TUBERCULOSIS (TB)

TABLE OF CONTENTS

1. Cause/Epidemiology

Tuberculosis (TB) is an infectious disease caused by the bacteria, *Mycobacterium tuberculosis* (MTB). Worldwide, more people die of TB than of any other infectious disease, including malaria and acquired immune deficiency syndrome (AIDS). TB has increased incidence in developing countries. In Manitoba, the disease burden isn't distributed equally with disparities pronounced in certain population groups and geographic regions; foreign-born individuals and Aboriginal peoples in particular are disproportionately affected by TB. While the greatest number of cases in Canada is reported among foreign-born individuals, the reported incidence rate has consistently been highest among Canadian-born Aboriginal individuals over the past decade.

Groups at higher risk of developing active TB disease TB include:

- People living with individuals diagnosed with active tuberculosis
- People who previously had active tuberculosis
- People born or previously residing in countries with a high TB incidence in Asia, Eastern Europe, Africa and Latin America,
- Staff and residents of homeless shelters
- Urban poor
- Injection drug users
- Aboriginal Canadians residing in communities with high TB rates
- Elderly persons
- People infected with HIV/AIDS
- People with:
  - transplantation (related to immune-suppressant therapy)
  - silicosis
  - chronic renal failure requiring hemodialysis
  - carcinoma of head and neck
  - recent TB infection (less than 2 years)
  - abnormal chest x-ray – fibronodular disease
- Immunocompromised patients (e.g., HIV, diabetes, alcoholism, end stage renal disease, patients on immunosuppressive therapy)
- Staff and inmates of correctional facilities and previously incarcerated people
- Healthcare workers serving at-risk groups

Key Infection Prevention and Control strategies to prevent the transmission of TB within healthcare facilities include:

1. Early identification of infectious cases
2. Isolation of infectious cases and use of appropriate Infection Prevention and Control Precautions
3. Prompt initiation of appropriate therapy
4. Investigation of source case, including pediatrics, for possible undiagnosed cases of active TB disease or newly infected persons.

2. Clinical Presentation

TB may present as either an infection or as a disease**.** TB disease most commonly presents as a respiratory infection; it can also present in any system of the body. Signs and symptoms depend on the site of the disease. TB can also be multi-drug resistant (where there is resistance to at least Isoniazid [INH] and Rifampin), or extensive drug resistant (where there is resistance to INH, Rifampin, and at least one of the three injectable second-line drugs [e.g., Amikacin]).
The presence of any of the following signs/symptoms should prompt rapid consideration of active TB disease:

- Cough > 3 weeks
- Unexplained weight loss
- Night sweats
- Bloody sputum/hemoptysis
- Unexplained loss of appetite
- Hoarseness
- Fever
- Fatigue
- Chest pain

2.1 TB Infection (Latent Tuberculosis Infection or LTBI)

People with LTBI are asymptomatic, **cannot spread TB to other people** (i.e., are not infectious), and usually have a normal chest x-ray.
People who have LTBI have been "infected" with TB and may have a positive tuberculin skin test. Approximately 10% of non-immunocompromised individuals with LTBI will progress to active TB disease if untreated.

> The tuberculin skin test (TST) is performed to **diagnose latent TB infection (LTBI)**. It is **not** a diagnostic tool for **active TB disease** in adults.

2.2 Active TB Disease

Active TB disease is most commonly seen as:

- Respiratory
- Laryngeal
- Non-respiratory
- Disseminated/Miliary
- Meningeal
- Peripheral TB Lymphadinitis

Active TB disease is potentially infectious, depending on the site of disease (e.g., respiratory and laryngeal are more infective), the amount of anti-tuberculin treatment received (e.g., fewer doses and ineffective treatment).To ensure the right drugs are being given the MTB sensitivities must be considered as soon as available. Resistant strains are no more transmissible than non-resistant stains provided the right drugs are being given.

There is a significantly greater risk of developing active TB disease when there is co-infection of HIV and MTB, as these patients have impaired immunity.

3. Incubation Period and Period of Communicability

The incubation period for infection (LTBI) is 4 to 12 weeks after exposure. The risk of progression to active TB disease is greatest within the first two years after infection. TB infection may exist for an individual's lifetime as a latent infection (LTBI).

Active infectious TB disease occurs when live tubercle bacilli are dispersed in sputum or aerosolized fluid. Untreated or inadequately treated persons may be infectious for a prolonged period of time. In general, non-respiratory active TB disease is not communicable, unless fluid from the site is aerosolized.

A number of variables influence the length of time an individual remains infectious:
- Initial level of infectivity
- Level of the patient's immune response
- Duration and efficacy of, and adherence to, TB therapy

4. Transmission

Mycobacterium tuberculosis (MTB) is carried in microscopic airborne particles that settle slowly and may remain suspended in the air for hours, particularly in locations without proper negative pressure ventilation. These particles are dispersed when a person with active infectious TB disease (respiratory/laryngeal) sneezes, coughs, speaks, shouts, or sings.

MTB is communicable mainly by the aerosol route. Droplet nuclei are created by forceful expiratory efforts, such as coughing, sneezing, singing, playing wind instruments and even speaking. The numbers of droplet nuclei can be greatly reduced by wearing a procedure or surgical mask, or covering the mouth and nose during coughing/sneezing.

Certain procedures, e.g., bronchoscopy, sputum induction, specimen processing, autopsy, and even irrigation or other manipulation of non-respiratory tuberculous abscesses, may also produce infectious aerosols

Bacteria lodged on fomites (linen, furniture, books, floors) do not constitute a significant source of infection; most die quickly through the action of drying, heat or sunlight.

Because of the highly variable latency period of *M. tuberculosis* infection, it is difficult to precisely document transmission. People with positive Tuberculin Skin Test (TST) and/or Interferon-Gamma Release Assay (IGRA) results found during contact investigation may have been infected in the past (remotely) rather than by the recent source case of concern.

Acquisition of *M. tuberculosis* is most likely to result from exposure to persons who have:
- Unsuspected/undiagnosed active infectious TB disease and are not receiving anti-TB therapy/are not appropriately isolated
- Diagnosed active infectious TB disease and are receiving inadequate therapy, or
- Diagnosed active infectious TB disease and are early in the course of effective therapy

Patients who have sputum that is Acid Fast Bacilli (AFB) smear positive and MTB culture positive have active infectious TB disease. A patient, who has AFB smear positive sputum that is 3+ or 4+, with or without cavitating chest lesion, and is coughing, is the most infectious.

Patients with active TB disease whose sputum is AFB smear negative and MTB culture positive are also infectious, with increased risk if a cough is present.

The chest radiograph is one of the first steps in the evaluation of an individual with respiratory symptoms who is suspected of having active infectious TB disease. A patient with highly suspicious clinical findings and chest radiograph results suggestive of active TB disease with negative AFB smear results bears carefully consideration of their infectivity. These patients must be assessed on a case-by-case basis. Approximately 10% of cases of active respiratory TB disease may have normal CXRs.

Maintain a high index of suspicion for active TB disease and rapidly implement Airborne Precautions to minimize TB transmission

5. Infection Prevention & Control Practices

5.1. Implementation of Airborne Precautions

Implement Airborne Precautions immediately upon suspicion of active infectious TB disease. A high index of suspicion for active infectious TB disease and rapid implementation of Airborne Precautions are essential to minimizing transmission.
Refer to Airborne Precautions in the Additional Precautions section of the Acute Care IP&C Manual.
Refer to the Clinical Presentation/Microorganism/Infectious Disease Table for specific disease/microorganism information.

Notify TB Infection Prevention and Control/designate @ 204 793-9244 of:

- Any patient placed on Airborne Precautions for investigation of possible active infectious TB disease
- Any patient admitted for investigation of active infectious TB disease
- Any patient admitted for treatment of active infectious TB disease
- Possible discontinuation of Airborne Precautions related to MTB

Place patients on Airborne Precautions until deemed non-infectious if:

- ✓ Low index of suspicion for active infectious TB disease
- ✓ Suspected/Confirmed active infectious TB disease
- ✓ Suspected/Confirmed active non-respiratory TB disease (until active infectious TB is ruled out)
- ✓ Clinically Confirmed Case

5.2. Discontinuation of Airborne Precautions

Airborne Precautions may only be discontinued by the Attending Physician and/or Infection Prevention and Control.

5.2.1 When there is a **Low Index of Suspicion**, Airborne Precautions may be discontinued when ALL of the following criteria are met:

- Diagnosis of active infectious TB disease is considered unlikely
- There are no findings on the patient's chest radiograph indicating active infectious TB disease
- There are three negative AFB sputum smear results, where the specimens were collected at least 1 hour apart, and
- An alternative diagnosis has been made by a physician with expertise in TB diagnosis AND has concluded it is unlikely the patient has active infectious TB disease

5.2.2 When there is **Suspected or Confirmed Active Infectious TB Disease,** with AFB sputum smear negative (x3) with MTB culture pending or positive on admission to facility, Airborne Precautions may be discontinued when ALL of the following criteria are met:

- Evidence of clinical improvement
- The patient had a minimum of 14 days of anti-tuberculin treatment using 4 drugs
- The prescribed medication regimen was appropriate*
- There is evidence of adherence to the treatment regimen

5.2.3 When there is **Suspected or Confirmed Active Infectious TB Disease**, with AFB sputum smear positive (1+ or 2+) on admission to facility, Airborne Precautions may be discontinued when ALL of the following criteria are met:

- Three AFB sputum smear negative specimens have been obtained in the early morning on Days 12, 13 and 14 of anti-tuberculin medication treatment+
- The patient has had a minimum of 14 days of anti-tuberculin treatment using 4 drugs
- There is evidence of clinical improvement
- The prescribed medication regimen was appropriate*
- There is evidence of adherence to the treatment regimen

5.2.4 When there is **Suspected or Confirmed Active Infectious TB Disease**, with AFB sputum smear positive (3+ or 4+) on admission to facility, Airborne Precautions may be discontinued when ALL of the following criteria are met:

- Three AFB sputum smear negative specimens have been obtained in the early morning on Days 19, 20 and 21 of anti-tuberculin treatment+
- The patient has had a minimum of 21 days of anti-tuberculin treatment using 4 drugs
- There is evidence of clinical improvement
- The prescribed medication regimen was appropriate*
- There is evidence of adherence to the treatment regimen

***The prescribed medication regimen is considered appropriate when it includes at least 4 effective drugs (as recommended by the Canadian TB Standards) and the drug susceptibility tests have determined the treatment is the appropriate regimen, or in the event drug susceptibility tests are not yet available, the risk of drug resistance is considered to be very low.

[+]If **ANY** of the follow up sputum specimens are AFB smear positive the patient is to remain on Airborne Precautions. Do not collect further specimens until the patient has received an additional seven days of anti-tuberculin treatment. Following an additional seven days of anti-tuberculin treatment, collect sputum specimens from the patient on Days 7, 8, and 9 of the additional week. This sequence is repeated until there are three consecutive AFB sputum smear negative specimens.

Patients with MDR-TB or XDR-TB remain on Airborne Precautions through their entire hospitalization, or until three negative sputum CULTURES have been obtained.

5.2.5 When there is **Suspected or Confirmed Active Non-Respiratory TB Disease**, Airborne Precautions may be discontinued when:

- Active infectious TB disease has been excluded AND
- There are no open lesions/abscess within the oral cavity
- The affected site has no drains in situ
- There is no risk of aerosolization of drainage from lesions/abscess or affected site

5.3 Cohorting

Cohorting of patients with or suspected of active infectious TB disease is not recommended in hospitals, and does not meet the Canadian standard of care expected in Manitoba Hospitals.

If in exceptional circumstances, hospitals choose to cohort patients with or suspected of active infectious TB disease, the potential for organism transmission between these patients should be minimized. Issues of infectivity and the consequences of possible transmission should be considered (as outlined below) in consultation with Infection Prevention and Control. Patients with drug resistant (e.g., MDR, XDR) strains of active infectious TB disease cannot be cohorted under any circumstances.

Consultation with the Tuberculosis Infection Control Professional (TB ICP)/designate, and/or the Infectious Disease specialist on duty must occur whenever cohorting of patients with or suspected of active infectious TB disease is being considered.

The following patients must never be cohorted with patients with or suspected of active infectious TB disease, or with whom procedures are performed where irrigation of MTB is likely (e.g., wound irrigation)

- Patients with non-respiratory TB
- Patients without a clear diagnosis of active infectious TB disease, e.g., patients who are sputum AFB smear-positive with a high index of suspicion of having an atypical mycobacterial infection.

5.4 Code Blue

Unit staff to inform Code Team of patient's status and provide N95 respirators

5.5 Discharge/Transfer between Facilities

- Unit informs receiving facility of patient's status in advance, and documents same on Transfer/Referral Form
- Unit notifies Transport Services Airborne Precautions are required
- Patient performs hand hygiene prior to transfer; wears procedure or surgical mask
- Staff wears an N95 respirator during transport

5.6 Post Mortem/Autopsy

- Airborne Precautions

5.7 Transport within Facility

- Transport patient out of room for medically essential purposes only
- Healthcare worker performs hand hygiene and applies an N95 respirator
- Patient performs hand hygiene prior to transfer; wears procedure or surgical mask

6. Specimen Collection

A variety of specimens may be submitted to assess for the presence of MTB, including spontaneous sputum, induced sputum, bronchoscopy, gastric aspirate, urine, blood/body fluids, and biopsy.

It is important to obtain the appropriate specimens as soon as possible, once appropriate precautions have been implemented. When collecting specimens for suspected or active TB, **specimens must be collected utilizing Airborne Precautions regardless of age**.

If possible, collect diagnostic specimens before anti-tuberculin treatment has been initiated. If the patient has already started treatment, indicate this on the Clinical Microbiology Requisition.

Collect specimens in sterile leak-proof containers. The requisition must accompany the specimen and indicate:

- Specimen number (e.g., sputum #1)
- Specimen type (e.g., spontaneous)
- Site of collection (e.g., sputum), and if
- The specimen is a diagnostic or follow-up specimen
- Additionally, all standard information must be indicated on the requisition: patient name (first and last), patient's PHIN, test(s) requested and any relevant clinical information.

Specimen results must be evaluated in conjunction with all available patient data

A **minimum of three separate specimens** (any combination of: induced sputum, spontaneous sputum, bronchoscopy, post bronchoscopy sputum, or gastric aspirate) must be obtained **at least 1 hour apart**.

6.1. Spontaneous Sputum

- Should be collected in the early morning, when the patient first awakens
- Should contain a minimum of 5-10mL of material
- Is delivered to the lab immediately to prevent bacterial overgrowth. If this is not possible, place the specimen in the specimen fridge
- May be collected a minimum of one hour apart for diagnostic purposes, with one obtained in the early morning
- Are collected on consecutive days for follow-up purposes, 8 – 24 hours apart

6.2. Induced Sputum (usually performed by Respiratory Therapists)

- Maintain patients in Airborne Precautions until most of the coughing has ceased (usually 20 – 30 minutes post saline administration)
- Patients are not required to have 'nothing by mouth' (NPO) prior to this procedure.

6.3. Bronchoscopy

Bronchoscopy may be used to obtain respiratory specimens when patients are unable to spontaneously produce reliable sputum or induced sputum is not possible.

When performing bronchoscopy, additional specimens must be collected. A single negative AFB smear from a bronchoscopy does not definitively exclude active respiratory TB disease.

6.4. Gastric Aspirate

This technique may be used to collect a specimen in patients who cannot expectorate sputum, but can swallow. Gastric aspirates are known to be low yielding specimens, and though widely used in children, should only be used in adults when there are no other viable options.

- Must be performed immediately upon the patient awakening from a long sleep, at least six hours after ingestion of food or liquid, and before the stomach has emptied
- Three early morning specimens on consecutive days are required
- The specimen cannot wait for processing for more than four hours
- The specimen must arrive at the lab within one hour of collection

6.5. Urine
Three consecutive early morning (first voiding) specimens (40mL) are required. Collect samples using the mid-stream urine technique. Twenty-four hour urine collections are not suitable for culture due to overgrowth of organisms.

6.6. Body Fluids
Most normally sterile body fluids (e.g., cerebrospinal, pleural, peritoneal, pericardial) contain only small numbers of mycobacteria, even in patients with symptomatic disease. As much fluid as possible should be collected to increase the likelihood of detection and decrease the possibility of having to recollect the specimens. Deliver specimens to the lab as soon as possible after collection.

6.7. Biopsies
Biopsy of infected tissue is often the most sensitive diagnostic procedure in non-respiratory TB disease. Do not place specimens for MTB examination in formalin. Place biopsy tissue in a dry, sterile container without saline (or with less than 5mL of saline).

6.8. Microbiological Testing and Interpreting Results
Mycobacteria are referred to as acid fast bacilli. The term acid fast comes from the special staining techniques (flurochrome and carbol fuchsin) used in laboratories. The specimen is stained and washed with an alcohol-acid solution. Due to the unique chemical properties of mycobacteria, the original stain is retained by the organism, hence the term acid fast.

Success of identifying mycobacteria in the laboratory depends on several factors:
- Quality of the specimen (deep cough versus saliva)
- Handling and transport of the specimen to the laboratory
- Laboratory experience working with mycobacteria

6.8.1. Smear (Microscopic Examination)
A positive AFB smear indicates mycobacteria, but not necessarily *Mycobacteria tuberculosis (MTB)*,as other mycobacteria are also acid fast. Additional tests must be done to differentiate MTB from other non-tuberculosis mycobacteria. icroscopic examination may fail to identify between 20 – 80% of patients who have MTB disease.

The microbiology report reflects the number of AFB seen on examination of the stained smear. The more organisms seen the higher the number on the report and the more infectious the patient. For instance, a specimen with 4+ is more infectious than 1+.

Depending on the presence or absence of AFB on microscopic examination, 2 additional tests may be performed.

6.8.2. Culture
Culturing mycobacteria is the most reliable method to identify patients with MTB disease; all specimens are sent for culturing.

Detection of positive cultures can vary from 11 – 21 days or longer, depending on the organism load.

Respiratory specimen cultures (e.g., sputum, bronchoscopy) are observed for 7 weeks before reported as negative for mycobacteria. Fluid and tissue specimen cultures (e.g., lungs, pleural fluid) are observed for 8 weeks, skin specimens are held for 8 weeks unless *M. ulcerans* is suspected, in which case, cultures are held for 12 weeks.

Antimicrobial susceptibility testing is performed on all *M. tuberculosis* cultures.

6.8.3. Nucleic Acid Amplification Tests (NAAT)

If AFB are detected on microscopic examination of a respiratory specimen, NAAT is performed. These results are available in 24 – 48 hours. NAAT is not routinely performed on other specimens.

6.8.4. Non Tuberculosis Mycobacteria

Mycobacterium other than *M. tuberculosis* may produce disease in humans and is usually non-infectious from person to person; therefore these types do not require Airborne Precautions.

These organisms are acid-fast bacilli like *M tuberculosis* but are described as atypical, unclassified mycobacteria, non-tuberculosis mycobacteria (NTM) or mycobacteria other than tuberculosis (MOTT).

6.8.5. Clinical syndromes

Clinical syndromes associated with the pathogenic species of mycobacteria include the following:

- Disseminated disease in the presence of severe immunodeficiency such as AIDS: M. avium complex, M. kansasii, M. haemophillum, M. chelonae
- Pulmonary disease resembling tuberculosis: M. kansasii, M. avium complex, M. absessus, M. xenopi, M. simiae
- Lymphadenitis (primarily cervical): M. avium complex, M.scrofulaceum, M. kansasii
- Skin ulcers: M. ulcerans
- Post traumatic wound infections: M. fortiutum, M. chelonae, M. absessus, M. marinum, M. avium complex
- Nosocomial disease: surgical wound infections (following cardiac surgery, mammoplasty wounds), catheter-related infection bacteraemia, peritonitis, post-injection abscesses): M. fortuitum, M. chelonae, M. absessus
- Crohn's Disease: M. paratuberculosis

The epidemiology of these diseases has not been well defined but the organisms have been found in soil, milk and water. Other factors, such as host tissue damage and immunodeficiency predispose the individual to infection. There is no evidence of transmission through person-to-person contact.

The diagnosis of disease requiring treatment is based on repeated positive cultures from symptomatic individuals with illness. Human infections with non-tuberculous *Mycobacterium avium* complex (MAC) infection is a major problem in HIV-infected individuals

7. Specific Populations/Settings

7.1. Maternal and Newborn

Notify the TB ICP/designate when perinatal mothers are admitted or scheduled to attend out-patient appointments who have:

- Suspected or confirmed active infectious TB disease;
- Recent close contact to a case of active infectious TB disease.

Do not separate mother and newborn if the mother is not infectious.

In the event of fetal demise; the attending Physician will document the suspect/confirmed diagnosis of active TB disease in the mother and request evaluation for the presence of congenital TB post mortem.

Infants born to mothers:

- Under investigation as a contact to a case of active TB disease OR
- Under investigation for probable (suspect) TB disease OR
- Under investigation for active TB disease
- Must be managed according to one of the following four categories (7.1.1 – 7.1.4):

7.1.1. Mother with low index of suspicion for active TB disease and no abnormality on chest x-ray:

- No special precautions for mother
- No special investigation or therapy for newborn
- Do not separate mother and newborn
- Offer mother LTBI treatment if appropriate (e.g., recently infected; HIV co-infected)

7.1.2. Mother with abnormal chest x-ray consistent with active TB disease:

Rule out active infectious TB disease prior to delivery:

- Obtain three sputum specimens for AFB
- Refer mother to Respirologist or Infectious Diseases specialist with expertise in Tuberculosis
- Refer newborn to Pediatric Respirologist prior to delivery
- If active infectious TB disease is ruled out, delivery can occur as per routine; follow-up of the newborn is not required.

If unable to rule out active infectious TB disease prior to delivery, consider mother infectious. Manage care as outlined below (7.1.4).

If chest radiograph indicates abnormality that is considered related to previous healed TB and mother was not previously treated, refer patient for assessment to a Respirologist or Infectious Disease Specialist with expertise in Tuberculosis.

7.1.3. Mother with abnormal chest x-ray but no evidence of active TB disease:

Rule out active infectious respiratory TB disease prior to delivery:

- Obtain three sputum specimens for AFB
- Refer mother to Respirologist or Infectious Diseases Specialist with expertise in Tuberculosis

- Refer newborn to Pediatric Respirologist prior to and upon delivery
- If active infectious respiratory TB disease is ruled out, delivery can occur as per routine.

If unable to rule out active infectious TB disease prior to delivery, consider and treat mother as infectious. Manage care as outlined below in 3.9.1.4, 'Mother with confirmed or suspected active TB disease at or close to the time of delivery'.

7.1.4. Mother with Confirmed or Suspected Active Infectious TB Disease at, or close to the time of delivery:

If the mother is considered infectious/potentially infectious:

- Place the mother on Airborne Precautions
- Immediately separate mother and infant upon delivery
- Newborn may go to nursery; there is no requirement for Airborne Precautions for newborn

If mother has suspected or confirmed active TB disease (infectious or non-infectious) at the time of delivery, evaluate the newborn for congenital TB.

The care of the newborn should include:

- Notifying Pediatric Respirology of impending delivery
- Notifying Neonatology of impending delivery
- Sending placenta for physical examination and AFB
- Sending amniotic fluid (if available) for AFB
- Collecting gastric aspirates for AFB X 3 (one upon delivery)
- Collecting a chest radiograph (PA/LAT)
- Collecting blood specimens [CBC, Sed rate (ESR)]
- Collecting urine and stool for AFB
- Considering a lumbar puncture
- Considering an abdominal ultrasound

7.1.5. Other Considerations

Consider priority screening of household members for active TB disease prior to delivery, or as close to delivery as possible. Contact TB Infection Control Professional/designate for assistance as required.

7.2. Breastfeeding

- Mothers to use a breast pump until breastfeeding is deemed safe; consider referral to a Lactation Consultant; expressed breast milk is safe to feed the newborn.
- Breastfeeding is not contraindicated once the mother is deemed no longer infectious; mother should be encouraged to breastfeed
- Women receiving first-line TB drugs, including INH and Rifampin, may continue to breastfeed (note – concentrations of drugs in breast milk are insufficient to protect the infant).
- INH may cause peripheral neuropathy in both infant and mother, administration of supplemental Vitamin B6 (pyroxidine) will prevent this.

7.3. Children

- TB in children differs from that in adults in several ways:
- Diagnosis in young children may be difficult since signs and symptoms are often non-specific and disease is often paucibacillary (few bacilli present)
- TB disease in a very young child is often a sentinel event indicating recent transmission

- In young children, especially infants, there is a high risk of progression from latent TB infection (LTBI) to active and sometimes severe TB disease, especially in the absence of a BCG vaccination.

Children of any age who show signs and symptoms of active TB disease; whose respiratory secretions (e.g., sputum or bronchial alveolar lavage) have yielded AFB or are MTB culture positive; or who have a chest radiograph indicative of active TB should be immediately isolated using Airborne Precautions.

Rooming in is evaluated by the TB ICP/designate on an individual case by case basis.

Children most often acquire TB disease from close adult contacts. This should be considered when Airborne Precautions are necessary for children, especially those under 5, for suspected or confirmed active infectious respiratory TB disease. These same adults may pose a risk to healthcare workers and other patients while visiting. To ensure a safe environment, considerations should include potentially infectious close adult contacts. Visitors (limited to immediate adult family or guardians) should be screened by symptomology and radiography for active infectious TB disease. Those visitors having clinical symptoms suggestive of active infectious TB disease should be discouraged from visiting. Those who are required to visit should wear a procedure mask (both inside and outside of the isolation room) until active infectious TB disease is ruled out. Visitation by children is evaluated on a case-by-case basis by the TB Infection Control Professional/designate.

7.4. Renal Insufficiency and End-Stage Renal Disease (ERSD)

In patients with renal insufficiency and end-stage renal failure special consideration should be given to the following areas:

- Dosing of medications
- Drug interactions
- Drug side effects
- Difficulty with medication absorption
- Dialysis – timing of dosing

Patients with renal insufficiency and end-stage renal failure diagnosed with infectious respiratory TB disease will be placed on a medication regime which coincides with their hemodialysis/peritoneal dialysis schedule. Both Rifampin and INH are metabolized by the liver and are not dialyzed, dose adjustments are not necessary for either of these medications. The other two first-line medications**,** Ethambutol and Pyrazinamide (PZA) are dialyzed out so must be given following hemodialysis treatment. Patients on this anti-tuberculin regime are to follow the criteria for discontinuation for Airborne Precautions.

There is no data on the pharmacokinetic characteristics of first line anti-tuberculin medication in patients receiving peritoneal dialysis. The standard dosing and schedule used for hemodialysis is recommended but patients should be monitored closely and therapeutic drug monitoring (i.e. measurement of serum drug concentrations) should be considered.

7.5. Persons with HIV Infection

Patient care should be provided in collaboration with an Infectious Diseases specialist with expertise in management of both tuberculosis and HIV to assist in determining possible TB risk. Include the following information:

- Document anti-retrovirals, if any, he/she is presently taking in the patient's health record.
- Document clinical history – clinicians involved in care, current medications, recent blood work (e.g., CD4 cell count and viral load)
- A Drug Program Information Network (DPIN) printout in the patient's health record.

Note: Patients with HIV may present atypically (e.g., normal chest radiograph, no cough). Active non-respiratory TB disease is more common in those with HIV.

7.6. Operating Room- Adult and Pediatric Patients

Only perform medically necessary surgery on patients with suspected or confirmed active infectious TB disease. This would include both E1 – immediately and E2 - within 4-6 hours. All other surgery and procedures should be delayed on patients with active infectious TB disease until the patient is deemed no longer infectious.

Maintain Airborne Precautions for patients with suspected or confirmed active infectious TB disease.

If at all possible, patients with infectious tuberculosis should be scheduled at the end of the day to limit risk to other patients and healthcare workers. Perform the procedure with a minimal number of personnel.

HEPA respirators or N95 respirators are indicated for all persons entering the OR room for respiratory protection.

The doors to the OR will be kept closed and the number of personnel allowed in the OR will be kept to a minimum.

Tuberculosis patients must be recovered in a negative pressure ventilation room and personnel will follow Airborne Precautions and wear N95 respirators. Patients should then be transported to a negative pressure ventilation room as soon as possible. The patient will have both nose and mouth covered with a regular surgical mask during transport.

Personnel performing environmental cleaning and disinfection in the room of a patient who has an infectious airborne disease must use a properly fit tested N95 respirator until complete air exchange has been achieved.

The period of time required for the ventilation system to achieve a 99.9% air exchange should be noted, for example 21 minutes for a 20 air exchanges per hour cycle. Access to the room should be restricted until the 99.9% air exchange

7.7. Ambulatory Care

- Unit/clinic/site booking the appointment must notify receiving Ambulatory Care clinic of the Airborne Precautions required in advance.
- Place patient directly in examination room
- Patient performs hand hygiene on arrival; continues to wear procedure or surgical mask
- Keep door closed after appointment until air deemed cleared, if patient removed their procedure mask.

7.8. Diagnostic Imaging (DI)

- Bedside testing preferred
- Unit/clinic booking appointment must notify DI department of the Airborne Precautions required in advance
- Patient performs hand hygiene prior to transfer; wears procedure or surgical mask

7.9. Occupational and Environmental Safety & Health Occupational (OESH)

Contact Occupational and Environmental Safety and Health (OESH) for staff assessment and / or concerns. Staff wearing an N95 respirator must be fit-tested. Contact OESH to arrange.

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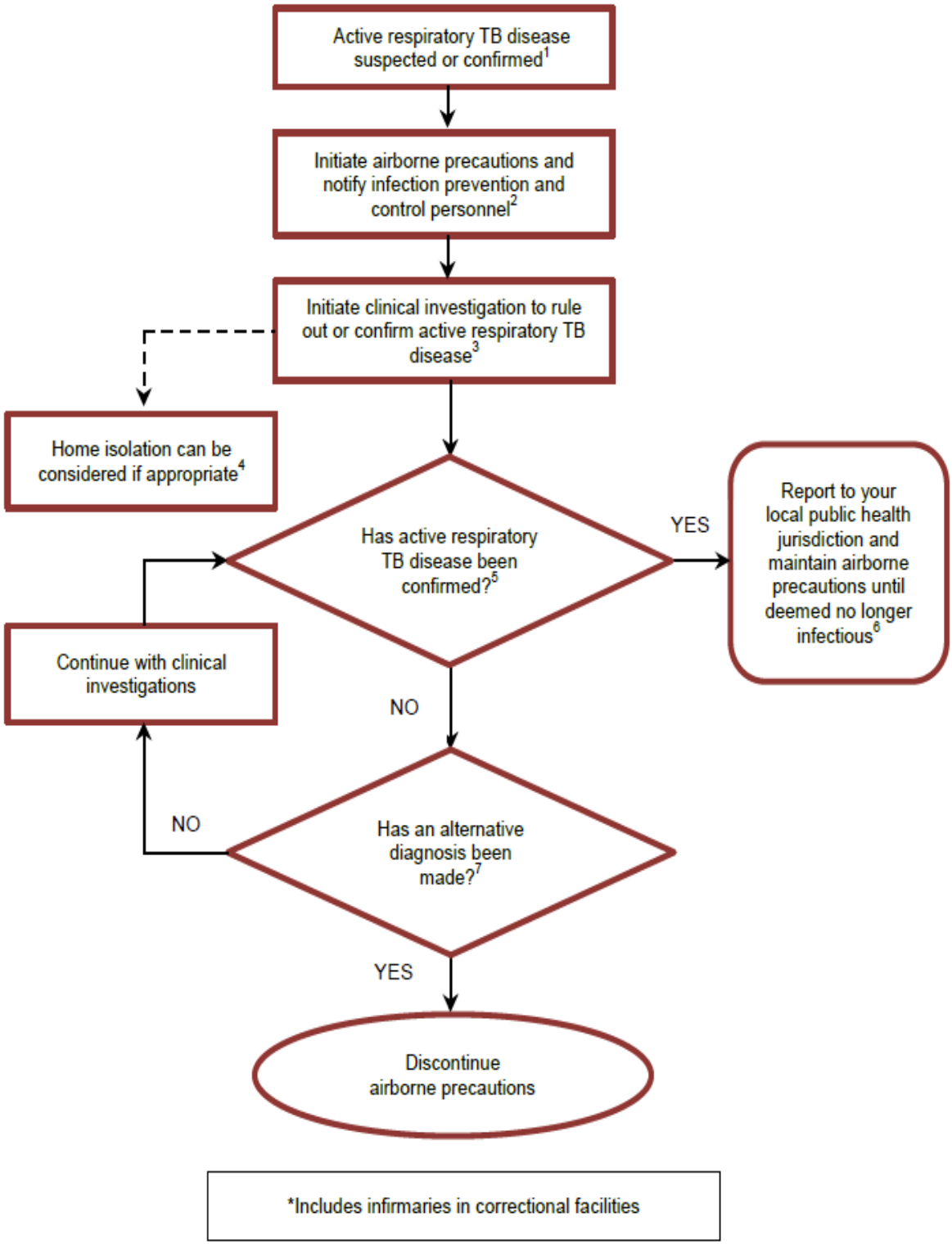
APPENDIX 1

Recommended Steps for Isolation for Suspected or Confirmed Active Respiratory TB Disease in Hospital*



APPENDIX 2

Definitions

1. Acid-Fast Bacteria (Bacilli) (AFB)
Microorganisms that are distinguishable by the retention of specific stains, even after being rinsed with an acid solution. The majority of AFB in patient specimens are mycobacteria, including species other than *Mycobacterium tuberculosis* (MTB) complex. The relative concentration of AFB per unit area on a slide (the smear grade) is associated with infectiousness. A positive culture is required for laboratory confirmation of MTB.[8.2]

2. Active Infectious TB Disease
The condition whereby the patient can transmit infection to others by virtue of the production of aerosols containing TB bacteria. Patients with smear-positive, cavitary and laryngeal disease are usually the most infectious

3. Active TB Disease
Clinical disease that is usually symptomatic and for which microbiologic tests are usually positive and radiologic tests usually abnormal.[8.2]

4. Aerosol
Solid or liquid particles suspended in the air, whose motion is governed principally by particle size, which ranges from 10µm-100µm.[8.12]
Note: See aerosol-generating medical procedures below. Note: Particles less than 10 µm (i.e., droplet nuclei) can also be found in aerosols; however, their motion is controlled by other physical parameters.[8.11]
Note: In a patient with respiratory TB these may contain MTB bacteria that are suspended in the air and lead to the spread of infection.[8.2]

5. Air Changes per Hour (ACH)
The number of air changes per hour in a room; one air change being a volume of air equal to the room volume (height X width X length).[8.2]

6. Airborne Infection Isolation Room (AIIR)
Formerly, negative pressure isolation room. An AIIR is a single-occupancy patient care room used to isolate people with a suspected or confirmed airborne infectious disease. Environmental factors are controlled in an AIIR to minimize the transmission of infectious agents that are usually transmitted from person to person by droplet nuclei associated with coughing or aerosolization of contaminated fluids. An AIIR should provide negative pressure in the room (so no air flows out of the room into adjacent areas) and should direct exhaust of air from the room to the outside of the building or recirculate the air through a HEPA filter before returning it to circulation.[8.12]

7. Cavitary Disease
Evidence on chest x-ray, CT scan, MRI or pathology tests of lung destruction resulting in cavities or cystic areas that communicate with a bronchus. Cavities generally harbor large numbers of bacteria and, as a result, patients with cavitary disease tend to be highly infectious.[8.2]

8. Confirmed Case (TB)
A TB case can be either laboratory or clinically confirmed.[8.9]

9. Laboratory-confirmed Case (TB)
MTB detected by direct PCR in a respiratory specimen; or MTB complex (excluding M. bovis BCG strain, which has been largely eradicated) identified on culture from an appropriate clinical specimen (e.g., sputum, tissue biopsy, respiratory, gastric lavage).[8.9]

10. Clinically-confirmed Case (TB)
In the absence of a positive culture or positive direct PCR, a TB expert has indicated TB disease is likely present, based on one or more of the following:

- Common signs and symptoms of respiratory TB, which include cough of at least three weeks' duration. This cough is initially dry but after several weeks to months will become productive.
- Fever and night sweats are common but may be absent in the very young and elderly.
- Hemoptysis, anorexia, weight loss, chest pain (pleuritic pain) and other symptoms are generally manifestations of more advanced disease.
- Positive AFB smear.
- Chest radiographic changes compatible with active TB disease (e.g., pulmonary infiltrates, volume loss due to destruction of the lung tissue and cavitations in the upper segments of the lung lobes). These are classic triad findings, mainly seen in non-immunocompromised adults
- Pathologic or post-mortem evidence of active TB disease.
- Favourable response to a therapeutic trial of anti-TB drugs.[8.9]

11. Contact (TB)
A person identified as having been exposed to Mycobacterium tuberculosis by sharing space with an infectious case of tuberculosis. The proximity and duration of contact usually corresponds with the risk of becoming infected.[8.2]

12. Culture – Positive Disease (TB)
The isolation of Mycobacterium tuberculosis complex (excluding BCG strain) from clinical specimens (sputum, body secretions, or tissue).[8.2]

13. Disseminated TB
Active TB disease that affects three or more sites or positive blood culture(s) for M. tuberculosis.[8.2]
See also miliary TB.

14. Droplet Nuclei
Airborne particles resulting from a potentially infectious (microorganism-bearing) droplet from which most of the liquid has evaporated, allowing the particle to remain suspended in the air.[8.2]
Note: Droplet nuclei can also be found in aerosols; however, their motion is controlled by physical parameters including gravity and air currents.[8.11]

15. Drug Resistance (TB)
In-vitro determination that growth of a strain of Mycobacterium tuberculosis is not inhibited by standard concentrations of an anti-TB drug.

16. Extensive drug resistant tuberculosis (XDR-TB)
Tuberculosis due to bacteria resistant to at least isoniazid and rifampin and any fluoroquinolone, and at least one of three injectable second-line drugs (capreomycin, kanamycin and amikacin).

17. First-line anti-tuberculosis drug
First-line antibiotics for the treatment of active tuberculosis disease. These are isoniazid, rifampin, ethambutol and pyrazinamide, and are considered the most effective and best tolerated. Streptomycin is no longer considered a first-line drug in Canada.

18. High-efficiency particulate air (HEPA) filter
A filter that is certified to remove >99.97% of particles 0.3 µm in size, including M. tuberculosis-containing droplet nuclei; the filter can be either portable or stationary. [8.2]

19. Immunocompromised
This term refers to patients with congenital or acquired immunodeficiency or immunodeficiency due to therapeutic agents or hematologic malignancies.

20. Interferon gamma release assay (IGRA)
In-vitro T-cell based assays that measure interferon-γ (IFN-γ) production and that have been developed as alternatives to tuberculin skin testing (TST) for the diagnosis of latent TB infection. At the present time, two different types of IGRAs are registered for use in Canada. These are the Quantiferon®-TB Gold In-Tube and the T-SPOT.*TB*® assays. [8.2]

21. Inactive TB Disease In CTS 7th Ed it is called inactive pulmonary disease
Abnormal chest x-ray with findings considered typical of previous TB infection or disease, plus at least three sputum cultures negative for tuberculosis or the chest x-ray abnormalities stable for at least 6 months. [8.2]

22. Induration
The soft tissue swelling that is measured when determining the tuberculin skin test response to purified protein derivative (PPD) tuberculin. It is to be distinguished from erythema or redness, which should not be measured.

23. Latent tuberculosis infection (LTBI)
The presence of latent or dormant infection with Mycobacterium tuberculosis. Patients with LTBI have no evidence of clinically active disease, meaning that they have no symptoms, no evidence of radiographic changes that suggest active disease and negative microbiologic tests; they are non-infectious. [8.2]

24. Laryngeal TB
A highly infectious form of TB disease, with erosive, exudative invasion of the larynx.
Note: Symptoms commonly include hoarseness, cough, pain on swallowing and hemoptysis. Most commonly, these individuals are smear positive and culture positive, however, they may have sputum that is smear negative and culture positive. Despite the fact their sputum may be smear negative, these individuals are considered highly infectious.[8.7]

25. Low Index Suspicion of Active Tuberculosis
A differential diagnosis of two or more diseases with similar symptoms exists and through systematic contrast and comparison of the clinical findings, it has been determined the likelihood of the diagnosis of TB is a low possibility.[8.13]

26. Meningeal Tuberculosis
TB of the meninges.
Note: The clinical course is characterized by a prodromal headache, malaise, fever and personality changes, followed by meningismus, cranial nerve palsies and confusion, which, if left untreated, can

lead to seizures, coma and death within weeks. TB meningitis should be treated as a medical emergency; time is of the essence in achieving a good outcome, as the condition is frequently associated with devastating consequences: 25% morbidity (i.e. permanent neurologic deficit) and 15% to 40% mortality despite available treatment. [8.2]

27. Miliary TB
Disseminated active TB with abnormal chest X-ray showing diffuse micronodules. [8.2]
See also disseminated TB.

28. Multidrug-resistant tuberculosis (MDR-TB)
Tuberculosis due to bacteria resistant to isoniazid and rifampin with or without resistance to other anti-tuberculosis drugs. [8.2]

29. Mycobacterium tuberculosis complex
M. tuberculosis (including subspecies M. canetti), M. bovis, M. bovis BCG, M. africanum, M. caprae, M. microti and M. pinnipedii. All of these species except M. bovis BCG are included in the Canadian case definition of tuberculosis. [8.2]

30. New Active Case of TB
No documented evidence or history of previous active TB disease. [8.2]

31. Non-Respiratory Tuberculosis
Refers to all other disease sites not part of respiratory TB. [8.2]

32. Nucleic acid amplification tests (NAAT)
A process whereby genetic material is amplified and then subsequently evaluated for the presence of DNA material; useful to identify specific mycobacterial species. [8.2]

33. Polymerase chain reaction (PCR)
Method of nucleic acid amplification. [8.2]

34. Peripheral TB Lymphadenitis
Presentation can be at a single nodal site or in multiple sites. A study of TB lymphadenitis in Manitoba found that 18% of cases also had a concurrent diagnosis of TB elsewhere in the body.93 In general, the disease is most often indolent, and the patient usually presents with an isolated, unilateral, non-tender neck mass.
Peripheral lymphadenitis is particularly common among immigrants to Canada from Asian countries such as China, Viet Nam and the Philippines. Among these immigrants, young women are especially prone to isolated lymph node involvement. High rates of tuberculous lymphadenitis in the foreign-born are well documented in high-income countries. In Manitoba, the highest incidence of peripheral lymphadenitis has been reported among older Aboriginal women. [8.2]

35. Purified protein derivative (PPD) tuberculin
A preparation of purified protein derived from culture filtrate of Mycobacterium tuberculosis. The tuberculin skin test uses 0.1 mL or 5 tuberculin units of PPD standardized to a common lot. [8.2]

36. Pulmonary TB
In Canada, pulmonary tuberculosis includes tuberculosis of the lungs and conducting airways, and includes tuberculous fibrosis of the lung, tuberculous bronchiectasis, tuberculous pneumonia and tuberculous pneumothorax. [8.2]

37. Respiratory TB
This consists of pulmonary tuberculosis, tuberculous pleurisy (non-primary) and tuberculosis of intrathoracic lymph nodes, mediastinum, nasopharynx, nose (septum) and sinus (any nasal). [8.2]

38. Second-line Anti-tuberculosis Drug
Anti-tuberculosis drugs reserved for use as alternative treatment to the first-line drugs.
Second-line drugs consist of:

i. Aminoglycosides, such as amikacin, kanamycin and streptomycin
ii. Cyclic polypeptides, such as capreomycin
iii. Analogs of d-alanine, such as cycloserine
iv. Fluoroquinolones, such as levofloxacin, moxifloxacin and ofloxacin
v. Rifamycins other than rifampin, such as rifabutin or rifapentine
vi. Salicylic acid-antifolates, such as para-aminosalicylate (PAS)
vii. Thioamides, such as ethionamide and protionamide, and
viii. Phenazine derivatives, such as clofazimine. [8.2]

39. Smear
A laboratory technique for preparing a specimen so that bacteria can be visualized microscopically. [8.2]
Note: Smear results are typically reported as a graded number of acid-fast bacilli (no AFB to 4+ AFB).

40. Smear Positive
A specimen that is positive for acid-fast bacilli. [8.13]
Note: The mycobacterium species may or may not be identified.[8.13]

41. Source Case (TB)
The person who was the original source of infection for secondary case(s) or contacts. The source case can be, but is not necessarily, the index case. [8.2]

42. Suspect (Probable) Case (TB)
High index of suspicion of active infectious TB disease with commitment to treatment. For the purposes of determining if a TB contact investigation should be considered, a "suspect (probable) case" of TB has been defined in Manitoba as a case where:

Acid-fast bacilli (AFB) are observed in smear of respiratory or other clinical specimen; and that case is clinically compatible with infectious MTB disease.

OR

A physician who has expertise in the diagnosis of TB has concluded that there is reasonable probability the individual has infectious MTB disease.[8.13]

43. Treatment of Latent Tuberculosis Infection (LTBI)
The provision of therapy to individuals with LTBI to prevent progression to active disease; formerly termed preventive therapy or chemoprophylaxis.[8.2]

44. Tuberculin Skin Test (TST)
Skin test to identify whether a person has delayed-type hypersensitivity reaction to tuberculin antigens.[8.2]
NOTE: This test is not helpful in diagnosis of active TB and can have a false negative result in advanced active disease and/or immunocompromised patients.

Addressograph

TB Risk Assessment Form

Address: _____
Home Telephone#: _____ Work Telephone#: _____ Cell Phone#: _____
DOB: ____/____/____ Sex: _____
Ethnicity: _____ Race: _____
Country of birth: _____ Year of arrival in Canada: _____
Language(s) spoken: _____ Interpreter needed? _____NO _____YES
History of Prior BCG? ____NO ____YES →Specify year: _____ Is patient pregnant? ____NO ____YES → LMP: ___/___/___
Drug allergies: _____

I. Screen for TB Symptoms *(Check all that apply)*

___None (Skip to Section II, "Screen for Infection Risk")
___Cough for > 3 weeks → Productive? ____Yes ____No
Hemoptysis? ____Yes ____No
___Fever, unexplained
___Hemoptysis
___Unexplained weight loss
___Poor appetite
___Night sweats
___Fatigue

Evaluate these symptoms in context

Pediatric Patients (≤ 5 years of age)
___Wheezing
___Failure to thrive
___Decreased activity, playfulness and/or energy
___Lymph node swelling
___Personality changes

II. Screen for TB Infection Risk *(Check all that apply)*

Individuals with an increased risk for acquiring latent TB infection (LTBI) or for progression to active disease once infected should have a TST. Screening for persons with a history of LTBI should be individualized.

A. Assess Risk for Acquiring LTBI
__Person is a current close contact of a person known or suspected to have TB disease
Name of source case: _____
__Person has lived in a country – for 3 months or more – where TB is common, and has been in Canada for 5 or fewer years
__Person is a resident or an employee of a high TB risk congregate setting
__Person is a health care worker who serves high-risk clients
__Person is medically underserved
__Person has been homeless within the last two years
__Person is an infant, a child or an adolescent exposed to an adult(s) in high-risk categories
__Person injects illicit drugs or uses crack cocaine
__Person is a member of a group identified by the local health department to be at an increased risk for TB infection
__Person needs baseline/annual screening approved by health department

B. Assess Risk for Developing TB Disease if Infected
__Person is HIV positive
__Person has risk for HIV infection, but HIV status is unknown
__Person was recently infected with ***Mycobacterium tuberculosis***
__Person has certain clinical conditions, placing them at higher risk for TB disease
__Person injects illicit drugs (determine HIV status)
__Person has a history of inadequately treated TB
__Person is >10% below deal body weight
__Person is on immunosuppressive therapy

HISTORY OF TB Skin Test and TB Treatment

Prior Mantoux Tuberculin Skin Test (TST)?
__No __Yes→ Date: __/__/__ Induration: ___mm
Prior TB treatment? __No__Yes →Provide details below:↓

TB Treatment History
___LTBI ___TB Disease
Year of treatment: _____
Treatment duration: _____
TB medications taken: _____
Location of treatment: _____

III. Finding(s) *(Check all that apply)*

___Previous Treatment for LTBI and/or TB disease
___No risk factors for TB infection
___Risk(s) for infection and/or progression to disease
___Possible TB suspect
___Previous positive TST, no prior treatment

IV. Action(s) *(Check all that apply)*

__Issued screening letter
__Referred for CXR
__Referred for medical evaluation
__Administered the Mantoux TB Skin Test
__Issued sputum containers
__Other _____

TST #1	*TST #2*
Arm ___Left ___Right	Arm ___Left ___Right
Date Given ___/___/___	Date Given ___/___/___
Time Given _____	Time Given _____
Date Read ___/___/___	Date Read ___/___/___
Time Read _____	Time Read _____
Induration _____ mm	Induration _____mm
__Positive __Negative	__Positive __Negative

Screener's signature: _____
Screener's name (print): _____
Screener's title: _____
Date: _____ Phone number: _____
Primary care provider: _____
Primary care provider phone number: _____
Comments: _____