

CHAPTER 4: BASIC FACTS ABOUT TUBERCULOSIS (TB)

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CHAPTER 4: BASIC FACTS ABOUT TUBERCULOSIS (TB)

4.1 Etiology

Tuberculosis (TB) is an infectious disease caused by any one of a group of bacteria collectively known as the *Mycobacterium tuberculosis* complex. These mycobacteria include:

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

Throughout this manual, bacteria included in the *M. tuberculosis* complex will be referred to as “TB bacteria”.

Other mycobacteria (known as non-tuberculous mycobacteria [NTM], atypical mycobacteria, or mycobacteria other than tuberculosis [MOTT]), can cause disease in humans. Signs and symptoms of pulmonary NTM disease can be similar to those of active pulmonary TB disease (e.g., cough, sputum, hemoptysis, weight loss, chest x-ray cavities). Because of the similarities in signs/symptoms, laboratory investigations such as RNA probes and mycobacterial culture are needed to differentiate between disease caused by TB bacteria and disease caused by NTM.

From a clinical perspective, it is important to determine whether someone has TB disease or NTM disease because the treatment regimens are different. From a public health perspective, it is important because person-to-person transmission of NTM is thought to be extremely rare. This is why:

- NTM disease is not a reportable illness.
- Contact investigations for NTM disease are not required.
- Treatment of NTM disease is not mandatory.

For more information on the diagnosis and treatment of NTM disease, refer to the [Canadian Tuberculosis Standards \(2014\)](#).

4.2 Characteristics of TB Bacteria

TB bacteria are:

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

The cell walls of TB bacteria also have a high lipid content. This means that specific laboratory methods are required to identify TB bacteria in smear examinations (acid-fast staining) and in culture (mycobacterial culture versus routine bacterial culture).

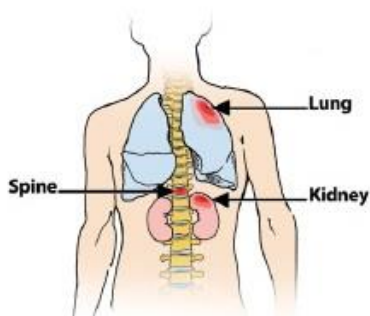
4.3 Signs and Symptoms of Active TB Disease

To an extent, the signs and symptoms of active TB disease depend on which site(s) are affected. Although TB disease occurs most often as a respiratory illness, it can develop at almost any body site. TB disease can also involve multiple sites at once (disseminated TB disease). A few examples of sites where TB disease can develop are shown in [Figure 4-1](#).

Other sites of non-respiratory TB disease include:

- Peripheral lymph nodes (TB lymphadenitis)
- Central nervous system (e.g., TB meningitis, tuberculoma)
- Abdominal cavity and/or digestive system
- Genitourinary system
- Bones and/or joints

Figure 4-1, Examples of sites of active TB disease¹



Generalized signs and symptoms of active TB disease often include:

- Fever
- Night sweats
- Weight loss/loss of appetite
- Fatigue

Signs and symptoms of TB disease involving the lungs (pulmonary TB) usually include:

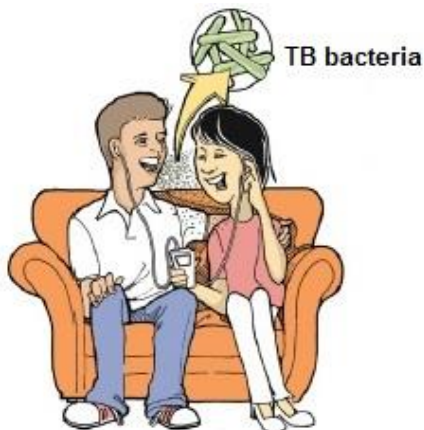
- Cough of at least 2 to 3 weeks' duration
- Chest pain
- Abnormalities on chest x-ray (e.g., upper lobe infiltrates, cavitation)
- Hemoptysis (blood in sputum)

Young children, the elderly, and people with advanced immune suppression might not have typical signs or symptoms of active TB disease.

4.4 Transmission

Infection with TB bacteria almost always happens from inhalation of tiny droplets of moisture (droplet nuclei) that contain TB bacteria. People with active respiratory TB disease (TB in the lungs or airways) expel TB bacteria when they cough, sneeze, laugh, sing, or play wind instruments. People with laryngeal TB disease (TB laryngitis) can expel TB bacteria when they talk ([Figure 4-2](#)).

Figure 4-2, Transmission of tuberculosis²



To a large degree, a person's risk for becoming infected with TB bacteria during an exposure to an infectious case depends on the concentration of TB bacteria in the air s/he breathes. This concentration is influenced by:

- How infectious the case is.
- The degree of air circulation and ventilation.
- How close (physical proximity) the person is to the infectious case.
- Whether the person is appropriately protected against inhaling TB bacteria (e.g., wearing a fit-checked, disposable N95 respirator).

How infectious a case is (the degree of infectiousness) is influenced by:

- **Site and extent of TB disease;** Cases with laryngeal involvement and/or cavities on their chest x-rays are considered highly infectious before treatment. Cases with sputum-smear positive/culture-positive pulmonary TB are considered relatively more infectious before treatment than smear-negative/culture-positive cases. Cases with non-respiratory TB disease are not infectious under most circumstances.
- **Strength and frequency of coughing and other behaviors/activities that produce infectious droplet nuclei;** Forceful expiration (e.g., coughing, sneezing, singing, playing wind instruments) can cause TB bacteria to be released into the surrounding airspace, as can certain medical procedures (e.g., sputum induction, bronchoscopy, autopsy, high-pressure wound irrigation of a non-respiratory site of TB disease). TB transmission has also been linked to smoking crack cocaine or marijuana^{3,4,5}.
- **Pathogen factors;** some strains of TB bacteria might be more transmissible.

Other factors that can influence the risk of transmission include:

- **Frequency and duration of exposure(s) to the case.**
- **Susceptibility of the exposed person;** people with pre-existing TB infection, such as those with LTBI or a history of TB disease, might have some innate immunity to reinfection.

[Table 4-1](#) summarizes factors that can increase the risk of transmission from cases to contacts.

Table 4-1, Factors that increase risk of transmission from cases to contacts⁶

Clinical Characteristics	Case Behaviors	Exposure Circumstances
<ul style="list-style-type: none"> • Respiratory TB disease • Positive AFB sputum smears or cultures • Cavitation on chest x-ray • Adolescent or adult case • Lack of TB treatment or ineffective TB treatment 	<ul style="list-style-type: none"> • Frequent coughing, sneezing, or other activities involving forceful expiration (e.g., singing, playing wind instruments) • Cough-inducing procedures or activities 	<ul style="list-style-type: none"> • Significant duration of exposure • Close physical proximity to case during exposure • Exposure in crowded and/or inadequately ventilated areas • Contacts without adequate personal respiratory protection (e.g., health care providers wearing surgical/procedure masks instead of fit-tested and seal-checked disposable N95 respirators)

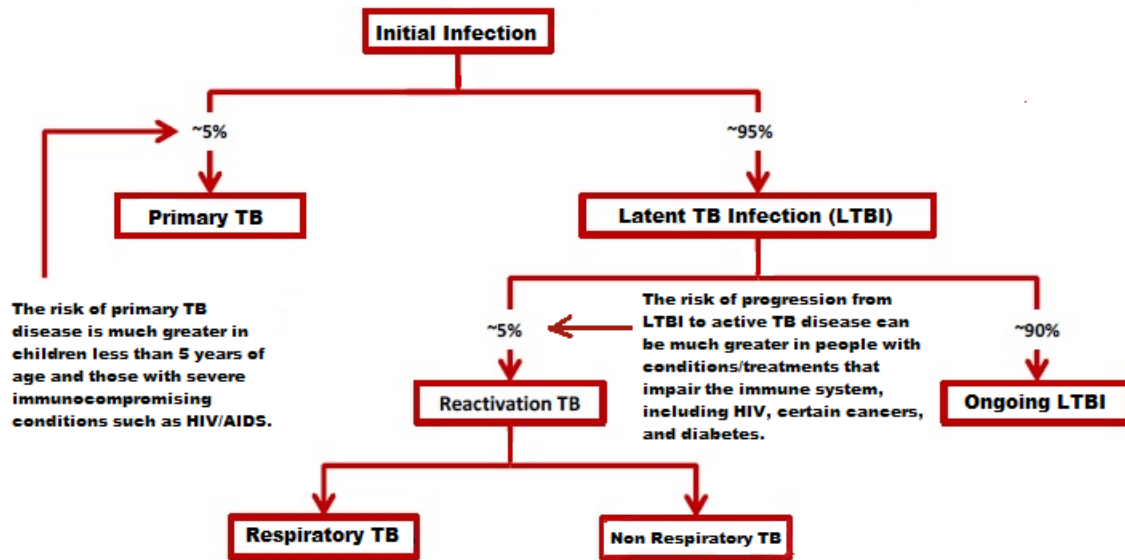
Early diagnosis and treatment of people with active TB disease is essential to minimize TB transmission within facilities and in the community. For information on testing for active TB disease, refer to Chapter 7. Refer to Chapter 9 for information of treatment of active TB disease.

Health care providers can contribute to TB prevention and control by remaining alert for clients that present with signs/symptoms of active TB disease and implementing airborne precautions when they are indicated. Refer to Chapter 11 for information on TB infection prevention and control and airborne precautions.

4.5 Disease Process (Pathogenesis)

The pathogenesis of TB in humans is described in [Figure 4-3](#).

Figure 4-3, Pathogenesis of TB in humans⁷



The likelihood of and timing for developing active TB disease after becoming infected with TB bacteria is highly variable. Some people, particularly young children and those with advanced immune suppression (e.g., HIV/AIDS) are highly susceptible to developing TB disease soon afterward (primary TB disease).

The majority (~95%) of healthy people over 5 years of age who become infected with TB bacteria develop latent TB infection (LTBI). Of these, a small percentage (~5%) will eventually develop active TB disease. TB disease that develops after a period of LTBI is known as reactivation TB disease. Reactivation TB disease is more likely to occur when a person with LTBI is or becomes immune suppressed. Risk factors for reactivation TB disease are outlined in [Section 4.7](#).

The similarities and differences between LTBI and active TB disease are outlined in [Table 4-2](#).

Table 4-2, Comparisons between latent TB infection (LTBI) and active TB disease

Latent TB Infection (LTBI)	Active TB Disease
<ul style="list-style-type: none"> • TB bacteria in the body (TST result usually positive /IGRA result usually reactive) • TB bacteria are inactive (latent) • NO signs/symptoms of active TB disease • NOT infectious • At risk for development of active TB disease in future (reactivation TB disease) • Treatment can prevent development of active TB disease in future • NOT a “case” of active TB disease 	<ul style="list-style-type: none"> • TB bacteria in the body (TST result usually positive /IGRA result usually reactive) • TB bacteria are active (multiplying) • Usually signs/symptoms of active TB disease • Potentially infectious (e.g., with respiratory TB disease) • Almost always curable with timely diagnosis and appropriate treatment • A “case” of active TB disease

4.6 Risk Factors for Infection with TB Bacteria

Groups at increased risk for being infected with TB bacteria include:

- Known contacts to infectious cases (TB contacts)
- Canadian-born elderly people (related to risk for exposure when TB disease was more prevalent in Canada)
- Foreign-born immigrants, refugees, students, and visitors from countries where TB is prevalent. TB incidence of specific countries is available from WHO, see [Chapter 6, figure 6.4](#).
- Canadian-born Aboriginal peoples from communities with high rates of TB
- Staff and residents of congregate settings, particularly those that house persons from the risk groups mentioned above, such as correctional facilities and shelters for the homeless/under-housed
- Staff of facilities where people with undiagnosed active TB disease could present for care (e.g., acute care hospitals)
- Some travelers to countries where TB is prevalent¹

¹ The Canadian Thoracic Society recommendations for travelers that should receive targeted LTBI screening 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 (Canadian Tuberculosis Standards, 2014)

4.7 Risk Factors for Development of TB Disease

Screening people at risk for TB infection and treating those at increased risk for developing TB disease are important TB prevention and control strategies. Although most people that become infected with TB bacteria will not develop active TB disease, age and immune function can have a substantial influence (see [Table 4-3](#)). Without treatment, people with LTBI have a life-long risk for developing TB disease.

Table 4-3 Risk factors for the development of active TB disease among people with a positive tuberculin skin test⁸

Risk factor	Estimated risk for TB relative to people with no known risk factor
High risk	
Acquired immunodeficiency syndrome	110-170
Human immunodeficiency virus infection	50-110
Transplantation (related to immune-suppressant therapy)	20-74
Silicosis	30
Chronic renal failure requiring hemodialysis	10-25
Carcinoma of head and neck	11.6
Recent TB infection (<2 years)	15.0
Abnormal chest x-ray – fibronodular disease	6-19
Moderate risk	
Tumour necrosis factor alpha inhibitors	1.5-45.8
Diabetes mellitus (all types)	2-3.6
Treatment with glucocorticoids (≥15mg/d prednisone)	4.9-7.7
Young age when infected (0-4 years)	2.2-5
Slightly increased risk	
Alcohol consumption ≥3 drinks/day	3-4
Underweight (<90% 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 positive TST, no known risk factor, normal chest x-ray (“low risk reactor”)	1
Very low risk	
Person with positive two-step TST (booster), No other known risk factor and normal chest x-ray	0.5

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