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Communicable Disease Control Manual

Chapter 4: Tuberculosis

4.0(a) TB SCREENING & TESTING



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4.0(a) TB SCREENING & TESTING

4.1 Indications for TB Screening

TB screening is indicated for:

- people presumed to have active TB disease.
- people at increased risk for TB infection, specifically:
 - contacts to active cases of TB disease.
 - those born in high TB incidence regions.
 - some travellers¹ to high TB incidence regions.
 - residence in regions with a high incidence of active TB disease
 - [homeless or under-housed](#) (e.g., shelter users, those with no fixed address).
 - residents of congregate living settings (e.g., correctional facilities, residential treatment programs).
 - persons who inject drugs (PWID) and/or crack/cocaine use
- people with TB infection at increased risk for development of active TB disease (e.g., people with HIV infection, chronic kidney disease on dialysis or end-stage, contacts).
- people undergoing medical examinations related to migration.
- some employees, students, and volunteers.

Practitioner Alert!

When screening clients who are [immune compromised](#), [candidates for window period prophylaxis](#) or those who are symptomatic, consider additional tests and/or referral to TB Services.

[See Section 4\(b\): Tuberculosis Screening Decision Support Tool.](#)

¹ Canadian Thoracic Society's targeted LTBI recommendations for travellers are as follows: > 1 month of travel with very high risk contact (e.g., direct patient care in a hospital, prison, homeless shelter, refugee camp, inner city slum), > 3 months travel to TB incidence country >400 cases/100 000 population, > 6 months travel to a TB incidence country 200-399 cases/100 000 population, >12 months travel to a TB incidence country 100-199 cases/100 000 population (CTS 2014).



4.2 The TB Screening Form

The [TB Screening Form](#), formerly known as the HLTH 939, has the following main purposes:

- provides a framework for a comprehensive TB assessment, including TB health history, TB risk factors, TB symptoms and clinical assessment.
- acts as a chest x-ray requisition.
- is a referral pathway for continued care.
- allows for TB physicians to communicate recommendations to the client and their health care providers (HCPs).

Health care providers document TB screening activities using the [TB Screening Form](#). This form is divided into four parts, each completed by a specific individual involved in the screening process.

Table 4-1: Tuberculosis Screening Form

Part	Completed By
Part 1 – Demographic information	Client/Health care provider
Part 2 – Indications for screening, active TB symptom assessment, risk factors, and results of tuberculin skin tests (TSTs) or interferon gamma release assays (IGRA)	Health care provider
Part 3 – Chest x-ray results	Radiologist
Part 4 – TB Services physician recommendations	TB Services Physician

Referral to TB Services typically requires a health care provider completing and submitting the TB Screening Form to TB Services following completion of Parts 1 and 2.

Chest x-ray referral typically involves the health care provider instructing their client to take a completed TB Screening Form (page 2 with sections of medical history blacked out) to their local radiology department. Most radiology providers accept the TB Screening Form as a requisition for chest x-rays performed for TB screening purposes. For sites using Panorama, [chest x-ray requisitions](#) are available on the BCCDC website.

Recommendations from TB Services are communicated back to providers via Panorama or the TB Screening Form and/or physician narratives, and may include requests for additional follow-up or testing.

The [TB Screening Form](#) can be printed from the BCCDC website. Additionally, a [Documentation guide for the TB screening form](#) is available.



4.3 TB Screening

TB screening should begin with the initiation of the TB screening form ([Section 4.2](#)) to guide a comprehensive TB assessment which includes gathering a TB history, assessing for signs and symptoms of TB disease ([Section 4\(b\): Table 3](#)) and an evaluation of risk for the development of active TB disease if infected with TB bacteria (This risk is variable and largely influenced by factors that impair immune function (see [Section 4\(b\): Table 2](#)).

People at highest risk include:

- Those with substantial immune suppression, especially people with HIV infection/AIDS.
- Contacts to infectious TB disease within the prior two years, especially those with substantial immune suppression and children under five.

The results of the comprehensive TB assessment, along with the reason(s) for the TB screening, will determine which of the following tests to complete:

- Tuberculin skin test (TST) (see [Section 4.4.1](#) and [Appendix A](#)) and/or IGRA ([Section 4.4.2](#))
- Chest x-ray ([Section 4.4.3](#))
- Testing of sputum and/or other specimens for TB bacteria ([Section 4.4.4](#))

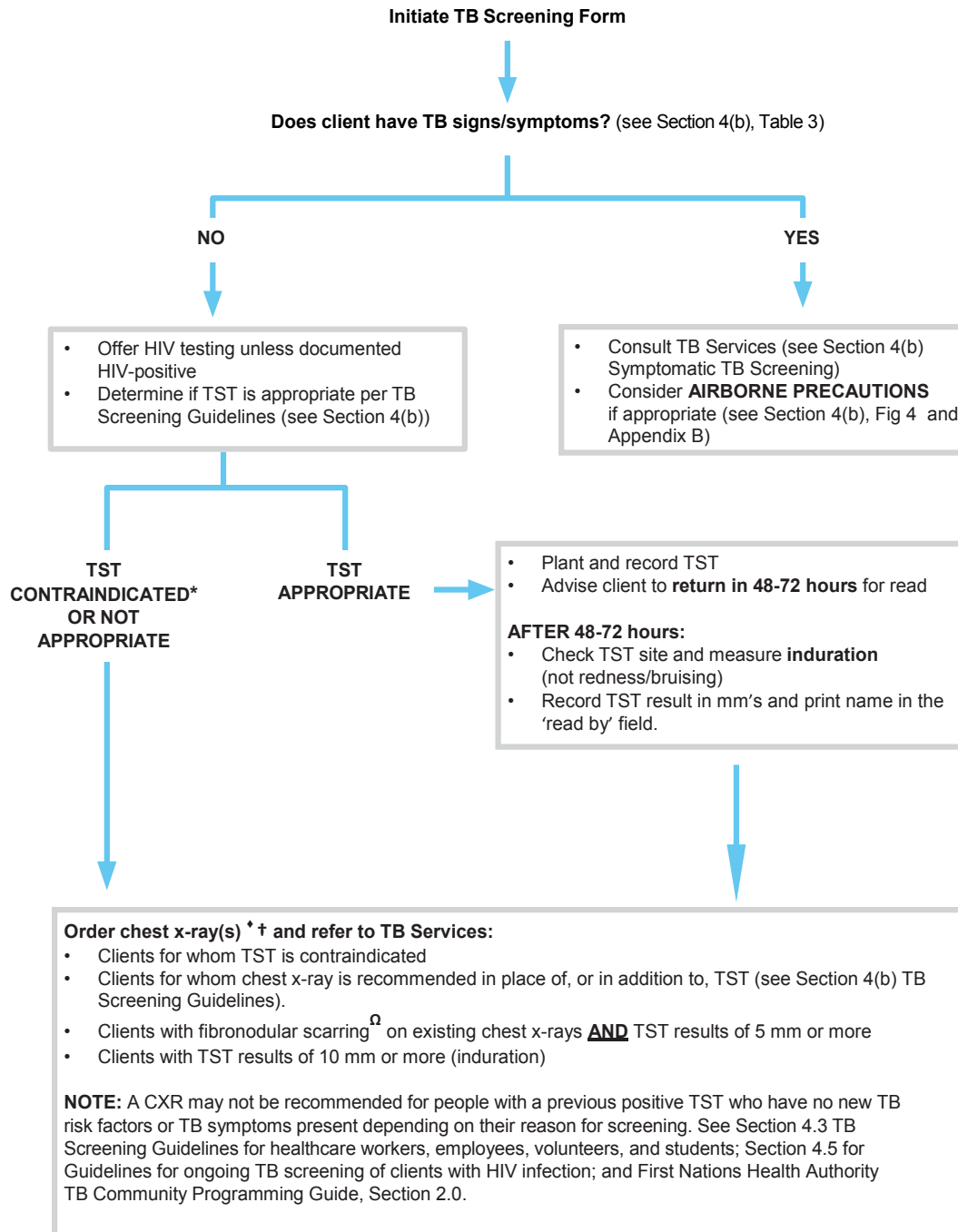
For additional information on other tests used in the diagnosis of active TB disease (e.g. histopathologic examinations, computed tomography, magnetic resonance imaging etc.) as well as for further information on the diagnosis of latent TB infection, please refer to the [Canadian Tuberculosis Standards](#).

Refer to [Section 8.2](#) for the TB testing flowchart for TB contacts.

Refer to [Section 4\(b\), Figure 3](#) for the post-landing TB surveillance testing flowchart.



Figure 4-1, TB Screening Flowchart



* Refer to Section 4(b), Table 5
 † See Section 4(b), Diagnostic Tests for use of pre-existing chest x-rays (Table 7) and chest x-rays during pregnancy.
 ‡ Children under 5 and clients with HIV infection – order posterior-anterior (PA) and lateral views
 Ω Healed TB and not previously treated



4.4 TB Tests

4.4.1 Tuberculin Skin Test (TST)

Refer to [Section 4\(b\) TB Screening DST](#) for an overview of TST indications, results and interpretation. Refer to Appendix A for an overview of the TST procedure, including precautions, limitations, administration and how to read.

TST is used to detect infection with TB bacteria. TST cannot differentiate between latent TB infection (LTBI) and active TB disease.

The test consists of an intradermal injection of a small volume (0.1 mL) of purified protein derivative from *M. tuberculosis* bacteria (PPD, also known as tuberculin). People infected with TB bacteria usually respond to tuberculin with a delayed hypersensitivity reaction that manifests as a discrete area of swelling and firmness (induration) at the site of the injection.

Serial TST's are usually done on an annual basis and are recommended for some people who are at risk for exposure to TB (see [Section 4.1](#)) to help identify new TB infections, otherwise known as [TST conversions](#). This can help facilitate the treatment of LTBI.

Two Step TST – Background and Indications

Where resources permit, two-step TST should be considered for any client where serial TSTs are likely to be offered, for example:

- Health care providers.
- Inmates and employees of correctional facilities.
- Some travellers prior to departure to countries with high TB incidence, where exposure to TB is considered likely²

The rationale is that some people with long-standing TB infection do not respond accurately to a single TST, but produce an anamnestic immune response if given a second TST at a later date. It is recommended that the second TST be performed within 1 to 4 weeks, but can be given up to a year later.

This phenomenon is referred to as 'boosting' or a 'boosted TST'. For example, a client could have a 5 mm TST reaction to an initial test, followed by a 15 mm TST reaction to a TST given 6 months later, even without an interval contact. BCG vaccination and exposure to some non-tuberculous mycobacteria (NTM) can also cause TST reactions that boost in response to repeated testing.

Boosting can be misinterpreted as a [TST conversion](#) if repeat TSTs are done within the window period for a true conversion, usually eight to twelve weeks post contact (known or unknown). This can have implications for clients, who may be wrongly considered a recent contact to TB and strongly advised to take LTBI treatment, and for programs that monitor for [TST conversions](#) in employees (e.g., hospitals, correctional facilities).

² For detailed recommendations on TB screening for returning travelers, refer to [Chapter 13](#) of the Canadian Tuberculosis Standards.



Two-step TSTs can be used to establish more accurate baseline TST results for people who have regular TSTs performed. The testing protocol (see [Appendix A](#)) is based on the premise that challenging a person's immune response to repeat tuberculin testing will elicit a more reliable TST result. After a two-step TST result has been documented for a client, a client should only get one TST in the future; regardless of how long it has been since the two-step TST was done.

Practitioner Alert!

Precautions on Two-step TST

The two-step TST protocol is not equivalent to the standard initial and 8-week post-exposure TST assessment in contacts and **should not** be used in TB contact investigations. Recent two-step testing does not preclude appropriate contact assessment with TST.

4.4.2 Interferon Gamma Release Assay ([IGRA](#))

IGRA is a relatively new test to detect infection with TB bacteria. IGRAs, just like TSTs, cannot differentiate between LTBI and active TB disease.

IGRAs are blood tests that work by measuring the level of interferon-gamma in a client's blood sample after exposure to antigens specific to *M. tuberculosis*. The results are interpreted as positive, negative or uninterpretable. Because the antigens used are more specific to *M. tuberculosis* than a TST, IGRA results are not influenced by cross-reactivity from BCG vaccination or exposure to most NTM. Consequently, IGRA can be more reliable for detecting TB infection than TST in these circumstances.

In BC, IGRA is not considered a replacement test for the TST but is used as a supplemental test in specific circumstances. IGRA testing can **only** be ordered by TB Services (TBS) physicians and clinic nurses, select physician specialists, and Federal Corrections, and can only be performed at designated testing sites at this time. Refer to the BCCDC website for current information on indications, eligibility, and procedures for accessing IGRA testing in BC, including the [IGRA Testing Guidelines for Physicians](#) and the [IGRA testing process for Public Health and Community Health Nurses](#) in most Health Authorities.

When a client presents with a history of IGRA testing, refer to [Section 4\(b\) Table 6](#) for screening recommendations. Refer to [Section 8.2 and 8.3.1](#) for further information on use of IGRA in contacts.



4.4.3 Chest X-Ray

Chest x-rays are used to detect radiographic abnormalities consistent with prior or current TB disease. Refer to [Section 4\(b\) TB Screening Guidelines](#) on when to include chest x-rays in routine TB screening. Refer to [Section 8.2](#) for guidelines on chest x-rays for contacts. Refer to [Section 4.2](#) for information on how to refer clients for a CXR.

Indications

The following clients should be sent for chest x-rays and referral made to BCCDC TB Services:

- Anyone with a new positive TST result (see [Section 4\(b\) Table 6](#))
- Anyone presumed to have active TB disease (See [Symptomatic TB Screening](#))
- ALL immune compromised clients getting screened prior to starting immune suppressant therapy, regardless of TST result
- ALL new dialysis clients, as per BC Renal Agency [TB Screening & Follow-Up](#) guidelines
- ALL clients getting screened for live donor assessment
- ALL baseline screening for people living with HIV infection, regardless of TST result
- ALL less than 5 years of age at high risk for infection (e.g. symptomatic, contact to a case of active TB disease), regardless of TST result

See [Section 4\(b\)](#), Diagnostic Tests, for further information on CXR contraindications, limitations and when pre-existing CXR's are acceptable.

Chest X-Ray Findings Suggestive of Active TB Disease

Typical findings in immune competent adults include:

- Infiltrates in the apical-posterior segments of upper lobes or superior segment of lower lobes
- Volume loss
- Cavitation – often seen in later stages

Findings in children and clients with immune compromising conditions may include:

- Hilar and mediastinal adenopathy
- Non-cavitary infiltrates and lower lobe involvement

When clients are referred for TB screening due to abnormal chest x-ray results, TB Services may request lateral views and/or repeat PA views.



4.4.4 Testing of Sputum and Other Specimens for TB Bacteria

Refer to [Appendix C](#) for information regarding collection and submission of specimens for TB testing.

Testing of sputum and other specimens for TB is essential for diagnosing or excluding active TB disease and important for clinical and public health management. In Canada, the gold standard for confirmation of active TB disease is a mycobacterial culture that is positive for [MTB complex](#) using both liquid and solid media. Routine culture and sensitivity (C&S) testing will **not** detect TB bacteria. Mycobacterial testing (e.g., [acid-fast bacilli \(AFB\)](#) smear and mycobacterial culture) is required.

Mycobacterial testing can:

- **Detect** whether there are mycobacteria in a specimen.
- **Identify** which mycobacteria are present (if any).
- **Inform estimates** on the degree of infectiousness of a TB case and/or monitor response to treatment based on the number of TB bacteria seen in AFB smears of respiratory specimens.
- **Confirm** which drugs the tested mycobacteria are susceptible to via ([drug susceptibility testing](#)).

Almost any body fluid or tissue can undergo mycobacterial testing. Sputum and other respiratory specimens (e.g., bronchial washings and gastric aspirates) are tested most often. Other specimens, such as pleural fluid, cerebral spinal fluid, urine, blood, and tissue biopsies are used in the diagnosis of non-respiratory TB disease. Consult TB Services and/or the client's health care provider prior to submitting specimens other than those originating from the respiratory tract.

Submission of multiple, good-quality specimens is very important for ensuring accurate test results. Accurate test results can reduce delays in diagnosing new cases of TB disease and help to interrupt transmission of TB from infectious cases. When sputum specimen testing for TB is indicated, submit three specimens (see [Appendix C](#)). Indicate on the requisitions that copies of the results are to be sent to TB Services. See [Table 4-2](#) on Mycobacteriology Lab Results Timelines for lab reporting details.

Indications

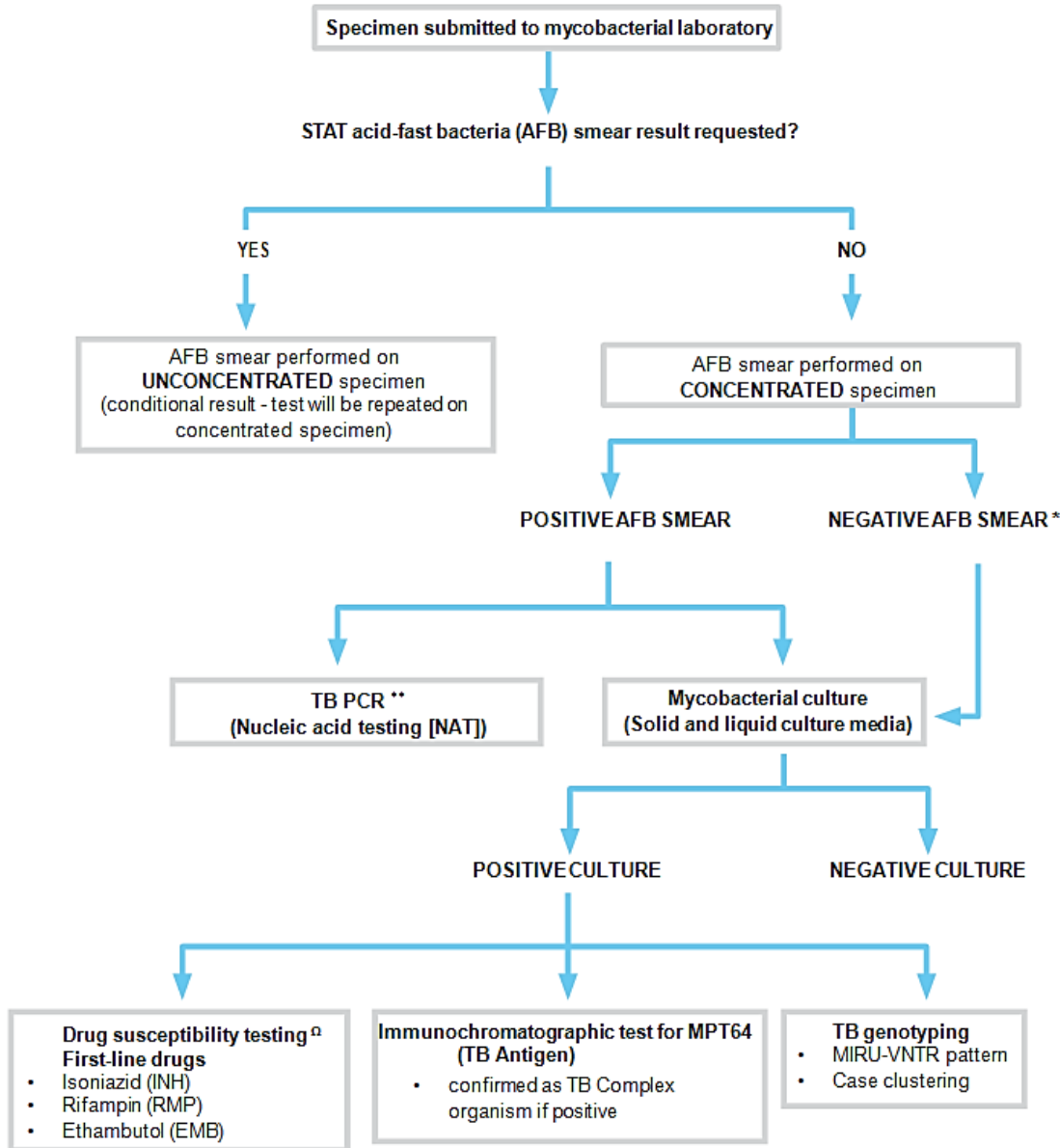
Submit **one STAT** sputum specimen plus **two** additional specimens for TB testing for:

- Symptomatic clients: for clients suspected of having non-respiratory forms of TB disease (e.g., TB lymphadenitis). Sputum testing for TB is important for ruling out concurrent respiratory TB disease, and determining whether respiratory isolation and/or contact investigation is necessary (see [Figure 4-1](#) and [Appendix B](#)).
- Clients with chest x-ray findings suggestive of active TB disease (see [Section 4.4.3](#)).
- TST-positive and/or IGRA-reactive clients with HIV infection (see [Section 4.5](#)).

Sputum specimen testing may also be recommended by TB Services in lieu of shielded chest x-rays for pregnant women for whom TB screening is indicated.

Consult TB Services for guidance on management of clients unable to spontaneously produce sputum (see [Appendix D](#)).

Figure 4-2, Flowchart for testing of specimens for TB bacteria



* If there is a high suspicion for active TB disease, NAT's can be performed for AFB smear-negative respiratory specimens on request from the physician or TB Services. TB NAT testing on respiratory smear negative specimens has only ~66% sensitivity. Interpret negative results with caution.

** TB PCR is performed on AFB smear-positive specimens from new cases automatically. Repeat TB PCR may be performed with BCCDC Public Health Laboratory (PHL) medical microbiologist's approval. Positive TB PCR results indicate active TB disease is likely; results from mycobacterial culture are required to confirm organism visibility and drug susceptibilities.

Ω Further drug susceptibility testing may be ordered in consultation with the BCCDC PHL and/or TB Services.



Table 4-2: Mycobacteriology Lab Results Timelines

Mycobacteriology Lab Type	Timelines	Notes
Direct specimen processing		
AFB smears	TAT 24-48 hrs from receipt Processing: mornings Reporting: afternoons	Available Monday - Saturday If specimen arrival is after 11am, it will be processed the next working day.
PCR (polymerase chain reaction)	TAT 48-72 hrs Daily Mon-Fri, results usually ready after 1200hrs	Testing starts at 0800 for AFB positive processed specimens received the day before. MTB complex and MAC for AFB smear positives (new) or requested AFB smear negative
Culture set up		
Cultures	Incubated up to 8 weeks; no growth reported at 6 weeks Growing isolates are identified within 2-14 days of positivity, depending on species	All fresh specimens are set up for culture. Solid media are manually read once weekly at weeks 1-4, 6 and 8. Liquid media are continuously monitored for 6 weeks. Positive growths (in solid or liquid media) go on to be identified/speciated
Isolates Speciation		
TB complex MPT64 Antigen test – for TB diagnosis	Test performed on the day growth positivity detected	Available Monday – Friday; performed on AFB-positive isolates
Biochemical-based TB complex speciation	Results available up to 3 weeks after positive growth	Respiratory isolates are reported as “ <i>M. tuberculosis</i> ” with speciation confirmed later; Non-respiratory isolates are reported as “ <i>M. tuberculosis</i> complex, species identification to follow”
Non-TB Mycobacteria (NTM) MAC Accuprobe – for MAC diagnosis	Performed Tuesdays and Thursdays	Performed on all non-TB complex isolates suspicious for MAC
HSP65 Sequencing – for any NTM diagnosis	Performed once a week	Performed on all non-TB complex and non-MAC isolates Testing starts on Tuesdays with results available on Thursday afternoons



Table 4-2: Mycobacteriology Lab Results Timelines (cont'd)

TB Susceptibility testing		
1st line drugs – BCCDC	1-2 weeks after culture growth	Ethambutol, Isoniazid (0.1 and 0.4 if 0.1-resistant), Rifampin
Pyrazinamide - BCCDC	Results available within 7 days of set-up	Pyrazinamide susceptibility is performed on all Isoniazid and/or Rifampin-resistant and CSF isolates
2nd line drugs – National Microbiology Lab and National Jewish Hospital	Results available in several weeks from send out	Amikacin, Capreomycin, Ethionamide, Kanamycin, Linezolid, Ofloxacin, PAS, Rifabutin, Streptomycin, Moxifloxacin, Clofazimine, Cycloserine All Isoniazid resistant isolates are sent out to NML for fluoroquinolone susceptibility testing All Rifampin resistant isolates and MDR isolates are sent out to NML and National Jewish laboratory for extended susceptibility testing
MIRU	2-3 weeks after culture grows (typically)	Done automatically on all new TB cultures

Note: The information provided was last updated July 2019. It serves as a general reference and changes may not be reflected in a timely manner. Please refer to the [eLab Handbook](#) of the BC Public Health Microbiology & Reference Laboratory for further details.



4.5 Guidelines for Ongoing TB Screening of Clients with HIV Infection

A low CD4 count ($CD4 < 200 \times 10^6/L$) compromises the capacity to mount a response to the TST. Although it is not clear whether the [IGRA test](#) is similarly affected, an IGRA may be recommended by TBS when baseline TST is negative, there is high concern for exposure/infection and/or the $CD4 < 200 \times 10^6/L$.

If baseline TST is negative ($< 5mm$) and CD4 increases to $> 200 \times 10^6/L$, a repeat TST is suggested.

Annual follow-up:

- Assess for ongoing risk factors and [signs & symptoms](#) (see [Section 4\(b\), TB Assessment](#)).
- Manage clients with findings or [signs & symptoms](#) consistent with active TB disease as described in [Section 4\(b\), Symptomatic TB Screening](#).
- If there is risk³ for ongoing exposure **AND** baseline TST is negative: repeat both the TST and posterior-anterior (PA) and lateral chest x-rays. This should not preclude formal contact investigation.
- If there is risk³ for ongoing exposure **AND/OR** there is a documented history of untreated LTBI (i.e. TST positive or IGRA reactive, fibronodular changes on CXR) repeat PA and lateral chest x-rays, consider sputum collection, and offer treatment for LTBI once active TB is ruled out.

Active TB in clients with HIV infection may present in the absence of classic signs and symptoms. Maintain a high index of suspicion for active TB in clients with HIV infection, when there is unexplained illness **AND/OR** a history of latent TB infection (e.g., previous TST positive, IGRA reactive or fibro nodular scarring on chest x-ray footnote) and/or increased risk for recent or remote exposure.

For the management of contacts with HIV infection, see [Figure 8-3](#).

Manage clients with findings or signs/symptoms consistent with active TB disease as described in [Section 4\(b\), Symptomatic TB Screening](#).

³ Travel to a high TB incidence country, residence in regions with a high incidence of active TB disease, homeless/under-housed, resident of a congregate living setting (e.g., correctional facility, long-term care facility, residential alcohol and drug treatment program) or contact to an active case of TB disease (past 2 years).



4.6 Immigration Medical Surveillance Program

The [Canadian Immigrant and Refugee Protection Act](#) [1] mandate includes TB screening in migrants coming to Canada to ensure all newcomers to Canada are free of infectious TB disease. The process starts with an Immigration Medical Exam (IME) and, depending on the results, may include TB medical surveillance.

4.6.1 Immigration Medical Exam

All migrants applying for permanent residency and certain migrants applying for a visitor, student or worker visa need to complete an [Immigration Medical Exam](#) [2]. An approved immigration physician ([Panel Physician](#)) from Immigration, Refugees and Citizenship Canada (IRCC) performs this exam [3]. Once an IME is completed, it is valid for 12 months.

IMEs for most migrants are performed in their country of origin and the cost is borne by the applicant (except refugees). Those found to have active TB disease must complete treatment and provide proof of successful treatment completion prior to arrival to Canada.

Refugees and refugee claimants may be eligible for coverage of IMEs and other TB-related medical services through the [Interim Federal Health Program](#).

The IME, in addition to identifying individuals with active TB disease, will also identify individuals at increased risk for progression to active TB. They are permitted to enter Canada but are placed under **TB medical surveillance** (see [Section 4.6.2](#)). IRCC will inform the applicant that they need to report to Public Health for medical follow-up as a condition of their immigration application. At the same time, IRCC will notify TB Services of applicants requiring TB medical surveillance.

Some IMEs are performed **in Canada** when an applicant wishes to renew their visa, change their immigration status or claim refugee protection. During the IME process, the immigration physician or IRCC Regional Medical Office may require additional medical testing and referral to a TB specialist at BCCDC TB Services. This is known as the **furtherance process**, as the applicant requires further specialized medical assessment prior to their IME being completed. It is different than the TB medical surveillance process, which occurs after the IME is complete and is a condition of their immigration application [3]. If the person is diagnosed with active TB, immediate TB treatment and care is provided and paid for by the BC government and the applicant may remain in Canada. Their diagnosis does not affect their immigration status.

4.6.2 TB Medical Surveillance Process

All applicants requiring TB medical surveillance will receive a *Medical Surveillance Undertaking* form (IMM 0535B) from the visa/immigration officer prior to the applicant's departure for Canada or by the port-of-entry officer upon the applicant's arrival to Canada. This form contains information on when (either within 30 days if routine follow-up or 7 days if urgent follow-up) and how to report to provincial/territorial public health authorities for TB medical surveillance.

Following notification from IRCC of applicant's requiring TB medical surveillance in BC, TB Services will send a letter to the appropriate regional health authority (RHA) to facilitate follow-up at the local public



health unit. If an applicant reports to a public health unit to initiate their medical surveillance prior to the public health unit receiving a letter from TB Services, please fax a copy of their *Medical Surveillance Undertaking* form (IMM 0535B) to TB Services so that their file can be requested from IRCC (See [Figure 4-3, TB medical surveillance process](#)).

1st Surveillance Visit: When the applicant presents to a public health unit with their *Medical Surveillance Undertaking (MSU)* form **and/or** the public health unit has also received a letter from TB Services, initiate a comprehensive TB Assessment, including:

- Assessment of TB signs/symptoms;
- Evaluation of risk for development of active TB disease;
- 3 sputum samples;
- Stat CXR if symptomatic;
- If asymptomatic, request CXR in 3 months.

Consideration of fees and TB medical surveillance:

In general, most applicants **do not** have to pay for TB medical surveillance if they:

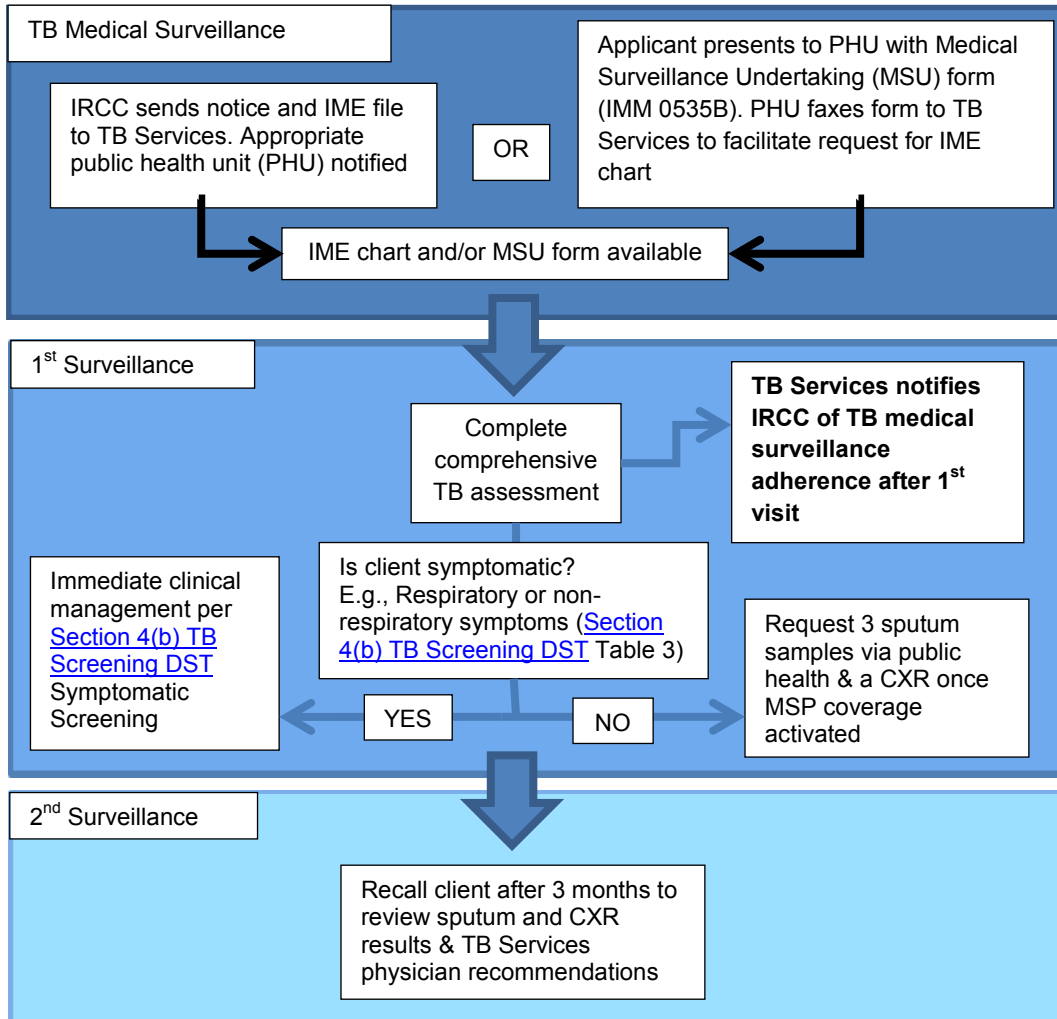
- present to Public Health/TB Services for TB medical surveillance;
- are eligible to receive MSP and;
- do not require a CXR prior to activation of MSP.

If a client is symptomatic of **active TB disease**, all related investigative health care expenses may be covered by Public Health and TB Services.

2nd Surveillance Visit: Asymptomatic clients are recalled after three months to review the results of the TB assessment, including sputum smear and culture results and chest x-ray reports, and the BCCDC TB Services physician recommendations. Further follow-up recommendations may include testing or treatment of LTBI and would be followed as per usual process.

See [Section 4\(b\), Immigration Screening](#) for further details on TB medical surveillance testing and follow-up.

Fig 4-3, TB medical surveillance process





REFERENCES

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