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Communicable Disease Control Manual
Chapter 4: Tuberculosis

Section 4(a): TB Screening Overview

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4.0(a) TB SCREENING OVERVIEW

4.1 Indications for TB Screening

TB screening is indicated for:

- people presumed to have TB disease.
- people at increased risk for TB infection.
- people at increased risk for development of TB disease.
- people undergoing immigration medical surveillance screening.
- employees, students, and volunteers in some workplace settings.

See Section 4(b) TB Screening Decision Support Tool (DST) for detailed guidance on screening the above populations.

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 (TBS).

See **Section 4(b): Tuberculosis Screening DST**.

4.2 Considerations for Key Populations

Some work or school settings

Persons who work in settings where exposure to TB is more likely may be at risk for TB infection based on local TB epidemiology and risk of transmission. It's important to identify a person's baseline TB status to appreciate their risk of progressing to TB disease at the time of testing and/or with a future TB exposure to help inform their TB care plan.

Residence in some congregate settings

Persons who live in settings where the risk of both TB exposure and subsequent transmission is high benefit from TB screening, mainly, by identifying TB disease prior to a person residing in a shared, congregate setting.

Immunosuppressive conditions or treatments

Persons with an immunosuppressive medical condition or taking immunosuppressive treatment are at risk for developing TB disease if infected with TB. Prevention and early intervention is key.

People living with HIV infection (PLWH) who become infected with TB are at high risk for developing TB disease. Timely antiretroviral treatment (ART) and treatment for TB infection (TPT) reduce this risk (1).

Symptomatic

People who present with TB symptoms and have TB risk factors for TB exposure should be evaluated for TB disease. Canada is a low TB incidence country, but TB disproportionately impacts some populations within our communities. Health inequities, current and historical racism, TB stigma and discrimination, lack of TB awareness among health care providers and health care system resource issues can impact timely TB diagnosis and care (2).

Contacts

Persons exposed to an individual with infectious, TB disease, represent the group with the highest risk of being infected with TB. Amongst contacts, risk for progression to TB disease is highest among children less than 5 years of age (1). Prompt evaluation of contacts is key. See Section 8 Assessment and Follow-Up of Persons of Contact.

Surveillance screening in First Nations communities

Indigenous peoples are disproportionately affected by TB due to current and historical social and health service inequities related to colonialism. The First Nations Health Authority (FNHA) TB Services program, also known as “In'ati Is'ick (Paddling Together)", aims to close the gap in the disparity of incidences of TB for First Nations peoples (3). Services are primarily delivered in First Nations communities and include community-level assessment, monitoring and prevention of TB, holistic case management and contact assessment, capacity building through culturally-informed TB awareness and prevention activities, and surveillance, data collection and evaluation.

Immigration or travel to places with high rates of TB

Immigration, Refugees and Citizenship Canada (IRCC) requires all individuals applying for permanent residency and certain individuals applying for temporary residency to undergo an immigration medical exam (4). While IRCC mandates TB screening upon arrival to Canada, most TB amongst newcomers to Canada occurs due to the reactivation of TB infection acquired in their country of origin years after their arrival. This is related to their experiences of social, legal and economic inequities in Canada. About 80% of TB disease cases in BC occur in those born in high-burden countries, although local transmission is low within BC.

Travel to places with high rates of TB may result in an increased risk of developing TB infection. The length of time and type of visit impact the risk (4).

4.3 TB Screening Form

The TB Screening Form has the following main purposes:

- provides a framework for the TB screening process that includes: a TB risk assessment, including a review of a person's TB history and TB risk factors, a TB signs and symptoms evaluation and a clinical assessment.
- acts as a chest x-ray requisition.
- is a referral pathway for continued care.
- allows for TB clinicians 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, 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 and location (e.g., CareConnect)	TBS X-ray Clerk
Part 4 – TBS recommendations	TBS Clinician

Referral to TBS 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 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 TBS 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.

4.4 TB Screening Process

TB screening should begin with the initiation of the TB Screening Form (**Section 4.3**) to guide the TB risk assessment and signs and symptom evaluation, which includes:

- gathering a TB testing and treatment history;
- evaluating TB risk factors for exposure and progression to TB disease; and
- assessing for signs and symptoms of TB disease.

Refer to Tables 1, 2 and 3 in Section 4(b) TB Screening DST for risk factor and signs and symptoms overview.

The risk of developing TB disease is variable and primarily influenced by factors that impair immune function. As discussed in **Section 4.2**, people at the highest risk include:

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

The results of the TB risk assessment and TB signs and symptoms evaluation along with the reason(s) for TB screening will determine if further testing is needed and if so, which of the following tests to complete:

- TST and/or IGRA (**Section 4.5**)
- Chest x-ray (**Section 4.6**)
- Testing of sputum and/or other specimens for TB bacteria (**Section 4.6**)

Recommendations provided by TB Services for further follow-up and/or treatment are based on the information provided on the TB Screening Form - TB risk factors, signs and symptoms, and recent or historical TST/IGRA and diagnostic test results.

For additional information on other tests used in the diagnosis of TB disease (e.g. histopathologic examinations, computed tomography, magnetic resonance imaging etc.) and for further information on the diagnosis of latent TB infection, please refer to the Canadian Tuberculosis Standards, 8th edition.

TB screening guidelines for specific settings, programs and key populations are described in **Section 4(b), TB Screening DST**.

4.5 TB Screening Tests

Tuberculin Skin Test (TST)

The TST is used to detect infection with TB bacteria. The TST cannot differentiate between TB infection and TB disease.

The test consists of an intradermal injection of purified protein derivative (PPD) 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.

- Refer to Appendix A for an overview of the TST procedure, including contraindications, precautions, limitations, administration and how to read.
- Refer to Section 4(b) TB Screening DST for details on TST indications and TST results.

The interpretation of TST results is completed by TBS. Not all positive TST results indicate treatment for TB infection, and not all negative TST results indicate an absence of TB infection. The interpretation of a TST result is based upon the:

- size of the TST reaction (see **Section 4(b), Table 4**)
- likelihood of true infection (see **Section 4(b),Table 1**) and
- risk factors for developing TB disease (see **Section 4(b), Table 2**)

Serial TST's are usually done on an annual basis and are recommended for people in some settings (e.g. health care) who are at risk for exposure to TB to help identify new TB infections, otherwise known as TST conversions. This can help facilitate the treatment of TB infection.

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 a high TB incidence, where exposure to TB is considered likely[1]

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.

[1] For detailed recommendations on TB screening for returning travellers, refer to Chapter 13 of the Canadian Tuberculosis Standards, 8th ed (4)

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 TB infection preventive treatment, and for programs that monitor for TST conversions in employees (e.g., hospitals, correctional facilities).

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 tracing. Recent two-step testing does not preclude appropriate contact assessment with TST.

Interferon Gamma Release Assay

The Interferon Gamma Release Assay (IGRA) is another test to detect infection with TB bacteria. IGRAs, just like TSTs, cannot differentiate between TB infection and 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.

The interpretation of IGRA results, similar to TSTs, is provided by TBS in the context of the likelihood of true infection and TB risk factors.

Additionally, online tools can help support clinicians interpretation of TST or IGRA results among different populations. These include *The Online TST/IGRA Interpreter, Version 3.0* and the *PERISKOPE TB.* Both tools help the health care provider assess the absolute risk of TB disease to inform recommendations and client education (5,6).

In BC, TBS recommends IGRA testing in specific circumstances or populations to support a diagnosis of TB infection.

- The Physician IGRA Guidelines outlines who can order publicly-funded IGRA testing in BC as well as information on IGRA indications, eligibility, and testing procedures.
- The Nurse IGRA Guidelines outline IGRA testing information relevant for nurses such as indications, referral procedures, testing sites and client instructions and teaching points.

Refer to Section 8 for further information on use of IGRA in contact assessment.

4.6 TB Diagnostic Tests

Chest X-Ray

Chest x-rays (CXR) are used to detect radiographic abnormalities consistent with prior or current TB disease.

Chest X-Ray Findings Suggestive of TB disease

Typical findings in immune competent adults may include:

- Infiltrates in the apical-posterior segments of upper lobes or superior segment of lower lobes
- Associated scarring or 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

Refer to Section 4(b) TB Screening DST for further information on:

- CXR indications in the Population-based TB Screening section;
- CXR contraindications, limitations and use of pre-existing CXR's in the Diagnostic Tests and Referrals section.

Refer to Section 4.3 for information on how to refer clients for a CXR. When clients are referred for TB screening due to abnormal CXR results, TBS may request lateral views and/or repeat PA views.

Testing of Sputum and Other Specimens for TB Bacteria

Testing of sputum and other specimens for TB is essential for diagnosing or excluding TB disease and important for clinical and public health management (see Section 3 Tuberculosis). In Canada, TB disease is confirmed with 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. TB disease is also confirmed with detection of MTB complex by nucleic acid amplification testing (NAAT) for cases with clinical findings consistent with current TB disease (See **Figure 4-2, Flowchart for testing of specimens for TB bacteria**).

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).

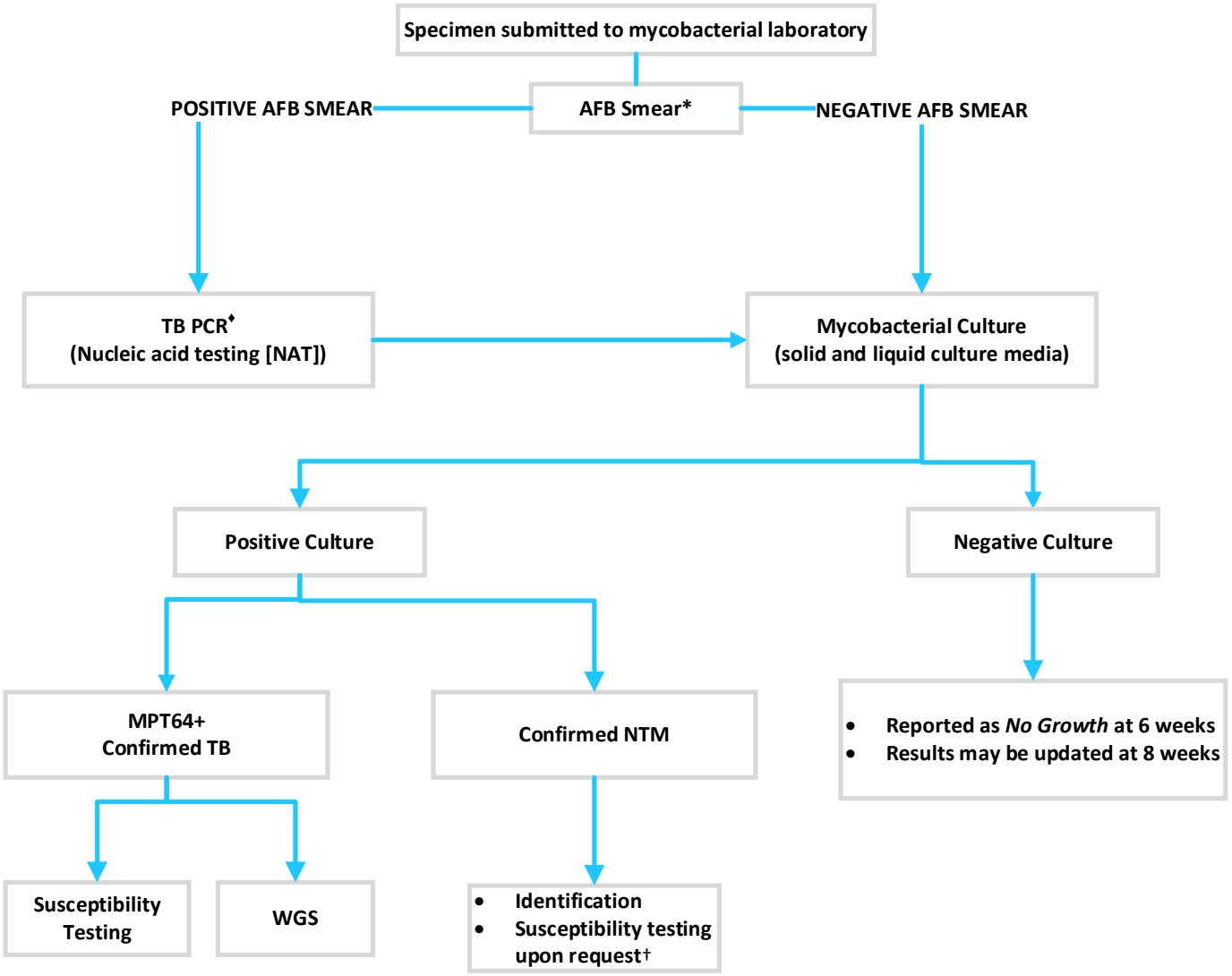
Almost any body fluid or tissue can undergo mycobacterial testing. Sputum and other respiratory specimens (e.g., bronchial washings and gastric aspirates) are tested most often. Other specimens, such as pleural fluid, cerebral spinal fluid, urine, blood, and tissue biopsies are used in the diagnosis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

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

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. For information on test result timelines, see **Table 4-2: Mycobacteriology Lab Results Timelines.**

Refer to Section 4(b) TB Screening DST for further information on when to collect sputum samples. Refer to Appendix C for information on sputum collection processes.

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



*Consult with the lab if expedited results are required.
♦ 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. Results from mycobacterial culture are required to confirm organism viability and drug susceptibilities.
†Blood, bone marrow and joint isolates are routinely set up for susceptibilities.

Table 4-2: Mycobacteriology Lab Results Timelines

Mycobacteriology Lab Type	Timelines	Notes
Direct specimen processing		
AFB smears	Turn Around Time (TAT) 24-48 hrs from receipt Processing: mornings Reporting: afternoons	Available Monday - Friday If specimen arrival is after 11am, it will be processed the next working day. During statutory holidays TATs are likely to be delayed – please contact the laboratory about any urgent cases that might be affected.
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 During statutory holidays TATs are likely to be delayed – please contact the laboratory about any urgent cases that might be affected.
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 Acid Fast Bacilli 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 is detected at samples incubating at the BCCDC. For samples positive at other sites, expect delays related to transport times.	Available Monday – Friday; performed on AFB-positive isolates
Whole Genome Sequencing (WGS) - based TB complex speciation	Results available within about 1 week after positive growth	All first yearly isolate per patient per body site will be sub-speciated by WGS

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

Mycobacteriology Lab Type	Timelines	Notes
Isolates Speciation		
Non-TB Mycobacteria (NTM) HSP65 Sequencing – for any NTM diagnosis	Performed once a week	Performed on all non-TB complex isolates On weeks with STAT holidays schedule may need to be modified – please contact the lab with any urgent requests that might arise over these times
TB Susceptibility testing		
1st line drugs and moxifloxacin – BCCDC	1-2 weeks after culture growth	Ethambutol, Isoniazid (0.1 and 0.4 if 0.1-resistant), Rifampin
Pyrazinamide - BCCDC	Results available within 21 days of set-up	Pyrazinamide susceptibility is performed on all Isoniazid and/or Rifampin-resistant and CSF isolates
2nd line drugs – National Microbiology Lab (NML)	Results available in several weeks from send out	Amikacin, Capreomycin, Ethionamide, Kanamycin, Linezolid, Ofloxacin, PAS, Rifabutin, Streptomycin, Moxifloxacin, Clofazimine Bedaquiline susceptibility testing is approaching implementation at the NML All Rifampin resistant isolates and MDR isolates are sent out to NML for extended susceptibility testing Cycloserine testing on MDR isolates will no longer be routinely done; please contact the lab with any special requests for it
WGS	1-2 weeks after culture grows (typically)	Done automatically on all new TB cultures per patient per body site Genotypic resistance predictions are available from WGS results Genomic clustering information is available from WGS results

Note: The information provided was last updated October 2023. 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 (7).

4.7 Immigration Medical Surveillance Program

The Canadian Immigrant and Refugee Protection Act (8) 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.

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 (4,9). An approved immigration physician (Panel Physician) from Immigration, Refugees and Citizenship Canada (IRCC) performs this exam (10).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 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 (11).

The IME, in addition to identifying individuals with TB disease, will also identify individuals at increased risk for progression to TB disease. They are permitted to enter Canada but are placed under **TB medical surveillance** (see **TB Medical Surveillance Process** below).

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 TBS. 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 TB disease, 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.

TB Medical Surveillance Process

As described above, medical surveillance is for a person newly arrived in Canada to check that their presumed inactive TB has not progressed to TB disease. IRCC defines inactive TB as an assessment that a person may have had TB in the past, or have TB infection, or have been exposed to TB bacteria. Medical surveillance is sometimes referred to as post-landing surveillance.

The IRCC Medical Surveillance webpage outlines this process. In addition, clients can find common questions and answers on the Medical Surveillance page of the BCCDC website.

IRCC has made recent changes to the medical surveillance process. Clients are now instructed to provide IRCC their Canadian contact information when they have a home address and phone number in Canada. Then, the IRCC Public Health Liaison Unit notifies the BCCDC TBS that the client has arrived in BC.

Depending on where a client lives in BC, they receive follow-up at TBS or their local health authority. Please follow your agency's policy for medical surveillance appointments and communication with TBS. TBS notifies IRCC once the client completes their medical surveillance requirements. IRCC notifies the client by email that they have met medical surveillance requirements.

Consideration of fees and TB medical surveillance:
Clients may have to pay for TB testing unless they have coverage through:

- The BC Medical Services (MSP) health insurance. Consider ordering CXR once the client's MSP is active (3 months post arrival in BC).
- The Interim Federal Health Program for refugees.
- A private insurance provider.

For clients with TB disease symptoms, do not delay care due to financial concerns. Public Health and TBS may cover the associated health care expenses.

Refer to **Immigration Screening** in Section 4(b), TB Screening DST for further details on providing TB screening related to medical surveillance.

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