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Communicable Disease Control Manual
Chapter 4: Tuberculosis

Section 3: Tuberculosis

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TUBERCULOSIS

3.1 Etiology and Presentation

Tuberculosis (TB) is caused by any one of the mycobacteria grouped into the *Mycobacterium tuberculosis* (MTB) complex. These include, but are not limited to:

- M. tuberculosis (including subspecies M. canetti)
- M. bovis (excluding BCG strain)
- M. africanum
- M. caprae
- M. microti
- M. pinnipedii

Throughout this manual TB causing mycobacteria will be referred to as 'TB bacteria'. TB bacteria are:

- Rod-shaped
- 1 to 5 microns in size
- Aerobic (prefer to grow in high oxygen environments)
- Slow-growing (divide once every 15 to 20 hours)

Due to the high cell wall lipid content, TB bacteria require specific laboratory methods for identification in clinical specimens. These methods include acid-fast staining and mycobacterial culture, as opposed to gram staining and routine bacterial culture.

There are two different types of TB: TB infection and TB disease. TB infection (formerly called latent TB infection) is not infectious and there are no signs or symptoms. TB Disease is often infectious and there are usually signs and symptoms (**See Table 3-1**).

The **classic** signs and symptoms of **respiratory** TB disease are:

- cough (dry or productive) for 2 to 3 weeks or more with or without fever
- unexplained weight loss
- hemoptysis
- loss of appetite
- night sweats

The clinical presentation of TB disease is influenced by which body site(s) are involved, as TB disease can develop in any organ. Most often, respiratory TB disease develops but TB can also develop at sites outside of the respiratory system (i.e., non- respiratory TB disease) and at multiple sites simultaneously (i.e., disseminated TB disease).

In respiratory TB disease a physical assessment is often unremarkable, even in relatively advanced cases. In non-respiratory TB disease, physical findings are dependent on the site of disease but may involve swelling and/or dysfunction of the affected body site (e.g. lymphadenopathy).

Clinical presentation can also be influenced by immune capacity and response. For example, fever and night sweats may be absent in the very young and elderly.

Table 3-1: Signs and symptoms of TB disease

Systemic Signs and Symptoms	Respiratory TB disease	Non respiratory TB disease
• Fever * • Night sweats * • Loss of appetite (anorexia) • Unexplained weight loss • Fatigue	• Systemic signs and symptoms • Cough (dry or productive) for more than 2-3 weeks, with/without fever • Bloody sputum (hemoptysis) • Chest pain • Shortness of breath • Abnormalities on CXR ♦	• Systemic signs and symptoms • Pain, swelling, and/or dysfunction of the involved body site(s) (i.e. swollen lymph node)

* May be absent in the very young and elderly
♦ Radiographic presentation can be atypical in clients who are immune compromised, and in the very young or old

Other mycobacteria not included in the MTB complex are known as nontuberculous mycobacteria (NTM) (e.g., atypical mycobacteria, or mycobacteria other than TB (MOTT)). Some NTMs can cause disease presentations similar to TB. In general, NTMs are not thought to spread from person-to-person in routine circumstances. The Clinical Resources section of the BC Centre for Disease Control (BCCDC) website now has a Nontuberculous Mycobacteria page.

3.2 Transmission

Transmission of TB bacteria is almost always airborne and person-to-person. When someone with respiratory TB disease exhales forcefully, such as when coughing, sneezing, laughing or singing, tiny drops of moisture containing TB bacteria (droplet nuclei or aerosols), are released into the surrounding airspace. Once released, TB bacteria droplets in aerosols have an extremely slow settling rate (0.5mm per second or less) and can be readily inhaled by others in the area. Large particles settle quickly and do not typically cause TB infection.

Transmission can also occur as a result of:

- Inhalation of TB bacteria aerosolized during:
  - Pressurized irrigation or debridement of open TB wounds.
  - Handling of laboratory or pathology specimens containing TB bacteria.
  - Autopsies of people with TB disease.
- Organ transplants where the donor has TB Infection or TB disease
- Ingestion of *M. bovis* during consumption of unpasteurized milk or other food products from diseased animals (e.g., cheese made from unpasteurized milk)[1].

1 Bovine TB is caused by ingestion of milk/food products contaminated with *M. bovis*, has been largely eradicated because of the pasteurization of milk and the tuberculin testing of cattle, followed by the slaughter of animals found to be infected. Ingestion of contaminated milk/food products is more likely to occur in low-income countries without such programs.

Transmission risk correlates with the:

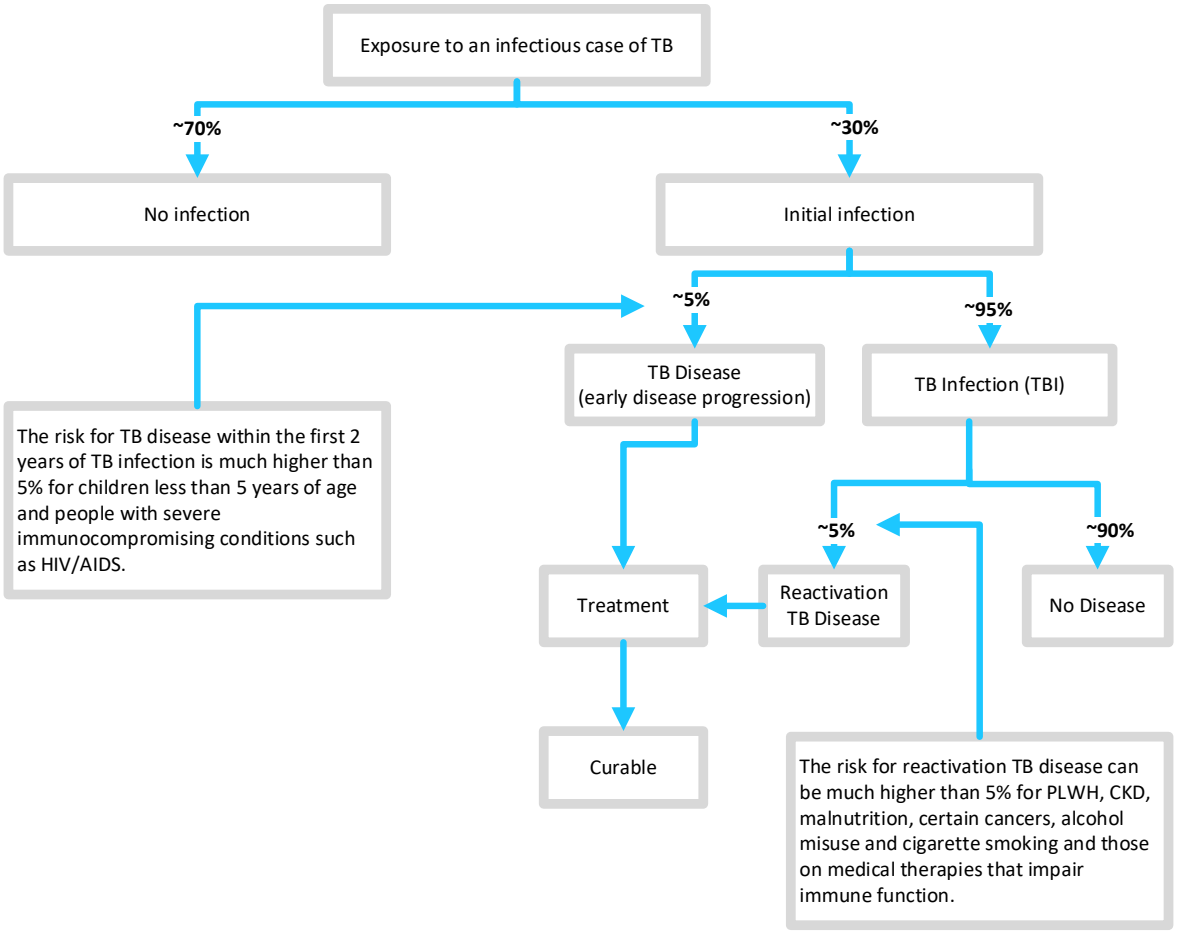
- Concentration of droplet nuclei in the airspace.
- Frequency and duration(s) of exposure.
- Virulence of the TB bacteria.

For further information on:

- transmission risk, refer to Section 7.5 Transmission Risk
- measures to prevent transmission, refer to Appendix B Infection Prevention and Control,
- risk factors for progression from TB infection to TB disease, see Section 3.3 and Section 4(b).

3.3 Pathogenesis and Risk Factors

Figure 3-1, Pathogenesis of tuberculosis (1–3)



After a person inhales TB bacteria, host lymphocytes interact with macrophages in the lungs to either eradicate the bacteria (no infection) or contain the bacteria and stop their replication (initial infection). When someone develops a contained, initial infection, the person has TB infection. When the macrophages do not contain the bacteria, a person develops TB disease.

TB disease can develop relatively quickly after initial TB infection if a person's immune response is immature or inadequate, thus it is more likely to occur in children 0-4 years of age and the immunocompromised. Early disease progression (formerly primary TB) occurs in approximately five per cent of people with TB infection. TB disease that develops after the first few years of TB infection is called reactivation TB disease. Again, it is much more likely to occur in people who are immunocompromised. Approximately five per cent of people with TB infection will experience reactivated disease.

Young children and people with substantially impaired immunity are at highest risk for primary TB disease and potentially lethal forms of disseminated TB disease (e.g. miliary TB and TB meningitis). For these reasons, enhanced assessment and management processes are used for contacts belonging to these groups (See Section 8). Additionally, targeted TB screening for people with medical risk factors and groups disproportionately affected by TB due to health inequities is an important component of TB prevention (See Section 4).

3.4 Risk Factors for Development of TB Disease

Risk for TB disease, both early disease progression TB and reactivation TB, is influenced by age and factors that impair immune function (**see Figure 3-1**). Table 3-2 outlines the risk factors for progression from TB infection to TB disease.

Table 3-2: Risk factors for the development of TB disease (4)

Very High Risk
People living with HIV infection (PLWH)
TB contact within the past 2 years, especially if child less than 5 years old or an adolescent
Silicosis
High Risk
Chronic kidney disease on dialysis or end-stage
Transplant recipients (solid organ or hematopoietic)
Some cancers (lung, sarcoma, leukemia, lymphoma or gastrointestinal)
Abnormal chest x-ray (CXR) - fibronodular disease
Receiving immunosuppressing drugs (e.g., Biologics such as tumour necrosis factor alpha inhibitors (TNFi) or steroid treatments equivalent to 15 mg or more per day for 1 month or longer)
Moderate Risk
Diabetes
Heavy alcohol consumption (3 drinks or more/day)
Heavy tobacco cigarette smoker (at least 1 pack/day)
Abnormal CXR – granuloma
Underweight (less than 90% ideal body weight or BMI less than 20)
Low risk
General adult population with no known risk factor
Person with a positive 2-step TST, no known risk factor

3.5 Epidemiology

TB is an important health issue globally and locally.

Global

Globally, in 2021, the World Health Organization (WHO) estimated that 10.6 million people developed TB disease, and 1.6 million people died from the disease that same year. Although TB occurs in every part of the world, the largest number of new cases were identified in the WHO South-East Asia Region (46%), followed by the WHO African (23%) and Western Pacific (18%) Regions (5). For more information, refer to the WHO Fact Sheet.

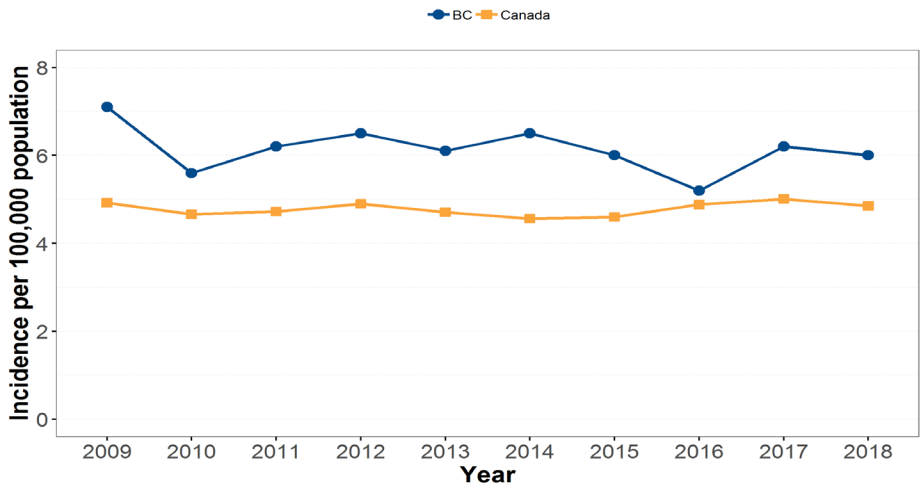
Canada

Canada has approximately 1600 – 1800 new diagnoses of TB each year (6). The rate of TB disease in Canada has remained relatively unchanged over the past decade(7). Nevertheless, Canada has one of the lowest rates of TB disease in the world. Disparities are pronounced in certain population groups and geographic regions. For more information, refer to: Government of Canada – TB: Monitoring (6) and Canadian TB Standards, 8th Ed. – Epidemiology (7).

British Columbia (BC)

BC has approximately 300 new diagnoses of TB disease each year(8). Since 2009, the provincial rate has declined slightly but remained higher than the Canadian rate. Health inequities significantly affect a person's risk for exposure and development of TB. In BC, people born outside of Canada account may account for up to 85% of all cases of TB disease, although local transmission is low. Specifically, people from countries of high TB incidence have a higher risk for exposure. Further, their experiences of social, legal and economic inequities in Canada affect their risk of reactivation. Indigenous peoples are disproportionately affected by TB due to current and historical social and health service inequities related to colonialism (1). For more information, refer to BC Surveillance TB Annual Reports.

Figure 3-2: TB Disease Rates in BC and Canada, 2009-2018 (8)



3.6 Case Definitions and Reporting[2]

Laboratory Confirmed Case

- Cases with *Mycobacterium tuberculosis* complex (excluding *M. bovis* BCG strain), isolated by culture from a clinical specimen.

  OR
- Cases with laboratory detection of *Mycobacterium tuberculosis* complex by nucleic acid amplification testing (NAAT) and with clinical findings consistent with current TB disease.

The BCCDC Public Health Laboratory advises Health Authorities and TB Services (TBS) simultaneously of laboratory-confirmed cases of TB disease. Cases identified by other laboratories or jurisdictions within BC must be reported within **one business day** to either the local Medical Health Officer (MHO) or to TBS. The receiving institution must notify the partner institution of all such reports **within one business day**.

Clinically Confirmed Case

In the absence of confirmation by culture or NAAT proof, cases clinically compatible with TB disease, include:

- CXR changes compatible with TB disease; **OR**
- clinical symptoms and/or signs of non-respiratory TB[3]; **OR**
- pathologic evidence of TB disease (e.g. compatible histopathology, positive AFB staining); **OR**
- post-mortem evidence of TB disease; **OR**
- favourable response to therapeutic trial of anti-TB drugs.

Health care providers are required to report clinically confirmed cases to the local MHOs and to TBS **within one business day** of identification.

Re-treatment exclusion

A re-treatment case of tuberculosis is a case that has both current TB Diseas and historic documentation of previous TB disease. If re-treatment commences within 6 months after the end of treatment for previous TB disease, this re-treatment case is not counted as a new case of TB disease. This is consistent with the 6-month re-treatment approach practised by the Public Health Agency of Canada (PHAC) (10).

Presumed Case

For reporting purposes, a “presumed case” of TB means:

- A person who a health care provider believes - after weighing signs, symptoms, and/or laboratory evidence - is likely to have TB disease.
  OR
- A person who is a contact to respiratory TB disease and has other findings suggestive of TB disease.

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[2] For the current provincial case definition, please refer to the TB Disease case definition on the BCCDC website (9).

[3] TB can occur anywhere in the body such as meninges, bone, kidney, or peripheral lymph nodes.

Examples of presumed TB cases for the purpose of provider reporting to the local MHO and/or to TBS include:

- Any person presenting body fluid or tissue that tests positive for acid fast bacilli (AFB smear-positive) in a smear or preliminary culture.
- Any person presenting body fluid or tissue that tests positive for MTB with nucleic acid amplification testing (NAAT), e.g., TB PCR, Gen-Probe™ Accuprobe.
- Any person with pathologic findings consistent with TB disease, unless other clinical evidence makes a TB diagnosis unlikely.
- Any person with clinical, radiographic, or laboratory evidence consistent with TB disease. This includes cases where the diagnostic evaluation is incomplete or culture results are pending, and where the level of clinical suspicion of TB disease is high enough to warrant the initiation of anti-TB treatment, whether or not such treatment has actually been started.
- Any person with known or suspected HIV infection who:
    - Has a new finding on CXR consistent with TB disease, regardless of symptoms, AFB smear results, and whether or not anti-TB treatment has been initiated.
      AND
    - Resides in, or may reside in, a congregate setting where other immune compromised persons could be exposed, such as a correctional, homeless, or residential facility.

Health care providers are required to report presumed cases of TB disease to the local MHO and/or to TBS.

Reporting of Cases to the Canadian TB Reporting System (CTBRS) (10)

All cases of TB disease diagnosed in BC must be reported to TBS at the BCCDC. TBS reports all laboratory or clinically confirmed cases of TB disease to the Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control (CCDIC), PHAC, through the Canadian Tuberculosis Reporting System (CTBRS). Among temporary residents (visitors, students, and people granted work permits) and undocumented foreign nationals who are in Canada, laboratory and clinically confirmed cases are reported through the CTBRS only if treatment was initiated in BC. This may result in differences in TB disease case totals when comparing BCCDC provincial counts to those reported by PHAC.

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