug resistance
- failure to convert sputum cultures in 2 months
- bone/joint TB
- TB meningitis

Appendix 6. First-Line Tuberculosis Drug Doses

Drug	Daily (maximum dose)	Twice (2x)Weekly (maximum dose)	Thrice (3x) Weekly (maximum dose)
Isoniazid (INH)	5 mg/kg (300 mg)	15 mg/kg (900 mg)	15 mg/kg (900 mg)
Rifampin (RIF)	10 mg/kg (600 mg)	10 mg/kg (600 mg)	10 mg/kg (600 mg)
Rifabutin (RBT)	5 mg/kg (300 mg)	5 mg/kg (300 mg)	5 mg/kg (300 mg)
Pyrazinamide (PZA)[1]	15-30 mg/kg (2000 mg)	50-70 mg/kg (4000mg)	50-70 mg/kg (3000 mg)
Ethambutol (EMB) [1,2]	15-25 mg/kg (1600mg)	50 mg/kg (4000 mg)	25-30 mg/kg (2400 mg)
For Renal Insufficiency (creatinine clearance <30 ml / min.)[3]			
Isoniazid (INH)	5 mg/kg (300 mg)	Do not use	15 mg/kg (900 mg)
Rifampin (RIF)	10 mg/kg (600 mg)	Do not use	10 mg/kg (600 mg)
Pyrazinamide (PZA)[1]	Do not use	Do not use	25-35 mg/kg (3000 mg)
Ethambutol (EMB) [1,2]	Do not use	Do not use	15-25 mg/kg (2400 mg)

[1] Dosing for PZA and EMB is based on the 1994 Centers for Disease Control recommendations (ATS/CDC. Treatment of tuberculosis and tuberculosis infection in adults and children. Am J Respir Crit Care Med 1994;149:1359-1374). More recent (2003) CDC recommendations (ATS/CDC. Treatment of tuberculosis. Am J Respir Crit Care Med 2003;167:603-662) base PZA and EMB dosing on calculated "*lean body weight*." To reduce confusion necessitated by needing to separately calculate "*lean body weight*," this BOP guideline relies on the 1994 CDC recommendations for PZA and EMB dosing, which were based on *actual weight*. In the end, there is no significant difference between the 1994 and 2003 dosing recommendations.

[2] Start with EMB 15 mg/kg to reduce the risk of ocular toxicity. The use of 25 mg/kg should be reserved for patients requiring retreatment or drug resistant TB.

[3] For patients on hemodialysis, administer medication 3 times weekly after dialysis, using renal insufficiency dosing in the lower half of the table above.

Appendix 7. Tuberculosis Treatment Regimens in Special Situations

Situation	Months of Rx	Comments
Cavitary CXR & Culture (+) after 2 mos.	9	If initial CXR shows cavitation and sputums remain culture positive after 2 months of TB treatment, the continuation phase (INH and RIF) should be extended an additional 3 months (lasting 7 months instead of 4 months), for a total of 9 months of treatment.
Culture-negative	4	For persons with suspected pulmonary TB who have negative cultures, but clinical or radiographic improvement, the continuation phase can be shortened to 2 months for a total of 4 months of treatment. Exception: If HIV seropositive or cavitation on CXR, then treat for 6 months total.
Bone/Joint TB	9	Extend standard therapy to a total of 9 months.
CNS TB	9 to 12	For TB meningitis, extend standard therapy for a total of 9 to 12 months. Adjunctive dexamethasone use recommended. Consult a TB expert
HIV Co-Infection	usually 6	*CD4+ T cells <100/mm^3:* Due to increase risk of acquired rifampin resistance, give daily or thrice (3x) weekly. *CD4 + T cells≥100/mm^3:* Standard dosing. *Anti-retroviral therapy:* If taking anti-retrovirals at TB diagnosis, continue them. When anti-retrovirals are medically indicated, their initiation generally should be postponed for 2 to 3 months after start of TB treatment. Patients on protease inhibitors and non-nucleoside inhibitors may need medication adjustments because of drug interactions with rifampin. Consult an HIV/TB expert. Consult: www.cdc.gov/nchstp/tb/TB_HIV_Drugs/Table1.htm and www.cdc.gov/nchstp/tb/TB_HIV_Drugs/Table2.htm
Pregnancy	9	Treat without delay. Start with INH, RIF, and EMB (not PZA). Discontinue EMB once INH and RIF susceptibility has been demonstrated. Continue INH and RIF. Give equivalent of pyridoxine 50 mg/day (unless already taking the equivalent in a prenatal vitamin).
Renal Disease	6	If creatinine clearance <30 ml/min. or on renal dialysis, alter dosing. If on hemodialysis, give 3 times weekly after dialysis (for dosing see *Appendix 6*).
Treatment Regimens for Drug Resistance or Intolerance		
INH	6	Once resistance to INH is known or INH intolerance identified, discontinue INH and continue RIF, PZA, and EMB for the duration of therapy.
RIF	9 to 12	For rifampin resistance or intolerance, treat for 12 months with INH, PZA, EMB, and a flouroquinolone. An injectable agent (e.g., streptomycin) for the first 2 months should be considered for more extensive disease or if a shorter duration of therapy (9 months) is desired.
PZA	9	For PZA resistance or intolerance, treat for 9 months with INH and RIF.
INH / RIF	18 to 24	Multiple drug resistant (MDR-TB). Must be closely managed in consultation with a TB expert, utilizing multiple drugs to which the organism is sensitive.

Appendix 8. Monitoring TB Treatment Response & Adverse Reactions

Monitoring	Baseline	Monthly	Comments
TB Treatment Response			
Chest Radiographs	PA/ Lateral	Initial PRN End of Tx	After initial CXR, only repeat if clinically indicated. With suspected culture negative TB, perform a CXR at 2 months to evaluate for CXR improvement. For pulmonary cases, a CXR should be obtained when treatment is completed.
Sputums	Daily, on 3 consec Days	Obtain 3 monthly until culture conversion	Obtain 3 early morning sputums monthly until culture conversion is documented. Extend treatment if culture conversion occurs after 2 months of treatment. If patient can produce sputum at the end of treatment, then obtain sputums.
Vital Signs/ Weight	X	X	Weight and temperature are often a critical measure of treatment response
TB Signs and Symptoms	X	X	Check for cough, hemoptysis, chest pain, fever, night sweats, fatigue, and malaise.
Adverse Reactions			
Blood Work	X	Varies	Baseline liver function tests, uric acid and complete blood count including platelets. Monthly liver function tests should be done only for those with: – abnormal baseline liver function tests – development of hepatitis symptoms – HIV infection – history of heavy alcohol use, liver disease, or chronic hepatitis
Vision	X	while on EMB	While on ethambutol, check visual acuity (Snellen) and color vision (Isihara). If on EMB greater than 3 months, evaluation by an ophthalmologist is required.
Signs and Symptoms	X	X	Check for nausea, vomiting, abdominal pain, decreased appetite, jaundice, dark urine, rash/ itching, joint pains, and tingling extremities.

Appendix 9. Dosage Chart for Tuberculosis Drugs

Weight		Weight Adjusted Dosages (mg/kg)								
lb	**kg**	**5 mg/kg**	**10 mg/kg**	**15 mg/kg**	**20 mg/kg**	**25 mg/kg**	**30 mg/kg**	**40 mg/kg**	**50 mg/kg**	**70 mg/kg**
77	**35**	175	350	525	700	875	1050	1400	1750	2450
88	**40**	200	400	600	800	1000	1200	1600	2000	2800
99	**45**	225	450	675	900	1125	1350	1800	2250	3150
110	**50**	250	500	750	1000	1250	1500	2000	2500	3500
121	**55**	275	550	825	1100	1375	1650	2200	2750	3850
132	**60**	300	600	900	1200	1500	1800	2400	3000	4200
143	**65**	325	650	975	1300	1625	1950	2600	3250	4550
154	**70**	350	700	1050	1400	1750	2100	2800	3500	4900
165	**75**	375	750	1125	1500	1875	2250	3000	3750	5250
176	**80**	400	800	1200	1600	2000	2400	3200	4000	5600
187	**85**	425	850	1275	1700	2125	2550	3400	4250	5950
198	**90**	450	900	1350	1800	2250	2700	3600	4500	6300
209	**95**	475	950	1425	1900	2375	2850	3800	4750	6650
220	**100**	500	1000	1500	2000	2500	3000	4000	5000	7000
231	**105**	525	1050	1575	2100	2625	3150	4200	5250	7350
242	**110**	550	1100	1650	2200	2750	3300	4400	5500	7700

Appendix 10. Tuberculosis Contact Investigation Checklist

After identification of a TB case or suspected case, the inmate should be immediately isolated, medically evaluated, and, if appropriate, treated. The case should be immediately reported to the local or state health department. The contact investigation steps outlined below may overlap in time. As soon as close contacts are identified, they should be promptly evaluated.

√	Date	Task
		1. Notify correctional management officials
		2. Clinical assessment of case (including retrospective chart review): ▪ previous exposure to TB ▪ history of TB symptoms (cough, fever, night sweats, etc.) ▪ weight history ▪ chest radiographs ▪ TST ▪ bacteriology (AFB smear/culture/susceptibilities), nucleic acid amplification tests ▪ HIV status ▪ other medical conditions
		3. Case interview. For AFB smear-positive or cavitary cases, interview within 1 day; for all others, interview within 3 days. Re-interview in 7-14 days. Interview for: ▪ TB symptom history/onset of symptoms ▪ close contacts in correctional facility and community (if relevant)
		4. Determine infectious period. ▪ Generally: Onset of cough or 12 weeks prior to TB diagnosis, whichever is longer. ▪ Exception: If no TB symptoms, and AFB smear negative and non-cavitary, then 4 weeks prior to suspected TB.
		5. Convene contact investigation team (corrections and health department) ▪ Identify team leader; identify roles and responsibilities of team members. ▪ Develop plan for managing contact investigation data. ▪ Develop investigational priorities.
		6. Update correctional management officials (including the Warden, Regional staff, and Central Office HSD staff) regarding contact investigation strategy.
		7. Obtain index case traffic history (housing/work/school locations during infectious period).
		8. Tour exposure sites (where case frequented during infectious period). Assess: ▪ number of inmates housed together ▪ general size of airspace ▪ housing arrangements (cells/dorms) ▪ availability of data on inmates housed at same time ▪ ventilation: heating/air conditioning system (recirculated air?) ▪ pattern of daily inmate movement (cafeteria, general areas)

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Appendix 10. Tuberculosis Contact Investigation Checklist (page 2 of 2)

√	Date	Task
		9. Prioritize contacts. Group contacts based upon duration of exposure and/or intensity of exposure. Those with the most exposure and HIV-infected contacts (regardless of duration of exposure) are considered highest priority. Immediately refer to the health department the names of community contacts who are young children or who are HIV infected.
		10. Develop contact list. Obtain rosters of highest priority employee and inmate contacts and research their current location. Generate lists of exposed contacts grouped by their current location (currently incarcerated, transferred, and released).
		11. Conduct medical record review for highest priority contacts to collect: - Prior TST and CXR results - History of treatment for latent TB infection or TB treatment - HIV status - Other high risk medical conditions
		12. Initiate contact medical evaluation (employees and inmates). HIV-infected contacts should be evaluated as soon as possible. - **ALL contacts:** Interview for TB symptoms and encourage HIV testing if status unknown. If TB symptoms, perform CXR and medical evaluation. Isolate in an AII room if TB is suspected. **- Prior TST positives** (HIV seronegative or unknown): - Offer HIV counseling and testing - No further follow-up is needed unless contact is symptomatic. **- HIV seropositives** (regardless of prior TST result): - Do symptom review, TST (if prior TST negative), and chest radiograph. - Initiate complete course of treatment for LTBI after active TB ruled out (regardless of prior treatment for LTBI or active TB). **- Baseline TST negatives** (HIV seronegative or unknown): - Do symptom review and TST. - **Obtain CXR** if TST is positive.
		13. Referral for contact evaluation (for released/transferred inmates).
		14. Determine infection rate by exposure site. (Infection rate = # whose TST has converted from negative to positive divided into the total # skin tested.) Calculate rates separately for U.S. born and foreign born inmates. Decide whether or not to expand investigation beyond highest priority contacts.
		15. Follow-up tuberculin skin testing. Perform 8 or more weeks after exposure ended. - Perform record search in Sentry to determine current location of inmates. - Conduct testing of employees and inmate contacts who remain incarcerated. - Refer released/transferred inmates for follow-up TST.
		16. Determine infection rate and need to expand investigation.
		17. Write a summary report and submit through Warden to Regional and Central Offices.

Appendix 11. Tuberculosis Pre-Release Checklist

Appropriate discharge planning and referrals are critical for inmates receiving treatment for TB disease or LTBI, and for identified contacts to a TB case who are in need of evaluation. Coordination of release and referral procedures should take place to assist the inmate in making the transition to the community, maintain necessary care, and to protect the public health.

√	Date	Task
		1. Determine release/transfer destination: Anticipated Date:___/___/___ __ halfway house __ community by supervision (i.e., USPO) __ other jurisdiction (agency) __ full-release (i.e., residence) __ other country __ ICE facility **Contact information:** (name, address, alien number, state/country, telephone, FAX, etc.)
		2. Obtain a signed release of medical information (i.e., BP-S621), as needed.
		3. Complete *Interjurisdictional Tuberculosis Notification* (can be obtained at www.ntca-tb.org). Send form and other necessary information to the next provider of services, the TB program of the state where the inmate is going, and your state TB program. Also utilize this form for referral to the binational referral programs – Cure TB, TB Net, etc.). Contact information for State TB programs can be obtained at: www.cdc.gov/nchstp/tb/pubs/tboffices.htm.
		4. Request dispensation of medication supply based on current treatment: Restricted treatment (DOT) according to BOP policy on supply-fill for: __ Community correctional facility placement __ Other jurisdiction (i.e., state transfer, other agency, etc.) __ Release and referred for restricted treatment through a community provider, public health official, or other community resource
		5. Provide inmate education on: __ Current TB treatment (medications, doses, frequency, duration) __ Potential side effects __ Consequences of non-adherence __ **Follow-up (clinic) appointment :** Date ___/___/___ Time:_____ Location/address: Contact name, telephone no:
		6. Health departments notified: RECEIVING state/local health department(s): Date: ___/___/___ Contact name/telephone/FAX: TRANSFERRING (your) state/local health department(s): Date: ___/___/___ Contact name/telephone/FAX:
		_____ _____ ___/___/___ Verifying Employee (print last, first) Verifying Employee Signature Date *File copy of supporting documents/note(s) in medical record.*

Appendix 12. Tuberculosis Educational Resources

CDC Guidelines

The following Centers for Disease Control and Prevention guidelines are available at: www.cdc.gov/nchstp/tb/pubs/mmwrhtml/Maj_guide/List_categories.htm

Diagnosis

ATS/CDC. Diagnostic standards and classification of tuberculosis in adults and children (2000)

Targeted Testing and Treatment of Latent TB Infection

ATS/CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection (2001)

CDC. Update: Adverse event data and revised American Thoracic Society/Centers for Disease Control recommendations against the use of rifampin and pyrazinamide for treatment of latent tuberculosis infection-United States (2003)

TB Treatment

ATS/CDC. Treatment of TB (2003)

CDC. Notice to readers: Updated guidelines for the use of rifamycins for the treatment of TB among HIV-infected patients taking protease inhibitors or nonnucleoside reverse transcriptase inhibitors (2004)

Infection Control

CDC. Guidelines for preventing transmission of Mycobacterium TB in health-care facilities (1994)

CDC Educational Materials

TB Education and Training Resource Guide. This comprehensive 250-page resource guide, which provides access to a broad range of TB educational material, can be obtained through: www.cdcnpin.org/scripts/tb/guide/toc.asp

Division of TB Elimination Educational and Training Materials Order Sheet. (www.cdc.gov/nchstp/tb/pubs/tbfactsheets/250001.pdf). A large variety of TB training materials directed at both patients and providers can be ordered, including a 'Think TB' wall chart, Tuberculin Skin Testing Training, etc.

Self-Study Modules on TB, 1999-2000. This award-winning online course for health care providers can be accessed through: www.phppo.cdc.gov/phtn/tbmodules/Default.htm.

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Appendix 12. Tuberculosis Educational Resources (Page 2 of 2)

Other Educational Materials

Charles P. Felton National TB Center

www.harlemtbcenter.org

The Charles P. Felton National TB Center has developed a number of pocket cards for managing latent TB infection and other training materials for clinicians.

Francis J. Curry National TB Center

www.nationaltbcenter.edu

The Francis B. Curry National TB Center has developed a number of helpful materials including a 'Contact Investigation in a Worksite Toolbox' and 'TB Infection Control Plan for Jails Template' (2003). The jail template provides all the necessary components of a jail TB control plan.

New Jersey Medical School National TB Center

www.umdnj.edu/ntbcweb

The New Jersey Medical School National TB Center has developed a wide array of materials on diagnosing latent TB infection, TB treatment (including cards summarizing treatment recommendations), case management, and TB education.

National Institute for Occupational Safety and Health (NIOSH)

'NIOSH Respiratory Protection Program in Health Care Facilities - Administrator's Guide' can be found at http://www.cdc.gov/niosh/pdfs/99-143.pdf

NIOSH Approved Disposable Particulate Respirators (N-95) list can be obtained at: http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/

National Jewish Medical and Research Center

National Jewish Medical and Research Center offers a 4-day intensive TB course for clinicians, 'The Denver TB Course.' For more information see: https://www.nationaljewish.org/about/calendar/index.aspx

Consultation Services

National Jewish Medical and Research Center

Mycobacterial Diseases Consult Service: For more information see: http://nationaljewish.org/patient-info/progs/med/mycobacteria/consult.aspx\

Appendix 13. Airborne Infection Isolation (AII) Room Guidelines

Guidelines

- **Airborne infection isolation* rooms may be utilized for tuberculosis and other airborne infectious diseases,** including varicella (including disseminated herpes zoster) and measles.
- **General CDC guidelines for AII rooms include the following:**
  - Rooms have negative pressure relative to adjacent areas/corridors
  - New rooms have a minimum of 12 air changes per hours (ACH); former construction must have a minimum of 6 ACH.
  - Preferably, the rooms should be exhausted directly to the outside away from air intakes, windows and walkways. Alternatively, they can be filtered through a HEPA filter unit.
  - Exhaust systems are to be connected to emergency generator power.
  - HEPA filter maintenance requirements: If an AII room is equipped with a HEPA filter, the filter should be tested by an industrial hygienist or engineer. At least every 12 months, a leakage test should be performed on HEPA filters using a particle counter or photometer. A quantitative filter performance test (e.g., the doctyl phthalate penetration test) should be performed at the initial installation and each time the filter is changed. Maintain records for all filter changes and testing.
- **A room can be "validated" (but not "certified") as meeting the CDC guidelines** (negative pressure, adequate air changes, proper ventilation, exhaust, filtering, etc.). An industrial hygienist or ventilation engineer is best suited to validate whether or not an AII room meets the CDC guidelines.
- **Negative air pressure should be monitored periodically as follows,** utilizing smoke tubes or visual checks ("flutter strips")**:**
  - Before occupancy.
  - Daily while occupied (even if pressure-sensing devices are used in the room).
  - Monthly at all other times.
- **Keep doors closed except for entering and exiting.**
- **Cleaning procedures:** Utilize same cleaning procedures as other rooms. If a detergent germicide is used for routine cleaning, a hospital-grade, EPA-approved germicide/disinfectant that is *not* tuberculocidal can be used. Personnel cleaning the room must wear respiratory protection.
- **Clearance time:** BOP AII rooms should not be entered without respiratory protection for two hours after they have been exited by a patient with an airborne infectious disease.

References:

CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. MMWR 2005;54(RR-17).

CDC. Guidelines for environmental infection control in healthcare facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. *MMWR* 2003; 52(RR-10).

* AII rooms were formerly called negative pressure isolation rooms (NPIR).