Communicable Disease Control Manual
Chapter 4: Tuberculosis

Tuberculosis
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3.0 TUBERCULOSIS

3.1 Presentation

The presentation of active TB disease is influenced by which body site(s) are involved. Although active TB disease most often presents as a respiratory illness, TB disease can develop at sites outside of the respiratory system (nonrespiratory TB disease) and at multiple sites simultaneously (disseminated TB disease).

3.2 Etiology

Tuberculosis disease 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. microtii*
- *M. pinnipedii*

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 at: https://www.canada.ca/en/public-health/services/infectious-diseases/canadian-tuberculosis-standards-7th-edition.html.

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.
3.3 Transmission

Transmission of TB bacteria is almost always airborne and person-to-person. When someone with active respiratory TB disease 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 disease.
- Ingestion of *M. bovis* during consumption of unpasteurized milk or other food products from diseased animals (e.g., cheese made from unpasteurized milk)\(^1\).

Transmission risk correlates with the:
- Concentration of droplet nuclei in the airspace (or concentration of *M. bovis* in the contaminated milk/food product).
- Frequency and duration(s) of exposure.
- Virulence of the TB bacteria.
- Susceptibility of the exposed person.

Refer to Section 8 for additional information on transmission risk.

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\(^1\) 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.
3.4 Pathogenesis and Risk Factors

Figure 3-1, Pathogenesis of tuberculosis (1)

When TB bacteria are inhaled, host lymphocytes interact with macrophages in the lungs to contain the bacteria, stop their replication, and prevent development of active TB disease. This condition (infection without disease) is called latent TB infection (LTBI). The majority of people who become infected with TB bacteria will develop LTBI.

An infected person can develop active TB disease relatively quickly if their immune responses are immature or inadequate. TB disease that develops within two years of infection with TB bacteria is called primary TB disease. Primary TB disease occurs in approximately five per cent of those infected. TB disease that develops more than two years after TB bacteria 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.
3.4.1 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 3-1 outlines the relative risk of reactivation of active TB as compared to people with no known risk factors.

Table 3-1: Risk factors for the development of active TB disease among persons with a positive tuberculin skin test (presumed infected with TB bacteria) (2)

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

3.5 Epidemiology and Populations at Risk

TB is an important health issue globally. In 2013, the World Health Organization (WHO) estimated nine million people developed active TB disease, and 1.5 million people died from the disease that same year. Although TB occurs in every part of the world, the largest number of new cases (56 per cent) occurred in South-East Asia and WHO’s Western Pacific Regions (3).

In Canada, the number of reported TB cases and the overall incidence rate has maintained a slow decline over the past two decades (see Table 3-2).
characters
In BC, the incidence of active TB disease is historically higher than the overall Canadian rate, although disease incidence has decreased over the previous two decades (see Figure 3-3).

Figure 3-3: Incidence rates of active TB disease in BC and Canada, 1993-2012 (5)

Most of the Province’s active TB rates occur in the foreign-born population (70 per cent). While the overall number of foreign-born cases has decreased over the last decade, the recent influx of immigrants from countries with endemic TB is likely attributable for the province’s higher active TB rates. It must also be noted that BC has a more inclusive case definition of active TB than that of the Public Health Agency of Canada (PHAC) which may partially explain the elevated rates seen in BC.

Current information on the epidemiology of TB in BC can be found in the most recent TB Surveillance Annual Report at: http://www.bccdc.ca/health-professionals/data-reports/tuberculosis-surveillance.
3.6 Case Definitions and Reporting

3.6.1 Laboratory-Confirmed Case

Refers to cases with *Mycobacterium tuberculosis* complex demonstrated on culture (excluding *M. bovis* Bacillus Calmette Guérin [BCG] strain). The BC Public Health Reference Microbiology Laboratory (PHRML) 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 culture confirmation, cases clinically compatible with active TB disease may present with:
- chest x-ray changes compatible with active TB disease.
- active nonrespiratory TB disease (e.g., TB meningitis, bone TB, TB lymphadenitis).
- pathologic or post-mortem evidence of active TB disease.
- favourable clinical response to therapeutic trial of anti-TB 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.

Suspect Case (6)

For reporting purposes, a “suspect 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
- A person who is considered a probable case or an epidemiologically linked case, or who has supportive laboratory findings, under the most recent surveillance case definition established by the Centre for Communicable Diseases and Infection Control (CCDIC) and Public Health Agency of Canada (PHAC).

Examples of suspect 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.

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2 ‘epidemiologically linked case’ means a case in which a patient has/had contact with one or more persons who have/had the disease, and transmission of the agent by the usual modes of transmission is plausible.

3 ‘laboratory findings’ means the results of a laboratory examination of any specimen derived from the human body which yields microscopical, cultural or other evidence suggestive of TB.
• 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:
  o 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
  o 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 Centre for Communicable Diseases and Infection Control (CCDIC), Public Health Agency of Canada (PHAC), through the Canadian Tuberculosis Reporting System (CTBRS). Confirmed cases are reported through the CTBRS regardless of whether TB treatment was initiated.

### 3.7 Surveillance

TB Surveillance in BC is coordinated by Clinical Prevention Services (CPS) at the BCCDC.

CPS works with provincial data to produce quarterly reports that outline TB trends by age, origin, and gender, as well as yearly surveillance reports on the current epidemiology of the disease, and on clinical and treatment outcomes for TB disease and LTBI. Quarterly reports are communicated directly to each Health Authority.

The implementation of the [BC Strategic Plan for Tuberculosis Prevention, Treatment and Control](http://www.bccdc.ca/our-services/programs/tb-services) includes the development of a variety of TB indicators by the TB Surveillance Advisory Committee (comprised of BCCDC, Regional Health Authorities, and the Ministry of Health). In the future, these indicators will be used to monitor, evaluate, and report on the effectiveness of TB activities and programming in BC.

REFERENCES


