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Communicable Disease Control Manual

Chapter 4: Tuberculosis

3.0 TUBERCULOSIS



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3.0 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:

- *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: [latent TB infection](#) and [active TB disease](#). Latent TB is not infectious and there are no signs or symptoms. Active TB is often infectious and there are usually signs and symptoms (See [Table 3-1](#)). The **classic** signs and symptoms of active **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 active TB is influenced by which body site(s) are involved, as active TB 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 nonrespiratory TB disease, physical findings are dependent on the site of disease but may involve swelling and/or dysfunction of the affected body site (eg. 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 active TB disease

Systemic Signs and Symptoms	Active Respiratory TB Disease	Active Nonrespiratory TB disease
<ul style="list-style-type: none"> • Fever * • Night sweats * • Loss of appetite (anorexia) • Unexplained weight loss • Fatigue 	<ul style="list-style-type: none"> • 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 ** 	<ul style="list-style-type: none"> • 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. For more detailed information on NTMs, refer to Chapter 11 of the [Canadian Tuberculosis Standards](#).

3.2 Transmission

Transmission of TB bacteria is almost always airborne and person-to-person. When someone with active respiratory TB exhales forcefully, such as when coughing, sneezing, laughing or singing, tiny drops of moisture containing TB bacteria (droplet nuclei), are released into the surrounding airspace. Once released, TB bacteria droplets can be readily inhaled by others in the area. 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 active TB.
- Organ transplants where the donor has active or latent TB
- Ingestion of *M. bovis* during consumption of unpasteurized milk or other food products from diseased animals (e.g., cheese made from unpasteurized milk)¹.

Transmission risk correlates with the:

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

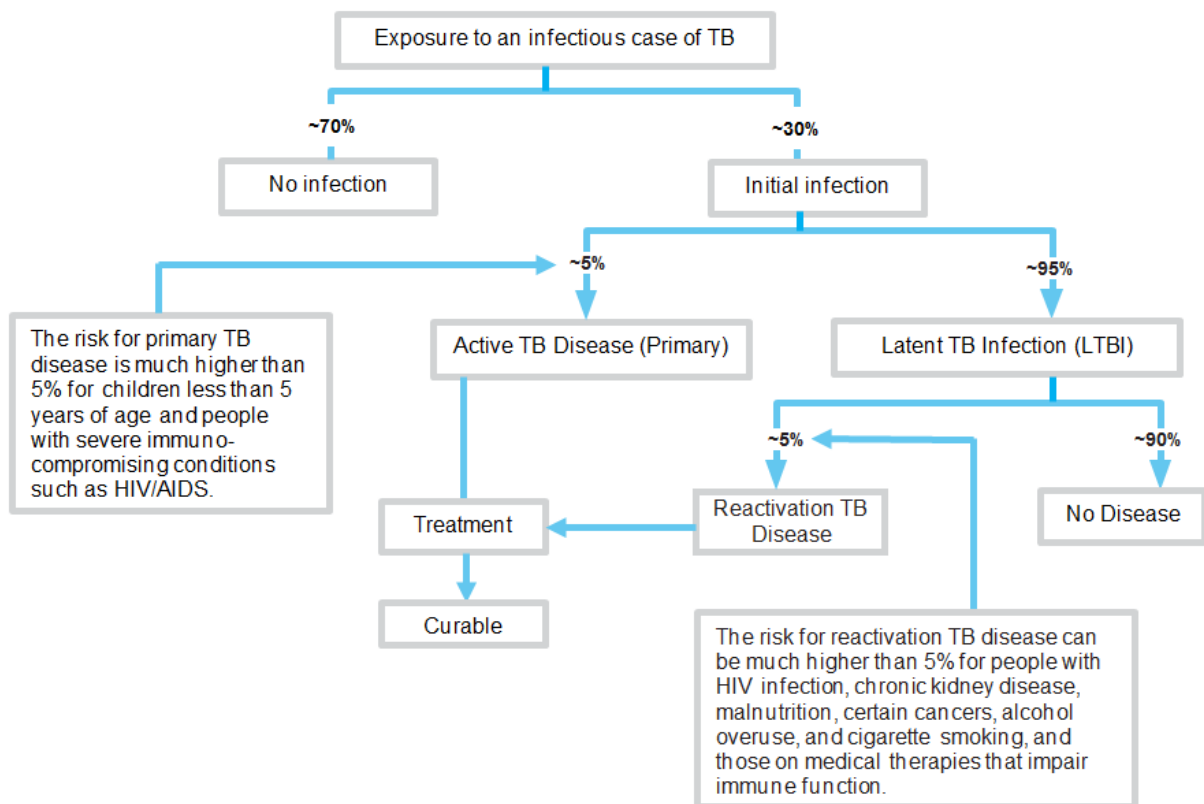
¹ Bovine TB, which is caused by ingestion of milk/food products contaminated with *M. bovis*, has been largely eradicated as a result of the pasteurization of milk and the tuberculin testing of cattle, followed by the slaughter of animals found to be infected. Ingestion of contaminated milk/food products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

For further information on transmission risk and measures to prevent transmission see [Section 7.5 Transmission Risk](#) and [Appendix B Infection Prevention and Control](#), respectively.

For further information on risk factors for progression from TB infection to Active TB, see [Section 3.3](#) and [Section 4\(b\)](#).

3.3 Pathogenesis and Risk Factors

Figure 3-1, Pathogenesis of tuberculosis (1)



After TB bacteria are inhaled by a person, 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 latent TB infection. When the macrophages do not contain the bacteria, a person develops active TB.

Active TB can develop relatively quickly if a person's immune response is immature or inadequate. If active TB develops within two years of TB infection it is called [primary TB disease](#). Primary TB disease occurs in approximately five per cent of people with TB infection. Active TB that develops more than two years after TB infection is called [reactivation TB disease](#). Approximately five per cent of people with LTBI 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](#)).

3.3.1 Risk Factors for Development of Active TB Disease

Risk for primary TB disease and reactivation TB disease is influenced by factors that impair immune function (see [Figure 3-1](#)). Table 3-2 outlines the relative risk of reactivation of active TB as compared to people with no known risk factors.

Table 3-2: Risk factors for the development of active TB disease among persons with a positive tuberculin skin test (presumed infected with TB bacteria) (2)

Risk Factor	Estimated risk of TB relative to people with no known risk factor
High Risk	
Acquired Immunodeficiency Syndrome (AIDS)	110 – 170
HIV infection	50 – 100
Transplantation (related to immune-suppressant treatment)	20 – 74
Silicosis	30
Chronic renal failure requiring hemodialysis	10 – 25
Carcinoma of the head and neck	11.6
TB infection within the prior 2 years	15.0
Abnormal chest x-ray – fibronodular disease (healed TB and not previously treated)	6 – 19
Moderate Risk	
Tumour necrosis factor alpha inhibitors	1.5 – 45.8
Diabetes mellitus (all types)	2 – 3.6
Treatment with glucocorticoids (> 15 mg/d prednisone)	4.9 – 7.7
Young age when infected (0 to 4 years-of-age)	2 – 2.5
Slightly Increased Risk	
Alcohol consumption > 3 drinks/day	3 – 4
Underweight (< 90 per cent ideal body weight; for most people, this is a body mass index < 20)	2 – 3
Cigarette smoker (1 pack/day)	1.8 – 3.5
Abnormal chest x-ray – granuloma	2
Low risk	
Person with a positive TST, no known risk factor, and a normal chest x-ray	1
Very low risk	
Person with a positive two-step TST (booster), no other known risk factor, and normal chest x-ray	0.5



3.4 Epidemiology

TB is an important health issue globally and locally. For additional information please see the links below:

Global

Globally, in 2017, the World Health Organization (WHO) estimated 10 million people developed active 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 (62%) occurred in WHO's South-East Asia and Western Pacific Regions (3). For more information, refer to the [WHO Fact Sheet](#).

Canada

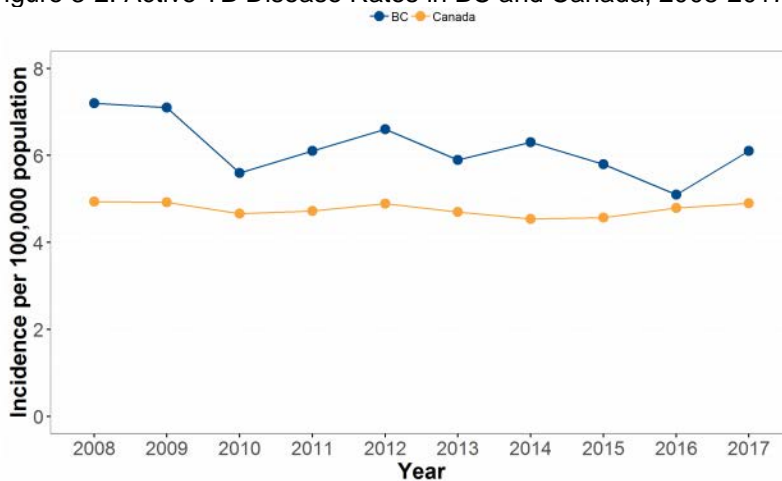
Canada has approximately 1600 – 1800 new diagnoses of active TB each year. The number of reported TB cases and the overall incidence rate has maintained a slow decline over the past two decades. Canada has one of the lowest rates of active TB in the world. Disparities are pronounced in certain population groups and geographic regions. For more information, refer to: [Government of Canada – TB: Monitoring](#) and [Canadian TB Standards – Epidemiology](#).

British Columbia (BC)

BC has approximately 250 – 300 new diagnoses of active TB each year. The incidence for active TB is slightly higher than the Canadian rate.

Health inequities significantly impact a person's risk for exposure and development of TB. In 2017, people from countries of high TB incidence accounted for 84% of all cases of active TB in BC, although local transmission is low. 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 (4). For more information, refer to: [BC Surveillance TB Annual Reports](#).

Figure 3-2: Active TB Disease Rates in BC and Canada, 2008-2017 (5)





3.5 Case Definitions and Reporting²

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 active tuberculosis disease.

The BC Centre for Disease Control Public Health Laboratory advises Health Authorities and TB Services simultaneously of laboratory-confirmed cases of active 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 TB Services. 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 active tuberculosis include;

- chest x-ray changes compatible with active tuberculosis;
OR
- clinical symptoms and/or signs of non-respiratory tuberculosis³;
OR
- pathologic evidence of active tuberculosis (e.g. compatible histopathology, positive AFB staining);
OR
- post-mortem evidence of active tuberculosis;
OR
- favourable response to therapeutic trial of anti-tuberculosis drugs.

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

Re-treatment exclusion

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

² For more information on the case definition of active tuberculosis, please refer to the Technical Appendix of the [annual TB surveillance reports](#)

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



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 active TB disease
- OR**
- A person who is a contact to TB and has other findings suggestive of TB

Examples of presumed TB cases for the purpose of provider reporting to the local MHO and/or to TB Services 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 active TB disease, unless other clinical evidence makes a TB diagnosis unlikely.
 - Any person with clinical, radiographic, or laboratory evidence consistent with active TB disease. This includes cases where the diagnostic evaluation is incomplete or culture results are pending, and where the level of clinical suspicion of active 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 chest radiograph consistent with active 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 suspect cases of active TB to the local Medical Health Officer (MHO) and/or to TB Services.

Reporting of Cases to the Canadian Tuberculosis Reporting System (CTBRS)

All cases of active TB disease diagnosed in BC must be reported to TB Services at the British Columbia Centre for Disease Control (BCCDC). TB Services reports all laboratory or clinically confirmed cases of active TB disease to the Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control (CCDIC), Public Health Agency of Canada (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 active TB case totals when comparing BCCDC provincial counts to those reported by PHAC.



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