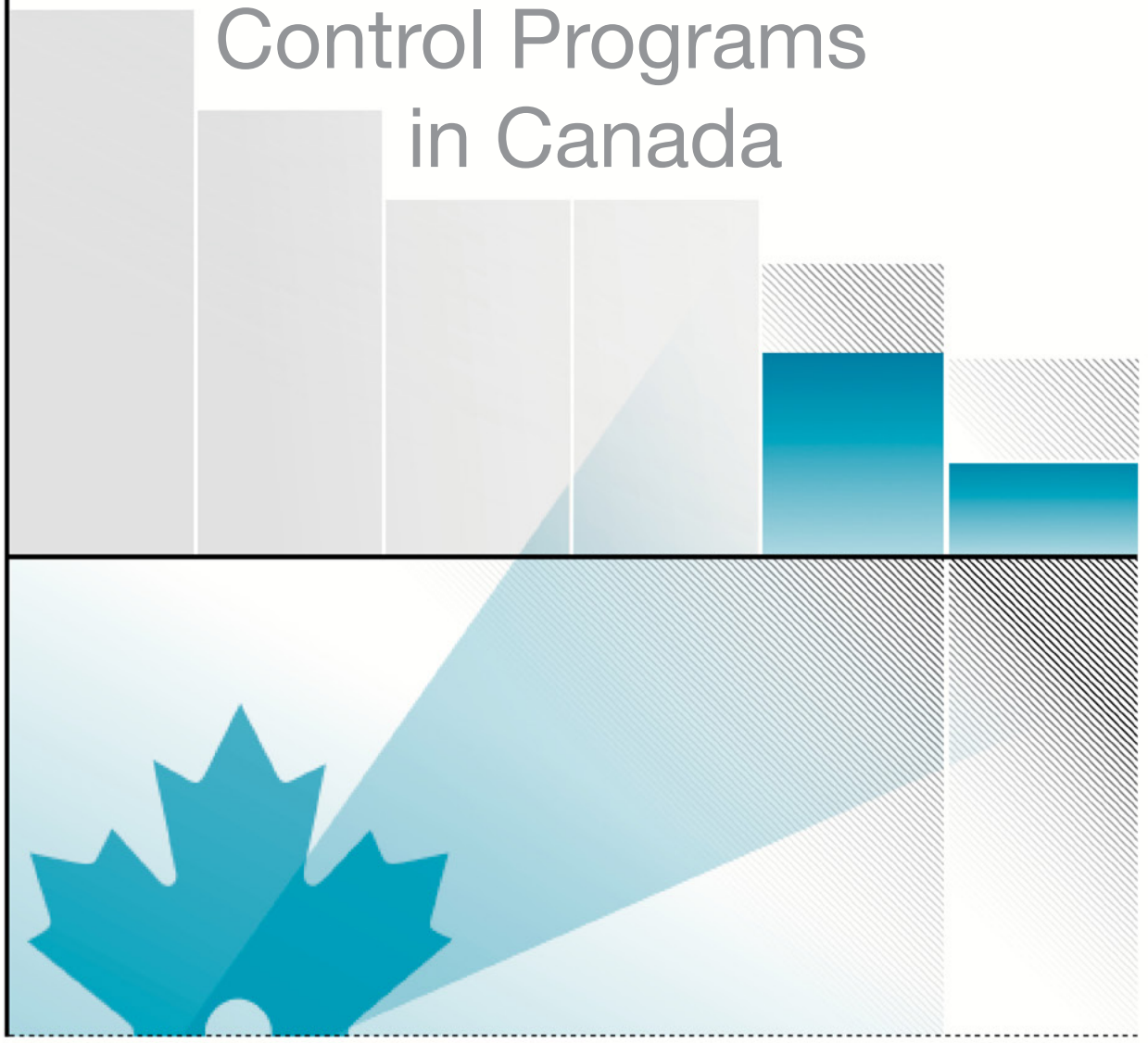
Pan-Canadian Public Health Network

Partners in Public Health

Guidance for Tuberculosis Prevention and Control Programs in Canada



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Preface

Drawing extensively from the work of tuberculosis (TB) experts across the country, *Guidance for Tuberculosis Prevention and Control Programs in Canada* represents an important step forward in our efforts to reduce the burden of TB in Canada. It offers stakeholders a modern, evidence-based approach to TB prevention and control that respects and responds to jurisdictional roles and responsibilities. As a compendium of best practices, it also serves as an important resource for frontline public health practitioners working to decrease the incidence and prevalence of TB within populations most at risk.

The major intent of this guidance document is to inform ongoing program delivery and development by providing decision-makers, health care providers and program planners with information on all aspects of TB prevention and control. It complements and aligns with the *Canadian Tuberculosis Standards* and *Health Canada's Strategy Against Tuberculosis for First Nations On-Reserve* and, as such, will figure as a key component in a future Canadian framework for action on TB.

The best practices articulated in *Guidance for Tuberculosis Prevention and Control Programs in Canada* reflect the knowledge and expertise Canada has acquired over decades of involvement in the fight against TB. It is our hope that all stakeholders – whether service providers, policy makers or laboratory scientists – can apply these best practices to their work on behalf of all Canadians.

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Executive Summary

Tuberculosis (TB) remains an important and serious global public health challenge that requires coordinated international and national prevention and control efforts. Although the incidence of TB in Canada is low and the disease is no longer common in the general population, TB remains a serious problem in certain sub-populations, such as First Nations and Inuit, persons living in Canada who have arrived from regions of the world with a high incidence of TB and those with other health problems like HIV/AIDS. The many and varied conditions in which Canadians live mean that the risks and impacts of TB are not uniformly distributed within our boundaries. There is a pressing need to better understand and target groups at increased risk, and tailor prevention and control efforts to meet their specific needs. In addition, resistance to some of the drugs used to treat TB is a growing problem in some countries. In a globalized, interconnected world the implications of drug-resistant strains are a concern for all nations.

Dealing with these issues in the Canadian context requires a modern, evidence-based approach that recognizes and mitigates both global and domestic influences. TB control is a shared responsibility among individuals, communities, governments and civil society. In response to the continuing presence of TB in Canada and the ongoing challenges in its prevention and control, the current document provides a framework and guidance for optimal TB control, through the adoption of best practices aimed at reducing the disease nationally and internationally.

The expectation is that a pan-Canadian approach to TB prevention and control will result in more highly coordinated, multisectoral action in addressing TB, while at the same time recognizing provincial and territorial responsibilities for the delivery of health services.

The existence of comprehensive Canadian objectives supports federal, provincial/territorial and local prevention and control efforts. The objectives, approaches and best practices outlined in this guidance document are consistent with internationally agreed upon targets and program components.

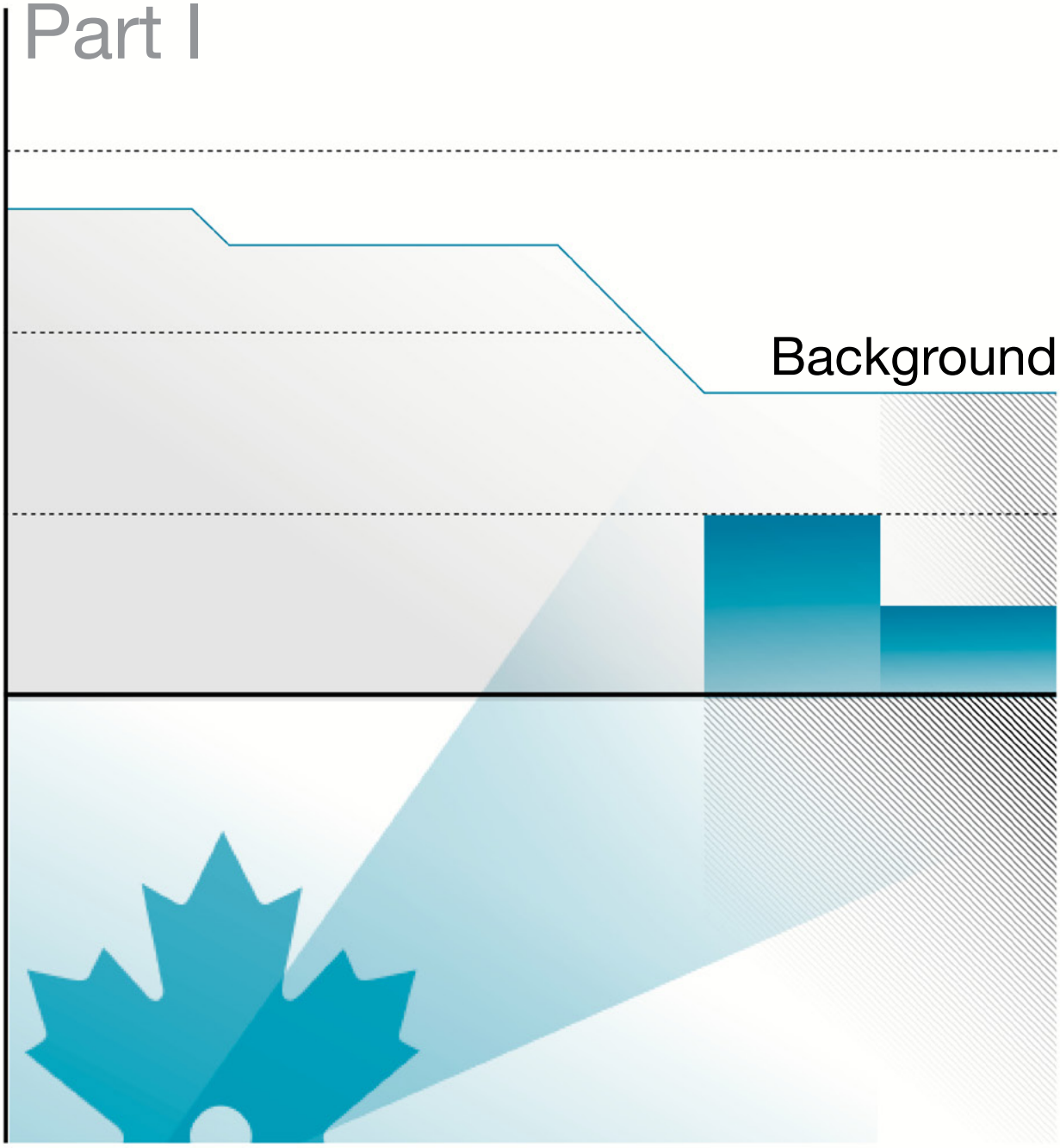
With an overarching goal of reducing the national incidence rate of reported TB in Canada to 3.6 per 100,000 or less by 2015, the principal activities are:

- Timely diagnosis and treatment of active cases, with special attention paid to HIV co-infection and drug-resistant cases
- Contact tracing and management of those found to have active TB disease or latent TB infection (LTBI)
- Screening and treatment of LTBI in high-risk populations
- Primary prevention aimed at stopping the cycle of transmission, in part through effective partnerships and interventions to address the social and other determinants of health

These activities must be supported by appropriate legislation and policy; strong laboratory services; public health surveillance; monitoring and evaluation; TB-related research; and adequately trained health professionals.

Many of the best practices described in this document are already in place in most provinces and territories. However, other best practices are not universally implemented; consequently, there remains a need to stimulate action towards improvements in TB-related services. For effective TB prevention and control, evidence points to the fact that all key components should be coordinated through an organized TB program.

Part I



Background

The global context of TB

As the 1980s came to a close it was becoming increasingly apparent that the incidence of TB was no longer declining in highly developed countries. At the same time, TB continued to present a serious health challenge in the developing world[1]. Given the extent of the disease, the number of deaths and illnesses and the global threats posed by TB, the World Health Organization (WHO) declared TB a global health emergency on World TB Day in 1993[2].

In 2006, the Stop TB Partnership, a global movement for improved TB prevention and control, launched the *Global Plan to Stop TB*. The *Plan's* goals included halving TB prevalence and deaths by 2015, compared to the 1990 levels. The *Plan* also set a longer term goal of eliminating TB as a public health concern by 2050 by reducing incidence rates to less than one per million[3]. The *Plan* was updated in 2011 to account for progress made since 2006 and to address new information, policy and priorities[4].

As a result of previous efforts and the global Stop TB Strategy, the world's incidence rate of TB began to slowly decrease after 2002. TB prevalence is also falling; however it is unlikely that the Stop TB target of a 50% decrease in the prevalence rate by 2015 will be reached. A reduction of the global and regional mortality rates by at least 50% could be achieved by 2015 in all regions except the African Region if the current rate of decline is sustained.

It is estimated that in 2010 there were 8.8 million incident TB cases, 12 million prevalent cases, 1.1 million TB deaths among HIV-negative people and 0.35 million TB deaths among HIV-positive people worldwide. An estimated 13% of incident TB cases were HIV positive; the African Region accounts for approximately 80% of these cases. In the same year, only 34% of TB patients were reported to know their HIV status.

In 2010, 65% of the estimated number of incident TB cases were reported; the 2015 goal is 70%. As of 2009, 87% of sputum smear-positive pulmonary TB cases were successfully treated compared with the 2015 goal of 85%. In 2010, there were an estimated 650,000 prevalent multidrug-resistant TB (MDR-TB) cases worldwide[5,6].

Meeting these targets and goals will require new strategies along with major extensions of existing interventions so that the global Stop TB Strategy (Box 1[7]) can truly become global and available to all those with TB. There will be a need for increased emphasis on prevention, including improved preventive therapy, better vaccines and, equally important, a focus on the social and other determinants of health[8].

Box 1: Components of the global Stop TB Strategy[4]

1. Pursue high-quality DOTS expansion and enhancement
   - Secure political commitment, with adequate and sustained financing
   - Ensure early case detection, and diagnosis through quality-assured bacteriology
   - Provide standardized treatment with supervision, and patient support
   - Ensure effective drug supply and management
   - Monitor and evaluate performance and impact
2. Address TB-HIV, MDR-TB and the needs of poor and vulnerable populations
   - Scale up collaborative TB/HIV activities
   - Scale up prevention and management of multidrug-resistant TB (MDR-TB)
   - Address the needs of TB contacts, and of poor and vulnerable populations
3. Contribute to health system strengthening based on primary health care
   - Help improve health policies, human resource development, financing, supplies, service delivery and information
   - Strengthen infection control in health services, other congregate settings and households
   - Upgrade laboratory networks, and implement the Practical Approach to Lung Health (PAL)
   - Adapt successful approaches from other fields and sectors, and foster action on the social and other determinants of health
4. Engage all care providers
   - Involve all public, voluntary, corporate and private providers through Public-Private Mix (PPM) approaches
   - Promote use of the *International Standards for Tuberculosis Care* (ISTC)
5. Empower people with TB and communities through partnership
   - Pursue advocacy, communication and social mobilization
   - Foster community participation in TB care
   - Promote use of the *Patients' Charter for Tuberculosis Care*
6. Enable and promote research
   - Conduct program-based operational research, and introduce new tools into practice
   - Advocate for and participate in research to develop new diagnostics, drugs and vaccines

TB in Canada

Canada has one of the lowest TB rates in the world (Appendix II – Epidemiology of tuberculosis in Canada), but despite the great strides that have been made in the control of TB in this country the disease continues to be a public health concern. Although the incidence in the Canadian-born non-Aboriginal population has declined steadily over the past 30 years, specific subgroups, such as First Nations peoples and Inuit as well as persons born outside of Canada continue to have rates many times those of Canadian-born non-Aboriginal people. Based on available data, TB-HIV co-infection and antibiotic resistance occur at low levels in Canada. However, the forces of globalization and population mobility ensure that international, social, economic and political events and trends have and will continue to have effects in Canada.

The economic impact of the disease also remains significant. In 2009, total TB-related expenditures in Canada were estimated at $75 million, equivalent to $47,000 for each active TB disease case diagnosed in that year[9,10].

TB control is a shared responsibility among individuals, communities, governments and civil society. In view of the continuing presence of TB in Canada and the ongoing challenges in its prevention and control, stakeholders have recognized the need to identify the best practices and targets to which all should aspire. The guidance provided in this document is closely aligned with the *Canadian Tuberculosis Standards*[11], which provide more detailed information on medical and public health aspects of TB prevention and control.

Box 2: *Guidance for Tuberculosis Prevention and Control Programs in Canada* aims to

- Provide a framework for action
- Advance Canadian TB control efforts
- Provide a basis for evaluating progress towards targets
- Serve as a resource document for programs and standards

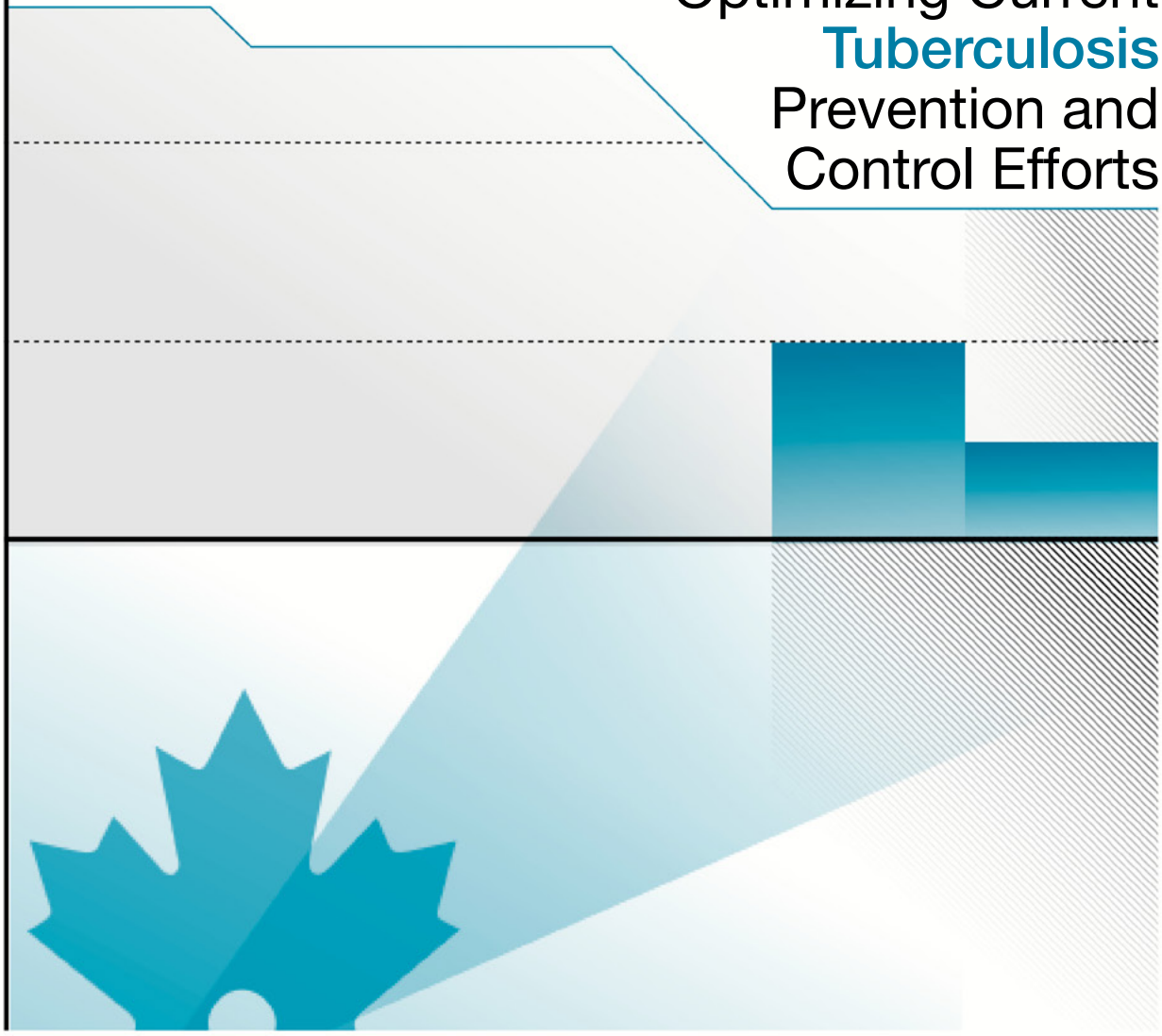
By providing an overall framework for action, *Guidance for Tuberculosis Prevention and Control Programs in Canada* outlines the key principles and interventions for preventing and controlling TB in Canada. It defines the essential components of a TB program and the necessary activities for dealing with the disease in high-risk populations. Additionally, it identifies the key players in TB prevention and control activities. At the country level, it recognizes the need for a coordinated and collaborative response across governmental and non-governmental entities and provides a consistent cross-boundary strategic approach to TB prevention. The existence of comprehensive Canadian objectives supports federal, provincial/territorial and local prevention and control efforts. The objectives, approaches and best practices outlined are consistent with internationally agreed upon targets and program components.

Overall goals for Canada

In 2006, the federal Minister of Health announced Canada's adoption of a TB reduction target of 3.6 cases per 100,000 by 2015, consistent with the *Global Plan to Stop TB 2006 – 2015*. In order to meet this target there would need to be an average annual reduction of 4% in the reported incidence rate of active TB disease in Canada between 2009 and 2015. Since the historical average annual reduction (from 1990 to 2009) has been 2%, or only half of that which is required to meet the target, more intensive and focused efforts are needed to accelerate the rate of decline and make the target a reality in Canada. In addition to the 2015 target, Canada supports the *Global Plan* target of TB elimination (equivalent to less than one new case per 1,000,000 population per year) by 2050.

Part II

Optimizing Current Tuberculosis Prevention and Control Efforts



1. The TB program

TB prevention and control in Canada is, for the most part, administered by provincial or territorial departments/ministries of health through provincial/territorial TB prevention and control programs (see also Part III for the responsibilities of Citizenship and Immigration Canada, Correctional Service of Canada and Health Canada's First Nations and Inuit Health Branch). This includes maintaining a relationship between public health departments, laboratories and clinicians.

The *Canadian Tuberculosis Standards* is recommended to provide the foundation upon which care is based, presenting ***what*** should be done. Individual provincial and territorial guidelines frame the structure of care and outline ***how*** an action is to be accomplished.

Regardless of the way in which public health and health care services are organized in a particular jurisdiction, TB prevention and control should be coordinated through an organized program that includes the following essential components:

- Management of cases of active TB disease
- Contact tracing and outbreak investigation
- Screening for LTBI and active TB disease
- Surveillance and data management
- Laboratory diagnostic capacity
- Education and training of health professionals
- Community-based awareness
- Monitoring and evaluation
- Strategies to address high-risk populations and settings as well as emerging issues such as co-infections and drug resistance

These elements need to be supported by appropriate legislation; a policy framework; regular program planning; adequate availability of drugs provided at no cost to the TB-affected individual; and appropriate resources, including staffing, facilities and financial resources. TB prevention and control also needs to be supported by strategies that address the social determinants of health which impact not only on TB but also on many other health conditions.

A commitment to support research should also form a part of TB prevention and control programs. Depending on regional or local resources and skills, this may mean being actively engaged in research activities or being involved at a less intense level.

Special considerations in the design of TB programs

Within an individual province or territory, a centralized TB program has many advantages, in that it brings together all TB services under one umbrella and ensures that all identified or suspected TB patients are seen and followed by health professionals with expertise in TB care. However, in certain provinces and territories unique geographic and/or administrative considerations have resulted in more decentralized approaches.

For example, in jurisdictions with very low incidence of TB, services are integrated with those of other communicable disease control programs and are provided through the overall public health infrastructure of the department/ministry of health. These areas may face challenges in maintaining adequate TB prevention and control activities, including a scarcity of health care providers or specialists with TB expertise, lack of special facilities for the prolonged health care services required by patients with TB and lack of resources for TB control.

Further challenges are encountered by those living in remote or isolated communities where access to medical personnel is limited. Many First Nations reserves and Inuit communities, for example, do not have full-time physician coverage. In some instances even basic diagnostic services are inaccessible. Simple radiological procedures, for example, may require air transportation to larger centres or facilities.

It is recognized that a centralized TB program maximizes efficiency and program capacity. However, whether the program is administered centrally or otherwise, every province and territory needs the capacity to ensure the availability of essential program components.

The objective of the TB program is to provide the essential components of TB prevention and control as per Canadian and international standards and to thereby minimize active TB disease and transmission.

Best Practices:

1.1 The TB prevention and control program includes all essential components as identified in this document.

1.2 In low-incidence areas or in other areas that do not have a centralized program, access to specialized TB services for TB prevention and control is ensured.

1.3 All TB medications, materials for diagnosing LTBI (e.g., tuberculin skin testing and interferon-gamma release assays as needed) and BCG vaccine are provided free of charge to the patient. There are no financial barriers to the diagnosis, management and treatment of TB or LTBI. The financial implications of diagnosis and treatment for those in isolated communities who may need to be relocated for repeated or extensive periods of time receive specific attention.

1.4 The TB program includes strategies for intersectoral collaboration to address the social and other determinants of health that affect the incidence of TB in largely marginalized populations.

2. Management of active TB disease

The identification and treatment of persons who have active TB disease remain the first priority in controlling the spread of the disease. The treating physician and public health authorities share responsibility for case management during the prolonged period required for treatment. Public health staff educate patients and their family or household members about TB treatment and the potential for treatment-related side effects; monitor for the occurrence of side effects; and evaluate the potential for non-adherence to the prescribed drug regimen by identifying and reducing barriers to adherence (e.g., health system, social, personal), including consideration of the use of incentives and enablers to promote adherence. They may also supervise therapy. In many jurisdictions, Directly Observed Therapy (DOT) is routinely offered, whereas in others it is employed for part of the treatment or only for select persons.

Public health legislation in the provinces and territories generally give public health officials the legislative tools to deal with TB cases and control the spread of the disease when less intrusive measures are unsuccessful. Under the authority of such legislation, patients who do not follow prescribed treatment regimes may be subject to more intrusive measures such as isolation (see Appendix III for links to legislation with application to tuberculosis prevention and control).

Ready access to anti-TB drugs and prompt initiation of therapy are critical aspects in the treatment of active TB disease. Thus, an adequate, continuous supply of relevant pharmaceutical drugs is essential. This is supported by several international organizations and associated guidelines[12].

Modern care ensures that most of those with active TB disease do not require hospitalization for treatment or infection control. However, there are situations in which hospital care may be required. These include complex or drug-resistant cases, cases for which adequate home treatment or isolation cannot be provided and legally mandated treatment in the case of non-adherence. During long-term institutional treatment, culturally appropriate ancillary social and educational services will also be required. While these situations are not common they do require specialized and costly facilities and services. The sustained and in some cases growing global prevalence of multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) disease suggests that the need to be able to provide this level of care for Canadians will continue for the foreseeable future. Regionalization of services and resource-sharing arrangements within a province/territory or among jurisdictions, if necessary, can help maintain the ready availability of these services.

The objective of case management is to ensure that prompt diagnosis and treatment of all cases of active TB disease in Canada are achieved in order to complete treatment/cure and stop the transmission of infection.

Best Practices

2.1 Individuals with active TB disease receive drug treatment according to the recommendations in the *Canadian Tuberculosis Standards* or published updates from the Public Health Agency of Canada (PHAC).

2.2 Individuals with suspected or confirmed active TB disease are maintained in airborne isolation or home isolation until they meet the criteria for discontinuation as per the *Canadian Tuberculosis Standards.*

2.3 Airborne isolation is implemented according to recommendations in the *Canadian Tuberculosis Standards*, and *Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care,* 1999[13].

2.4 Consideration is given to using appropriate legislative authorities to effectively manage the patient's care and treatment in cases where the patient does not follow medical advice.

2.5 Treating physicians and public health authorities share responsibility for case management during treatment, including education, monitoring the occurrence of side effects and identifying and reducing barriers to treatment adherence.

2.6 All efforts are made to ensure that a patient-centred treatment plan considers directly observed therapy in circumstances such as the following (see the *Canadian Tuberculosis Standards)*:

- suspected or proven drug-resistant organisms
- treatment failure
- documented re-treatment of disease
- injection drug use
- homelessness
- suspected or previous non-adherence
- mental illness
- sputum smear positive for acid fast bacteria
- HIV infection
- children

2.7 Treatment regimens are individualized and modified as necessary, without compromising their quality, in order to encourage adherence.

2.8 Hospitals and other facilities are available, if required, to provide complex treatment of drug-resistant disease, airborne isolation until non-infectiousness or, in some cases, court-ordered treatment.

2.9 There is a notification process in place to ensure that TB control stakeholders are forewarned of any anticipated shortages or stock-outs in drugs recommended for TB treatment.

3. Contact tracing and outbreak investigation

After identification and prompt treatment of active TB disease, the second priority of TB control is to investigate contacts of infectious TB cases, as they are at a high risk of becoming infected with TB and of progressing to active TB disease.

If data from a contact investigation indicate a potential outbreak, then an outbreak investigation should be initiated. This involves several overlapping contact investigations and places more emphasis on active case finding, particularly when the source case is unknown. Outbreak investigations often result in the need for additional public health resources.

The objectives of contact tracing are to:

- identify and initiate treatment of active secondary cases
- identify TB-infected contacts in order to offer treatment of LTBI as appropriate
- identify the source case that infected the index case

The objectives of an outbreak investigation are to:

- promptly identify the source case or cases and initiate appropriate treatment
- identify new cases of active TB disease and initiate treatment
- identify persons with recently acquired LTBI and offer treatment as appropriate
- identify and address the circumstances that precipitated the outbreak

Best Practices:

3.1 Contact tracing and outbreak investigations are led and managed by public health authorities.

3.2 As soon as a suspected case of active TB disease has been reported, public health authorities ensure that all the necessary investigations to confirm the diagnosis and determine the degree of infectiousness have been initiated.

3.3 Contact tracing and outbreak investigation strategies consider approaches beyond conventional epidemiologic methods, including molecular genotyping, social network analysis and geographic information systems.

3.4 Treatment of contacts with LTBI is initiated rapidly in those most susceptible to development of active TB disease as per the *Canadian Tuberculosis Standards;* individuals receiving treatment for LTBI are supported to ensure completion of therapy.

3.5 Outbreak investigation and management are supported by adequate and trained staff and financial resources.

3.6 TB programs have a surge capacity of personnel who can be mobilized on short notice to respond to outbreaks which have exceeded jurisdictional resource capacity.

3.7 In the event of an outbreak, communication plans are in place particularly for communicating appropriate information to the affected community. Individuals who communicate with the media are trained in strategic risk communication[14].

4. Screening

Screening refers to a process that attempts to discover conditions suitable for early preventive or curative intervention. Screening for LTBI and active TB disease is a well-recognized means of disease prevention and control. Because the overall TB incidence in Canada is low, screening should be used selectively in groups at high risk of active TB disease or LTBI, and screening of low-risk populations should be discouraged. Targeted screening for LTBI should only be used when there are sufficient resources and a plan to recommend and directly supervise (if necessary) treatment for those at increased risk of progression to active TB disease.

The objective of screening for active TB disease is to identify undiagnosed infectious respiratory cases in order to treat them successfully.

The objective of screening for LTBI is to identify and recommend treatment for infected individuals at increased risk of progression to active TB disease.

Best Practices

4.1 Screening should be considered in groups at high risk of LTBI and/or progression to active TB disease. Such groups would include the following:

- Close contacts of individuals with known or suspected active TB disease as per the *Canadian Tuberculosis Standards.*
- Persons with HIV infection as per the *Canadian Tuberculosis Standards* and *Recommendations for the Screening and Prevention of TB in Patients with HIV and the Screening for HIV in TB Patients and Their Contacts*[15].
- Persons with a history of active TB disease or with chest radiographic findings suggestive of past TB who have not received adequate therapy.
- Foreign-born persons referred for medical surveillance by Citizenship and Immigration Canada (CIC) as per the *Canadian Tuberculosis Standards*
- Urban homeless and the under-housed, including staff at homeless shelters.
- Staff and residents in institutional settings as per the *Canadian Tuberculosis Standards.*
- Those at risk of occupational exposure to TB, especially health care workers likely to be exposed to active cases of respiratory TB as per the *Canadian Tuberculosis Standards.*

4.2 Where resources allow and according to local epidemiology, screening for LTBI should also be considered for groups such as the following:

- Persons with risk factors for development of active TB disease as per the *Canadian Tuberculosis Standards.*
- Persons who have lived in a country with high TB incidence, have immigrated to Canada within the previous 2 years and have either been living with or in known contact with a TB case in the past or are at high risk of development of active TB disease.
- Persons at risk of active TB disease who are employed in settings where they may infect infants or persons who are immunosuppressed (e.g., a child care facility or HIV care facility).
- Persons with a history of substance abuse.

- Certain persons who are travelling or residing in an area with a high incidence of TB (see the recommendations of the Canadian Committee to Advise on Tropical Medicine and Travel[16]).

4.3 Treatment is recommended (if not contraindicated) and monitored for individuals in the above groups who are given a diagnosis of LTBI after active TB disease has been ruled out.

5. Surveillance and data management

All provinces and territories have legislation requiring physicians, laboratories and other health officials to report cases of active TB disease to the provincial/territorial ministry/department of health. Within individual TB programs, data on cases and contacts are necessary to inform program standards and delivery.

The Canadian Tuberculosis Reporting System (CTBRS), maintained by PHAC, is derived from records of these provincial/territorial TB registries. The CTBRS captures information (including treatment outcomes) on every new active or re-treatment case of TB diagnosed in Canada that meets the national case definition (see Appendix V for the link to the PHAC tuberculosis reporting procedures and forms). PHAC collaborates with the provinces and territories to determine the content and form of the CTBRS. PHAC prepares regular national surveillance reports and also reports selected data variables to the WHO for the purpose of informing international disease control and monitoring.

One current TB surveillance challenge in Canada is the monitoring of tuberculosis trends in children. There is marked variability between jurisdictions in the reported incidence rates of pediatric TB, especially in Aboriginal peoples. This may reflect real differences in incidence or jurisdiction-related differences in the application of the pediatric TB case definition. While challenges and controversies may continue to exist in the diagnosis of pediatric TB, it would be helpful for diagnostic, surveillance and evaluation purposes to have a case definition that is universally applied across Canada.

The objective of TB surveillance is to provide timely, ongoing and systematic collection, collation, analysis, interpretation and dissemination of information in order to

- Monitor disease trends (e.g., incidence of disease, geographic and risk group distribution)
- Estimate future disease impacts
- Plan, implement and evaluate interventions and preventive programs in order to reach performance targets
- Inform the development of health policy and resource allocation
- Assist in setting standards of care and practice guidelines
- Identify research needs

Best Practices

5.1 With attention paid to issues of security, confidentiality and relevant privacy legislation, data on all cases and their subsequent treatment outcomes are collected locally and reported through to provincial/territorial TB prevention and control programs which in turn report case details to PHAC.

5.2 PHAC, in collaboration with the provinces and territories, maintains a comprehensive surveillance system for active TB disease that is continuously reviewed and revised in response to the changing epidemiology of the disease.

5.3 Canada's TB case data are provided annually (or as requested) by PHAC to the WHO in order to contribute to the assessment of the global TB epidemic and progress made in TB care and control.

5.4 Provincial and territorial TB programs, together with other stakeholders, track the local epidemiology of TB within their jurisdictions.

5.5 A uniform case definition for pediatric TB is developed and implemented in all jurisdictions.

6. TB laboratory services

The laboratory is an essential part of the diagnosis, treatment, prevention and control of TB. Laboratories provide consultation and expertise in diagnostic testing for TB and interpretation of results. Delays in laboratory confirmation of TB and reporting of drug-susceptibility results can lead to delays in initiation of therapy, prolonged infectiousness, inappropriate therapy and missed opportunities to prevent transmission. A high standard of laboratory practice is necessary to definitively identify *Mycobacterium tuberculosis*, measure drug sensitivities and resistance, and perform other studies to identify chains of transmission. Therefore, it is essential to have access to high-quality TB testing and complete reporting in a timely manner.

The traditional acid-fast bacteria (AFB) smear from an appropriate specimen (e.g., sputum, bronchial washings, tissue and others) remains the first indication of the possible presence of the *Mycobacterium tuberculosis* organism and should be reported within 24 hours of receipt of the specimen in the laboratory. All specimens are cultured for growth of mycobacteria, regardless of the AFB smear result. Culture methods may take several weeks for adequate growth to be detected. Currently, the use of continuous monitoring liquid culture systems have greatly improved turnaround time for detection and identification of the organism, as well as susceptibility testing. Rapid nucleic acid amplification based diagnostic methods are now available that can definitively determine whether or not a specimen or culture is specifically positive for the presence of *Mycobacterium tuberculosis*.

In addition, DNA genotyping ("fingerprinting") of the bacteria can be used as a valuable adjunct to traditional epidemiologic methods to track the spread of an identified strain and assist in identifying persons or groups at risk of acquiring TB. Genotyping is also useful in identifying episodes of healthcare-associated disease, geographic spread of cases or laboratory specimen cross-contamination.

In addition to services provided by provincial/territorial laboratories, PHAC's National Microbiology Laboratory (NML) provides coordinating services to provincial/territorial laboratories in several key areas. These include reference services, proficiency testing, standardization, development of guidelines and training modules, and research. The NML coordinates the Canadian Tuberculosis Laboratory Technical Network (CTLTN),

which provides a forum for the technical staff of the provincial, territorial and federal mycobacteriology laboratories to discuss technical issues related to TB laboratory testing.

The role of the TB laboratory is as follows:

1. To ensure that there is timely confirmation and reporting of cases of active TB disease
2. To maintain a high standard of quality laboratory testing and bio-safety
3. To improve and enhance TB laboratory diagnostic and reference test methodologies
4. To provide expert consultative advice and education on diagnostic and other laboratory tests for TB and other mycobacterial infections, and interpretation of test results
5. To develop and evaluate emerging technologies for the detection of TB through research and innovation

Best Practices

Individual Laboratories

6.1 Appropriate laboratory services are in place to support the TB program and the laboratory services can easily and directly communicate with clinicians and public health authorities.

6.2 All specimens for *Mycobacterium* culture are managed in accordance with the latest edition of the *Canadian Tuberculosis Standards*, with respect to methods, reporting and recommended turnaround time for reporting results.

6.3 All isolates of *Mycobacterium tuberculosis* complex are tested for drug susceptibility.

6.4 Laboratories have the capacity to perform or have access to genotyping services.

6.5 Mycobacteriology laboratories participate in the NML proficiency testing program or equivalent and establish levels of service that reflect achievable quality of performance.

6.6 Provincial/territorial mycobacteriology laboratories develop contingency plans for surge capacity in order to respond in an outbreak situation.

6.7 Mycobacteriology laboratories have access to the use of new and appropriately validated technologies as they become available.

6.8 Laboratories maintain a prompt and efficient reporting and tracking information system.

Laboratory Collaboration and Coordination

6.9 The National Reference Centre for Mycobacteriology at the NML continues, to the extent possible, to provide and coordinate services, such as a full range of proficiency testing, quality assurance programs and standardization, as required by the provinces/territories.

6.10 Laboratory partnerships and collaborations within Canada are developed and/or maintained.

6.11 Surveillance of drug resistance and strain typing continues to be conducted at national and/or provincial/territorial levels and there is a coordinated approach to molecular surveillance of TB in accordance with internationally established standards and technologies.

7. Education and professional practice

As a result of the declining incidence of TB in Canada, there is the potential for decreased awareness and understanding of the disease among governments, health care professionals and the general population. At the program level, this can lead to the misallocation or inappropriate re-allocation of resources, whereas at the clinical level a lack of awareness and understanding can lead to unnecessary delays in diagnosis or misdiagnosis.

a) Health care provider education

A 2006 survey of the educational needs of TB care providers in Canada showed many deficiencies in knowledge among public health and health care professionals[17]. To prevent and control TB, it is essential that health professionals maintain awareness of the disease in Canada and of those individuals and/or populations at greatest risk. Opportunities exist at the federal level to assist in the development and implementation of training programs, particularly as a supplement to existing provincial/territorial training activities and especially for topics on which training is not cost-effective for each jurisdiction to prepare and deliver on its own.

The objective of health care provider education is to ensure that an appropriate level of awareness is maintained and that providers have the knowledge and skills required to support optimal TB prevention and control.

Best Practices

7.1 Appropriate training through a Canadian TB training and consultation network is available on request, using a variety of formats, to TB prevention and control organizations and health care providers.

7.2 Education in all aspects of TB continues to be part of the core curriculum of training programs in the health sciences, including medicine, nursing, dentistry, public health and epidemiology.

7.3 Continuing education programs take into account the need to maintain the TB prevention and control competencies of healthcare providers.

b) Professional practice

The *Canadian Tuberculosis Standards* should be considered the definitive manual to guide the diagnosis and treatment of LTBI and active TB disease.

Collaboration with professional organizations is necessary to ensure that they are involved in providing appropriate advice and information to their members. This is particularly important for organizations that represent practitioners who serve groups at increased risk of TB, such

as primary care providers serving communities with a high proportion of recent immigrants and those serving First Nations, Métis and Inuit communities.

Furthermore, ongoing communication and information sharing is an important part of education and improved clinical practice. For example, e-mail list serves can connect those involved in TB prevention/control in a service, education or research capacity.

The objective of improved professional practice is to secure the highest level of care and the best possible outcome for individuals with LTBI or active TB disease.

Best Practices

7.4 Professional standards and guidelines that relate to adequate TB prevention and control are regularly reviewed and updated, and additional guidelines and standards are developed as required.

7.5 The development of standards and guidelines is always conducted collaboratively, in consultation with the relevant professional societies and organizations.

8. Community-based awareness

Active TB disease usually causes symptoms, but in some cases the onset of the disease is gradual and insidious, and the symptoms are so unremarkable they are ignored by the individual. This may result in delay before the person seeks diagnosis and treatment.

Improving community awareness is a component of the National Lung Health Framework (**http://www.lung.ca/about-propos/framework-cadre_e.php**), a "made in Canada" action plan developed by a wide range of stakeholders, including the Canadian Lung Association, PHAC and others, to improve lung health. Its coordinated approach to the prevention and management of respiratory diseases is designed to have a significant impact on the state of lung health, including TB.

Empowerment of people who have TB is recognized as a component of the global Stop TB Strategy, wherein advocacy and community mobilization are key elements. An example of this is the *Patients' Charter for Tuberculosis Care* (The Charter) which outlines the rights and responsibilities of people with TB and serves as a resource for greater involvement by those affected with the disease in their own care and treatment[18].

TB has created a significant burden of loss and hardship for First Nations and Inuit. Before treatment was available in communities, patients were sent away to sanatoria sanitoriums. It was there that many passed away, far from their communities and families. While this situation was not uncommon in Canada, First Nations and Inuit endured more TB, and it had a dramatic impact on individuals, families and communities.

Migrants to Canada have been influenced by the general attitudes to TB in their countries of origin as well as their previous personal, family or community experiences with TB. Fear or mistrust of authorities may impact responsiveness to public health messages.

These experiences influence perspectives and attitudes towards the disease and, at times, the health care system. Today's TB programs need to continue to acknowledge and understand the prior experiences of those most affected by TB (migrants, First Nations, and Inuit) in order to work with communities to increase awareness, decrease stigma and discrimination against those with TB, and provide programming that is culturally sensitive.

The objective of community awareness activities is to increase awareness of TB and its transmission in the populations at risk.

Best Practices

8.1 Public awareness campaigns that are tailored to the cultural and linguistic needs of the population at risk are developed and implemented. This is best achieved if each community is actively involved in preparing the campaign, and choosing the method and medium of delivery.

8.2 Awareness in civil society of the importance of global TB control at professional, program and government levels is increased.

8.3 Those affected by TB are made aware of the *Patients' Charter for Tuberculosis Care.*

9. Monitoring and evaluation

Measuring progress and performance is the key to ensuring that resources are being used efficiently and effectively. More specifically, monitoring and evaluation provide an accountability mechanism for use by all levels of government and other interested parties; ensure that program objectives and priorities can be continually informed by the best available social and epidemiologic evidence; meet program managers' and policy makers' need for timely, accurate information on program performance, especially in the context of planning and program management; and provide information for communicating to the wider community the challenges that need to be met.

Potential TB program performance targets are listed in Appendix IV. TB programs should consider these targets as part of their planning and evaluation processes.

The objective of monitoring and evaluation is to assess the performance of TB prevention and control activities and measure progress towards achieving objectives.

Best Practice

9.1 TB programs establish appropriate performance targets and work towards regular monitoring of progress towards those targets.

10. High-risk populations and settings

Within Canada, the two populations with the highest reported rates of TB are (1) First Nations and Inuit and (2) the foreign-born. It is important to appreciate that while all components of TB prevention and control continue to be important for these population groups, there are fundamental differences between them in the approaches needed to address TB. Nearly all LTBI in First Nations and Inuit communities is acquired in Canada through transmission from those with active TB disease. This means that the emphasis for prevention and control efforts in First Nations and Inuit is on breaking that cycle of transmission.

In comparison, very little LTBI in the foreign-born is acquired in Canada. Most LTBI in these populations is acquired abroad, prior to arrival in Canada, and is reactivated over time[19]. This means that the foremost domestic TB prevention and control activities in the foreign-born are directed at preventing reactivation in those already infected with TB.

a) First Nations, Inuit and Métis

The *Constitution Act, 1982* recognizes three major groups of Aboriginal peoples in Canada: Indian (Status and non-Status Indian), more commonly referred to as First Nations, Inuit and Métis. Status Indians (on- and off-reserve) and Inuit account for the vast majority of incident cases of active TB disease in Aboriginal peoples in Canada. Within and between Aboriginal groups there is much linguistic, cultural and geographic diversity. This, along with different jurisdictional and governance structures, may complicate TB control within these communities. TB incidence rates are highest in those provinces and territories that have, in historical terms, been living with TB for the shortest duration of time[11]. Rates are high in some communities on the Prairies and in some Inuit communities.

Provinces and territories have the legislated authority for TB prevention and control within their jurisdictions. In the territories ultimate responsibility for TB prevention and control for the entire population rests solely with the territorial governments. Within the provinces, TB prevention and control for First Nations and Inuit is a shared responsibility that varies across communities according to the level of involvement of Health Canada's First Nations and Inuit health regional TB programs, provincial governments, and/or communities (whether transferred or not; see Appendix I for definition of Transferred Communities).

A clear definition of roles and responsibilities is critical for TB prevention and control overall and especially for First Nations, Inuit and Métis communities. An interdependent system calls for clarity with respect to overlapping functions and continuity of care.

There are challenges in monitoring the epidemiology and burden of TB in Aboriginal populations. Firstly, while Status Indians (on- and off-reserve) and the Inuit are relatively well enumerated in Canada, the non-Status Indian and Métis populations are less well enumerated. This creates challenges in calculating TB incidence rates.

In addition, there is marked variability between jurisdictions in the reported occurrence of pediatric TB cases in First Nations and Inuit. This may reflect real differences in actual incidence or jurisdiction-related differences in the applied case definition for pediatric TB.

The fundamentals of TB control need to be consistently applied to all population groups, (including First Nations, Inuit and Métis) and to all communities, however remote. In high-incidence communities, the emphasis should be upon the first objective of TB control: early diagnosis of infectious cases, prompt initiation of effective treatment and case management until completion of treatment. This is especially important given the evidence of ongoing transmission in these communities and the need to protect children. The second priority is to test and, if needed, treat the relevant contacts of active TB cases.

In any First Nations, Inuit or Métis community with a high rate of active TB disease or LTBI, screening of those at high risk for progression from LTBI to disease is important. Treatment should be recommended, if not contraindicated, and monitored for individuals given a diagnosis of LTBI after active TB disease has been ruled out.

Finding and retaining health practitioners sufficient to meet the needs of TB control, especially in remote communities with continuing high incidence rates, is an ongoing challenge. The adequacy of health human resources has a major impact on access to and continuity of care. Education and training of field staff need to be adequately and appropriately supported and should emphasize cultural competency and the importance of culture- and community-specific knowledge.

It is important for First Nations, Inuit and Métis to become engaged as partners in all components of TB prevention and control. Communities at high risk of TB need encouragement and support to become fully involved in TB control and in addressing the challenges that relate directly to the management of the disease. Professional development and broader community capacity building that recognize cultural and community-specific knowledge should aim to provide opportunities for First Nations, Inuit and Métis to lead the process at the community, policy and planning levels.

In order to reach long-term epidemiologic targets for TB prevention and control in First Nations, Inuit and Métis communities, additional interventions to reduce people's vulnerability to LTBI and active TB disease are required, some of which may fall outside of the health sector. Risk factors that are important at the population level include bacterial agent characteristics (e.g., virulence and infectiousness), host characteristics (e.g., age, sex, genetic characteristics, HIV co-infection, malnutrition, smoking, diabetes and substance abuse) and environmental factors (e.g., active TB disease cases in the community, crowded, poorly ventilated housing and indoor air pollution). Preventive interventions may target these proximate risk factors directly or through their underlying upstream determinants of health. In this regard there may be layers of causality to work through (proximal, intermediate, distal) that are unfamiliar to some TB prevention and control staff. It is important to address the upstream determinants of health that are contributing to continued high TB incidence in some communities.

In 2011 Health Canada renewed its TB Elimination Strategy. *Health Canada's Strategy Against Tuberculosis for First Nations On-Reserve* is based on best practices and lessons learned and was developed in collaboration with First Nations and Inuit organizations, TB experts, provincial authorities, PHAC and Aboriginal Affairs and Northern Development Canada. It is a technical document that will be used by health care professionals and administrators working in First Nations communities and by Health Canada TB staff. *Health Canada's Strategy Against Tuberculosis for First Nations On-Reserve* is closely aligned with *Guidance for Tuberculosis Prevention and Control Programs in Canada* and can also be used as a reference tool for anyone involved in TB prevention and control for First Nations and Inuit in Canada.

The objective of TB prevention and control for First Nations, Inuit and Métis is to ensure coordinated, appropriate and effective strategies to reduce the incidence and burden of active TB disease and LTBI.

Best Practices

10.1 Roles and responsibilities of key TB control stakeholders within each jurisdiction are delineated (province/territory; Health Canada's First Nations and Inuit Health Branch (FNIHB); regional health authorities; communities, etc.).

10.2 A program "custodian/leader" among the key stakeholders is identified, the terms and conditions of which are to be defined locally and collaboratively and all TB services for First Nations, Inuit and Métis are integrated into a coordinated program with strong central elements.

10.3 TB prevention and control in First Nations and Inuit is a priority, recognizing that transmission is ongoing in selected jurisdictions, groups and communities and that non-BCG vaccinated children under the age of 5 years are especially vulnerable to severe forms of active TB disease if newly infected.

10.4 Special attention is paid to the accurate reporting of First Nation, Inuit and Métis TB cases by population group and residence (on- or off-reserve) in order to optimize continuity of care and to track cases as necessary.

10.5 Emphasis is placed upon more effective TB prevention and control in First Nations (on- and off-reserve), Inuit and/or Métis groups or communities with rates that have been accurately measured and determined to be high.

10.6 The direction provided in *Health Canada's Strategy Against Tuberculosis for First Nations On-Reserve* is used to address access to care issues, including staffing challenges, in communities with a continuing high incidence of TB.

10.7 TB prevention and control in First Nations, Inuit and Métis is addressed within the broader paradigm of social and other determinants of health associated with vulnerability to LTBI and active TB disease.

10.8 First Nations, Inuit and Métis are engaged as full partners in TB prevention and control, based on the principles of respect, cultural sensitivity, transparency, accountability and responsibility.

10.9 Culturally specific TB education programs for First Nations, Inuit and Métis are developed and implemented.

10.10 TB prevention and control programs in First Nation, Inuit and Métis populations contain a strong evaluation component.

10.11 TB-related research in First Nations, Inuit and Métis is encouraged and supported, with special emphasis on effective interventions, community participation and building community research capacity.

10.12 Epidemiology of TB in First Nations, Inuit and Métis peoples is tracked annually and disseminated to key stakeholders, in order to identify high-risk groups and communities and to inform the development and implementation of targeted strategies.

b) Migrants from countries with high TB incidence

Over the last three decades TB in Canada has increasingly become a disease among the foreign-born, with approximately 65% percent of all cases in Canada being reported in this population. This is not unique to Canada and is a common observation in immigrant-receiving countries of low domestic TB incidence[20].

Through Citizenship and Immigration Canada's (CIC) immigration medical screening program, prospective migrants who are applying from abroad and found to have active pulmonary TB are denied entry to Canada until proof of completed treatment with an appropriate drug regimen is received. Those applying from within Canada who are examined and found to have active pulmonary TB are promptly treated and must complete their treatment prior to the finalization of their immigration application. Migrants found to have evidence of inactive TB (i.e., who do not have active TB disease but have a past history of TB or have abnormal but stable chest x-rays) are allowed entry to Canada. However, these migrants must report to provincial/territorial public health TB control programs after arrival in Canada for further follow-up. This is known as the immigration medical surveillance notification program for newcomers.

CIC continues to refine its risk mitigation strategies with regard to screening for immigration purposes and surveillance notification to provincial/territorial public health authorities of those at higher risk of developing active TB disease. Enhanced targeted screening and expedited surveillance and referral for care are components of these strategies, which are continually modified in response to evolving immigration demographics.

Migrants to Canada represent many origins, cultures, language groups and life experiences. For instance, certain migrants may come from countries with limited public health and clinical care, and inadequate supply of medicines and supervision of treatment. Additionally, the process of initially establishing oneself in Canada can be a demanding undertaking. Immigrants and refugees with LTBI are at highest risk of active TB disease within the first 5 years of their arrival[11]. Language, cultural barriers, poverty, fear and mistrust of authority may affect how migrants understand and respond to TB efforts and in some circumstances may contribute to non-adherence and limited use of medical care[21].

During the past decade, the reported TB incidence rate among the foreign-born in Canada has been slowly decreasing, more as a result of an increase in the foreign-born population than a decrease in the actual number of TB cases. This suggests that further interventions are required to reduce the burden of TB in the foreign-born, most likely in the form of detection and treatment of those individuals with LTBI, after arrival in Canada, who are at a greater risk of progression to active TB disease[22].

The objective of TB management among migrants to Canada is to develop targeted programs and policies that improve the detection and management of active TB disease and LTBI in migrants from countries with high TB incidence.

Best Practices

10.13 Immigrants, refugees and certain individuals applying for temporary residency in Canada are systematically screened in accordance with CIC policies in order to:

- detect and treat active pulmonary TB prior to their arrival in Canada and/or rapidly treat those identified in Canada
- identify those migrants who need to be under immigration medical surveillance for TB after arrival in Canada.

10.14 Federal, provincial/territorial and local stakeholders collaborate towards optimizing the TB immigration medical surveillance program to streamline communication and maximize efficiency and effectiveness.

10.15 Where resources allow, migrants to Canada are assessed for LTBI as per the *Canadian Tuberculosis Standards.*

10.16 TB control programs serving a large number of immigrants use epidemiologic methods to identify groups of foreign-born persons in their jurisdictions who are at high risk of active TB disease and LTBI in order to tailor TB control efforts to local needs.

10.17 There is recognition that providing TB-related services for foreign-born persons is often impeded by linguistic, cultural, socio-economic and health services barriers. TB control programs partner with community programs to ensure that services are accessible and appropriate to the population being served.

c) The homeless and underhoused

Overall, there is an increased incidence of TB in lower socio-economic groups, and TB has long been recognized as an important health problem among homeless and underhoused individuals.

There is clear evidence that LTBI has been acquired in homeless shelters. The potential for transmission is increased if there is inadequate ventilation and crowded accommodation. In Canada, many homeless people may be at increased risk of LTBI and active TB disease because of poor nutrition, alcoholism and other substance use, HIV infection, and medical and psychiatric conditions.

There may be high levels of non-adherence to treatment among the homeless, in particular among those individuals with psychiatric disorders and substance use. There are added difficulties in ensuring that adherence is maintained in this population, as individuals change their place of residence at short notice and may be difficult to locate for days or weeks at a time.

Guidance for the prevention and control of TB in homeless shelters is available[23].

The primary objective of TB management among the homeless and underhoused is to find active cases.

Best Practices

10.18 TB program staff proactively liaise with local institutions for the homeless in order to engage and educate personnel about TB prevention and control, including how to recognize possible TB cases and/or outbreaks without delay.

10.19 Stringent infection control policies and procedures are implemented in homeless shelters in order to protect both clients and staff.

10.20 TB programs develop and maintain mechanisms to monitor TB case and contact program objectives for homeless and underhoused populations (see Appendix IV – Tuberculosis program objectives and performance targets).

10.21 Guidelines specific to the Canadian context are developed for TB prevention and control for the homeless and underhoused outside of the shelter setting.

d) Institutional settings

Institutions housing large numbers of people, such as correctional facilities, hospitals and long-term care facilities, require special strategies to detect TB and prevent disease transmission. There is increased risk of infection and progression to disease in such settings, as individuals may be from risk groups that have a higher burden of infection, and the shared environment and closeness of contact may be conducive to transmission. Staff of these institutions may be at greater risk of infection than the general public.

Correctional facilities

Constant vigilance is required to decrease the risk of TB transmission in correctional settings, particularly in overcrowded institutions. Incarceration can provide opportunities for screening to identify active TB disease cases and LTBI, as well as a supervised treatment environment. Correctional health care staff need to work with local public health authorities when the individual is released to ensure that there is continuity of care and to follow up inmates who are named as contacts in public health investigations of active cases.

Hospitals and long-term care facilities

There is a long history of healthcare-associated infection with TB. The risk of transmission is increased if the disease is not recognized and the appropriate precautions are not taken to prevent spread. The risk is even greater if patients and/or staff are immunocompromised or otherwise at risk of disease because of predisposing conditions such as diabetes or malnutrition.

The objectives of TB control in institutional settings are:

- to secure the earliest possible identification and treatment of disease;
- to ensure that appropriate management of contacts within the institution is conducted, in collaboration with public health authorities; and
- to maintain appropriate infection control through administrative, environmental/engineering and personal controls.

Best Practices

10.22 The management of TB in institutional settings is guided by the *Canadian Tuberculosis Standards.*

10.23 Correctional institutions implement programs and activities for inmates that will safeguard institutional-community continuity of care for treatment of both active TB disease and LTBI upon entry and release of inmates.

10.24 All hospitals, long-term care facilities and correctional facilities develop, or update as necessary, specific TB detection and infection control procedures.

11. Strategies to address emerging issues

a) TB and HIV co-infection

People with HIV infection are at considerably greater risk than the general population of acquiring LTBI following exposure and also for progression from LTBI to active TB disease. HIV has significantly contributed to the resurgence of TB internationally, and in some regions of the world co-infection presents a serious challenge to TB control. The need to understand the relation between TB and HIV at the program and case management level cannot be overemphasized.

The true level of TB-HIV co-infection in Canada is unknown. In Canada in 2009, the HIV status of 40% of TB cases was reported to the CTBRS. In that group, the prevalence of HIV infection was 10%. The WHO estimated HIV prevalence among incident TB cases in Canada in 2008 to be 4.6%[24].

The *Canadian Tuberculosis Standards* provides details on TB and HIV testing of potentially co-infected individuals. The key messages are that all people with active TB disease should be tested for HIV and all HIV-infected people should be assessed for a history of active TB disease or likely exposure to TB and should be tested for TB as appropriate. Individuals who test HIV positive should receive post-test counselling according to current HIV testing guidelines.

Recent experience with opt-out testing in one Canadian province, where 95% of TB patients were tested for HIV in 2007-2008, indicates that this approach leads to significant progress towards universal testing for TB/HIV co-infection. With this form of testing, patients are briefly informed about HIV's connection with TB and the routine testing of TB patients for HIV unless they choose not to be tested. The practice has contributed significantly to improving understanding of the burden of co-infection, cooperation between TB and HIV programs and, ultimately, to the management of the two conditions[25,26]. For these reasons, TB programs should strongly consider using the opt-out approach, with informed consent, for HIV testing of people with active TB disease.

CIC introduced routine HIV testing on January 15, 2002, for all applicants who require an immigration medical examination and are 15 years of age or over. HIV testing is also a requirement for children who have risk factors for HIV, such as a known HIV-positive mother. HIV-seropositive newcomers are not required to report to provincial/territorial public health authorities after arrival in Canada for further investigation of their risk of acquiring TB. HIV-seropositive newcomers receive a handout advising them to telephone a health clinic specializing in HIV after their entry into Canada in order to maintain their own health, as well as to protect their family members. Since 2005, CIC provides monthly reports to

provinces/territories that have elected to be informed of HIV-positive newcomers to their jurisdictions. The CIC HIV policy is currently under review. Mandatory immigration medical surveillance notification for HIV-positive migrants is one of the issues under consideration

The objective for the management of TB and HIV co-infection is to secure the necessary coordination of care between health care providers/agencies and individuals in order to provide appropriate treatment and follow-up to those individuals with TB and HIV co-infection.

Best Practices

11.1 The *Canadian Tuberculosis Standards* with respect to screening of TB patients for HIV and HIV patients for TB are promoted.

11.2 All efforts are made to increase the proportion of TB cases with a known HIV test result (positive or negative) from 40% in 2009 to 90% by 2015.

11.3 The care and treatment of individuals who are HIV positive or have a positive tuberculin skin test follows the *Recommendations for the Screening and Prevention of TB in Patients with HIV and the Screening for HIV in TB Patients and Their Contacts*[15].

11.4 While maintaining individual patient confidentiality, there is cooperation and liaison between health care providers/agencies that deal with TB and those dealing with HIV in order to better deal with the risks and issues of care and to gain a better epidemiologic understanding of co-infection.

b) Drug-resistant TB

Drug resistance is a major threat to standards of care and resource allocation in TB prevention and control. The two forms of drug resistance of most concern are multidrug-resistant TB (MDR-TB), which is TB resistant to at least isoniazid and rifampin (the two best first-line antibiotics), and extensively drug-resistant TB (XDR-TB), which is TB that is resistant to any fluoroquinolone and at least one of three injectable second-line drugs (capreomycin, kanamycin and amikacin), in addition to being MDR-TB. Treatment for MDR-TB and XDR-TB can last for years, produces more side effects, requires longer hospitalization for infection control and/or nursing care and is expensive. In some cases, a cure may not be possible.

TB drug resistance in Canada is monitored by two surveillance systems: the Canadian Tuberculosis Reporting System (CTBRS) and the Canadian Tuberculosis Laboratory Surveillance System (CTLSS). The CTBRS monitors drug resistance in reported cases of TB, whereas the CTLSS reports drug resistance of TB bacteria cultured from patients. Both systems provide vital and complementary information on the nature and degree of TB drug resistance in Canada.

The objective with respect to TB drug resistance is to minimize its development and to implement strategies for improved treatment and care of drug-resistant cases.

Best Practices

11.5 Health care providers consult with a recognized medical TB expert in any situation in which drug-resistant TB is identified. This includes patients with mono-resistant TB, as the risk of treatment failure, relapse and acquired drug resistance is increased.

11.6 It is recognized that the treatment of multidrug-resistant (MDR)-TB and extensively drug-resistant (XDR)-TB is complex and requires special expertise. Therefore, MDR/XDR-TB patients and their contacts with LTBI are referred to physicians or centres with this recognized expertise for management.

11.7 All MDR-TB and XDR-TB patients are treated with directly observed therapy for the entire duration of therapy.

12. Social and other determinants of health related to TB

It has been long understood that the burden of TB is strongly related to social and economic indicators and determinants of health[27]. Increased risk of TB can be observed in poor and other vulnerable populations, such as the incarcerated, the homeless and some minority populations.

Examples of determinants of health related to TB:

1. Income and social status (e.g., adequate housing and diet; income maintenance while off work because of infectious active TB disease)
2. Social support networks (e.g., support from family, friends and community of diagnosed cases of TB)
3. Education and literacy (e.g., knowledge of TB)
4. Employment/working conditions (e.g., increased exposure to infectious TB cases in some settings)
5. Social environments (e.g., socially stable community)
6. Physical environment (e.g., homelessness; inadequately ventilated, crowded housing and homeless shelters; exposure to infectious TB cases)
7. Personal health practices and coping skills (e.g., adherence to treatment, smoking, obesity leading to diabetes, substance abuse, unsafe sex leading to HIV infection)
8. Healthy child development (e.g., children screened for LTBI in high-incidence settings)

9. Biology/genetic endowment (e.g., genetic factors in some individuals may increase susceptibility to active TB disease if infected)
10. Health services (e.g., timely diagnosis of active TB disease, high-quality treatment service, continuity of health care)
11. Gender (e.g., higher rate of TB among males)
12. Culture (e.g., different cultural beliefs regarding the cause and treatment of TB; community history of TB causing separation, loneliness, hardship, stigma and death)

Prevention interventions aimed at reducing rates of TB should target risk factors directly or their underlying upstream social and other determinants of health. Commitment by all relevant organizations, including civil society, to address these determinants is required.

The objective of addressing the social determinants of TB is to reduce the social, economic, cultural and environmental factors that are significant contributors to the development of LTBI and active TB disease and to their effective management.

Best Practices

12.1 TB control programs make strong efforts to collaborate with partners within and beyond the health sector to address the social and other determinants of health that influence TB outcomes in specific at-risk populations.

12.2 TB control programs devise strategies to correlate relevant TB epidemiologic data with socio-economic indicators in at-risk populations in order to inform the development and implementation of strategies to mitigate TB risk.

12.3 Partnerships amongst various levels of government and non-governmental stakeholders continue to be developed to address the social determinants of health that contribute to active TB disease and LTBI.

13. Research

Integrated systematic research is continually required to produce the evidence that will stimulate and sustain programmatic and clinical advances, drug regimens and the tools necessary to meet the challenges of TB. Innovative TB research in Canada has a long history and continues to support clinical treatment and other program activities in this nation and abroad.

Recently, the Stop TB Partnership and the WHO launched the “TB Research Movement”, an initiative to engage the full range of TB researchers in a collaborative and concerted strategic effort to increase the scope, scale and speed of TB research (see **http://www.stoptb.org/global/research/**).

In 2011 an international roadmap[28] for TB research was released. The roadmap was developed after an extensive consultation process, with research priorities identified in the fields of epidemiology, fundamental research, diagnostics, drugs, vaccines, public health and operations. The document identifies the key research questions that will provide a common framework for interdisciplinary collaborative research. The TB Research Movement has also produced *Priorities in Operational Research to Improve Tuberculosis Care and Control* [29] and more specific research agendas for childhood TB, TB/HIV co-infection and MDR-TB. All these documents can serve as resources for developing TB research priorities for Canada.

A number of funding agencies, such as the Canadian Institutes of Health Research, PHAC, the Canadian Lung Association, industry partners and other organizations are potential partners in advancing research activities.

The objective of TB research is to contribute to the global understanding and knowledge of LTBI and active TB disease.

Best Practices

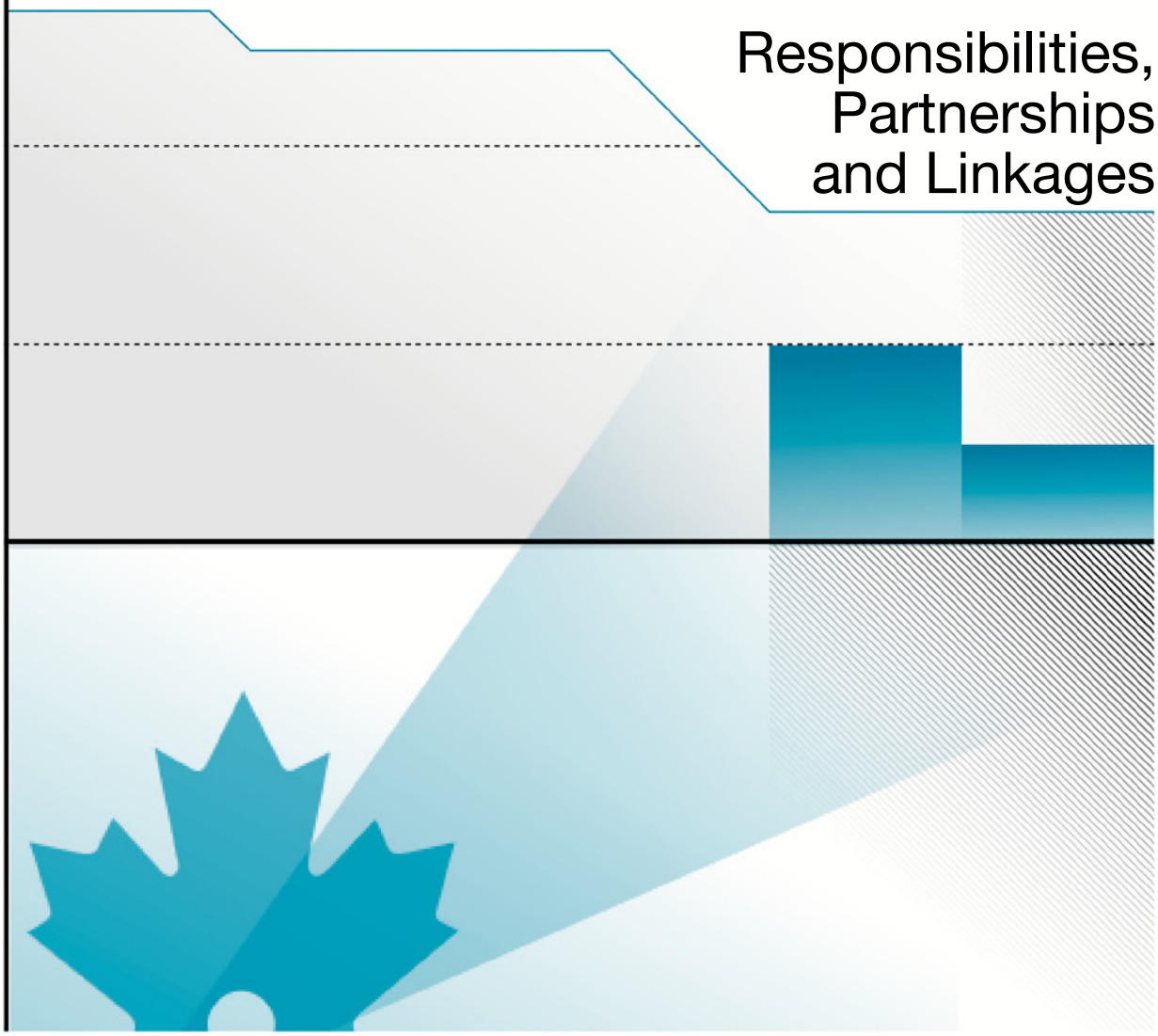
13.1 TB-related research is promoted actively and supported accordingly by all levels of government as well as by other potential funding sources.

13.2 Appropriate funding for training, infrastructure and the conduct of research into TB is available, primarily through peer review mechanisms.

13.3 TB research priorities are developed collaboratively by key TB stakeholders in accordance with needs identified through review of TB prevention and control objectives and progress towards meeting performance targets (Appendix IV) and the “TB Research Movement”.

Part III

Responsibilities, Partnerships and Linkages



Managing TB is the responsibility of many different government jurisdictions. In Canada, the federal, provincial, territorial and municipal governments are all involved in different aspects of TB issues. In addition, care is provided by hospitals, clinics and individual providers outside of the traditional public health system.

Federal

The federal role in TB prevention and control within Canada is broad and diverse. PHAC coordinates and/or supports several activities:

- Surveillance of active TB disease in Canada
- Surveillance of TB drug resistance in Canada
- Correctional Service of Canada Web-enabled Infectious Disease Surveillance System for TB screening among CSC staff
- Preparation and publication of the *Canadian Tuberculosis Standards*, in collaboration with the Canadian Thoracic Society and the Canadian Lung Association
- Support for federal/provincial/territorial collaboration, including the Pan-Canadian Public Health Network and its Communicable and Infectious Diseases Steering Committee
- International collaboration for continuity of care for individuals with active TB disease and LTBI moving between jurisdictions
- Support for multijurisdictional and international contact investigation
- Measures taken under the *Quarantine Act* with respect to international travellers who are arriving in or departing from Canada
- Provision of technical assistance and training
- Collaboration in targeted research
- National Microbiology Laboratory (see Section 6)
- The National Advisory Committee on Immunization issues guidelines on the use of BCG vaccine and will provide future guidelines as new TB vaccines become available
- The Committee to Advise on Tropical Medicine and Travel issues Advisory Committee Statements on TB prevention and control among travellers

Health Canada assures TB prevention and control services are either provided or accessible to First Nations on-reserve in partnership with provinces, territories and communities. Other areas of Health Canada monitor and regulate diagnostics, therapeutics and medical devices related to TB.

The Canadian Food Inspection Agency has responsibilities for the prevention and control of *Mycobacterium tuberculosis* and *M. bovis* in animals.

CIC is responsible for Canada's immigration medical screening program, a significant component of which involves screening for active TB disease.

Correctional Service of Canada (CSC) is responsible for TB prevention and control for inmates in federal correctional institutions. CSC staff are served through Health Canada's Public Health and Occupational Safety Program.

Provincial/territorial/municipal

Provincial/territorial and in some cases municipal governments are responsible for providing leadership in their jurisdictions in response to TB. This is primarily through TB control programs, which encompass both public health and the provision of health services through hospitals, community health and other primary care facilities.

Active TB disease represents the final pathway of a series of linked biological, medical, economic and social factors. As a consequence, definitive solutions also need to be multidisciplinary. This means that, depending upon location and local disease epidemiology, TB control programs potentially need to coordinate and liaise with other government sectors. Those sectors include ministries/departments of community services, social services, housing, environment, immigration/settlement services and correctional facilities. These liaisons and coordination are important in order to work towards improved social and economic determinants of health.

Provincial/territorial/municipal responsibilities include the following:

- Setting of goals and objectives for achievement of program outcomes and processes and outlining the roles and responsibilities of all partners in TB prevention and control
- Routine and systematic case finding, case management, contact tracing and outbreak investigation
- Monitoring and analyzing the epidemiology of TB within their jurisdictions, including the regular analysis of surveillance data and dissemination of results
- Developing, funding, delivering and evaluating a range of TB control program services, including health promotion, treatment and care, and training, that reflect the prevalence and changing needs of populations at risk
- Providing adequate medical follow-up of those recently arrived migrants deemed to be at increased risk of active TB disease
- Providing training and education for all program staff and providing leadership in TB education to community leaders, health care providers, policymakers, community agencies and the public
- Providing consultation and information on the technical aspects of TB control programs
- Establishing public policy and legislative frameworks

Academic and health sectors

Professional and other societies are often well positioned to assist in the development of new partnerships and the coordination of existing ones. Such partnerships at the public, private and academic level are necessary to effectively focus resources and attention on crucial aspects of TB control.

Best Practices

14.1 Academic and professional societies and organizations support the development of expertise in surveillance, research, diagnosis, drug sensitivity testing, program delivery and treatment of TB at the provincial/territorial, national and international levels.

14.2 Academic and professional societies use their networks to increase awareness of the importance of global TB control at professional, program and government levels and support the mobilization of existing resources and capacities to improve and sustain TB control.

Partnerships and linkages

TB control activities extend beyond health care providers and governmental responsibilities. TB is a disease with many sociological aspects, and issues of poverty, marginalization, housing, education and social integration influence disease acquisition and treatment completion.

At the same time, the social and human aspects that define TB mean that synergies exist between this guidance document and a number of efforts to combat other diseases and the risk factors related to them. All of these factors are best dealt with through integrated partnerships. By addressing common populations, mechanisms can be put in place to maintain the necessary linkages, avoid duplication or contradiction, and enable identification and exploitation of mutually beneficial opportunities.

Best Practices

14.3 All organizations with an interest in addressing TB prevention and control explain their roles and responsibilities in order to clarify their accountability, as this will assist with defining how effective partnerships can be formed to achieve common goals and individual organizational objectives.

14.4 Each TB prevention and control program is coordinated internally and externally with stakeholders, community groups and organizations to ensure that there is involvement of relevant partners, especially those responsible for the health of individuals in high-risk populations and conditions (as per Part II above). These partners work towards improving those social and other determinants known to be contributing factors to development of TB infection, disease and transmission.

Part IV

International Collaboration

Infectious diseases do not respect international borders. As a result of global interdependency and increasing international movement of people, infectious diseases spread more rapidly from country to country. TB is no exception. As with smallpox and polio, TB control in Canada should move beyond our borders to optimally protect Canadians. Investment in TB control in high-incidence countries would not only save lives and prevent spread of disease but would also reduce health care costs in those countries. Furthermore, there is evidence of a substantial impact in reducing health care costs in the migrant-receiving countries[30].

Many disease and health challenges result from or are sustained by under-resourced or weak health system capacities. At the beginning of the new millennium in 2000, nearly 200 nations agreed on eight goals to be achieved by 2015 in order to meet the major challenges to world development[31]. Known as the Millennium Development Goals, they are based on time-bound and measurable targets accompanied by indicators for monitoring progress. Improved TB control is one component of this global framework approach intended to strengthen health systems. It is well understood that permanent improvements in global health will require stronger health care system capacity and improved health system performance.

In 2008, UNITAID approved a project called EXPAND-TB, which supports the procurement and use of new TB diagnostic tools in low and lower-middle income countries between 2009 and 2013. Project partners include the WHO-Global Laboratory Initiative, the Foundation for Innovative New Diagnostics and the Stop TB Partnership's Global Drug Facility. EXPAND-TB aims to narrow the diagnostic gap affecting control of MDR-TB by accelerating access to new diagnostic technologies within appropriate laboratory services, accompanied by the necessary transfer of technology, while also ensuring that new tools are properly integrated within TB control programs. EXPAND-TB currently covers 27 countries.

The *International Standards for Tuberculosis Care* (ISTC)[12] describe a widely accepted level of care that all practitioners, public and private, should seek to achieve in managing patients who have, or are suspected of having, TB. Increasing the systematic use of the *International Standards* is an important adjunct to the *Global Plan to Stop TB*.

Canada is a supporter of the *Global Plan*, and its involvement in international TB control is multifaceted. In 2010, with the assistance of the Canadian International Development Agency (CIDA), the Stop TB Partnership launched the TB REACH initiative. The main objective of TB REACH is to promote early and increased case detection of infectious TB cases and their timely treatment while maintaining high cure rates within DOTS programs. PHAC provides technical assistance and collaborates with Stop TB Canada, as well as participating in the TB Working Group of the International Circumpolar Surveillance network. CIC detects hundreds of cases of active TB disease each year through its immigration medical screening program. Treating immigrants before their arrival in Canada prevents subsequent spread of infection in Canada and assists local TB control efforts at the migrant's place of origin. Individual clinicians, researchers and those with an interest in international development contribute much towards global TB control.

The objective of international collaboration is to enhance Canada's contribution to global TB prevention and control activities and thus contribute to the global reduction in the burden of active TB disease.

Best Practices

15.1 There is recognition and support for the concept that in order to have an eventual impact on the significant proportion of Canadian cases that occur in the foreign-born it is essential to address the global TB epidemic.

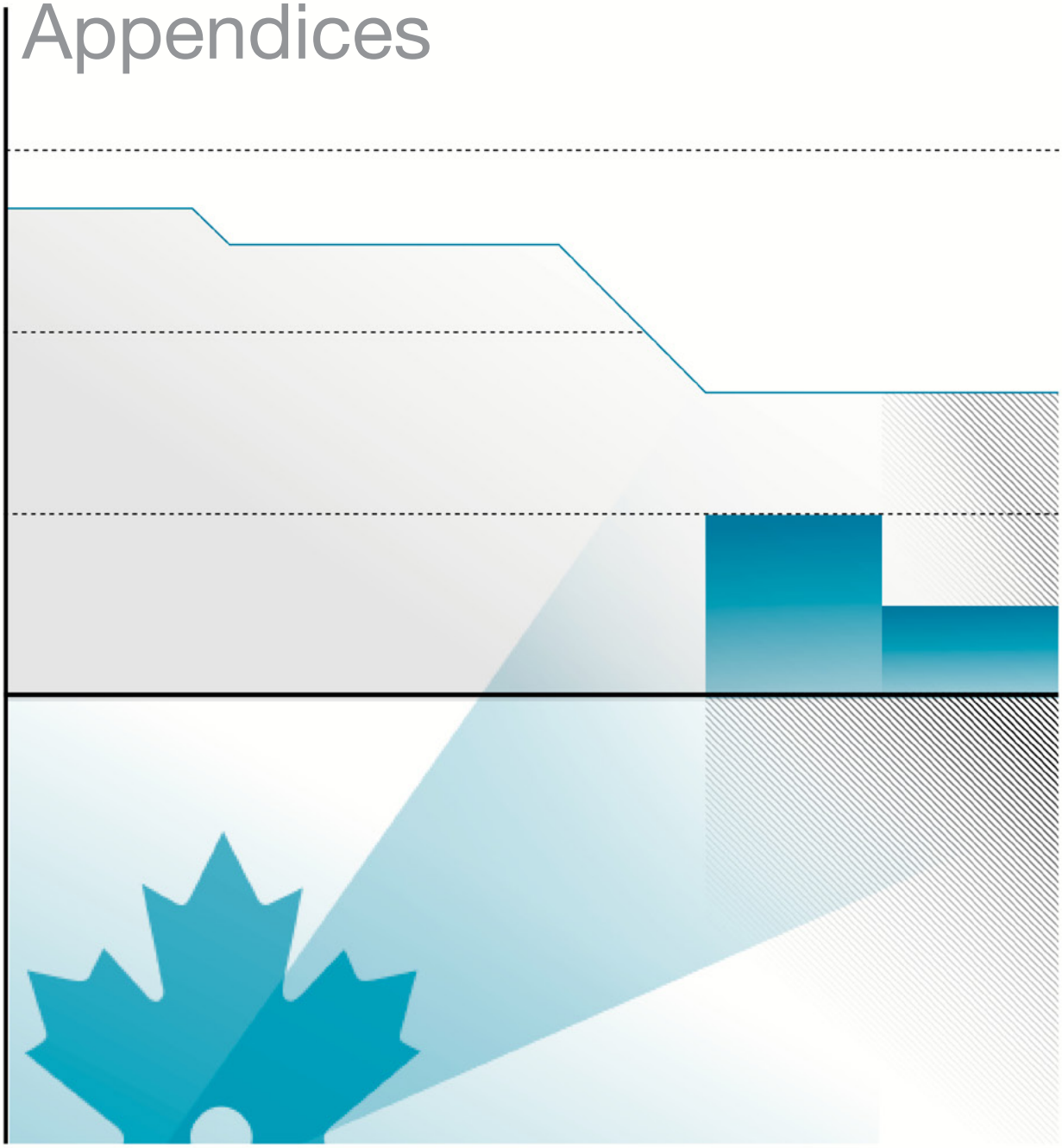
15.2 Canadian individuals and organizations at all levels continue to contribute to the global fight to eliminate TB, including collaboration with the WHO Global STOP TB Partnership.

Conclusion

In light of the disproportionately high rates of TB in certain Canadian population subgroups combined with the global challenges of TB drug resistance and TB-HIV co-infection, it is an opportune time to refocus efforts for TB prevention and control in Canada. Objectives and best practices identified in this document provide a framework and guidance for action. TB prevention and control in Canada is a shared responsibility among communities, governments and non-governmental organizations and concerted intersectoral action is required at all levels to address this preventable and treatable disease. In addition to programs and interventions within the formal health system, action to address the social determinants of health that contribute to ongoing transmission of TB and exacerbate its effects on those people who are infected is essential.

The intent is that stakeholders will review the best practices that are most applicable to their work and develop concrete action plans to operationalize or enhance their activities. Strengthened collaborative efforts are also critical to ensuring that Canada meets its TB reduction and elimination targets.

Appendices



Appendix I – Definition of terms and abbreviations

Aboriginal peoples – descendants of the original inhabitants of North America; the *Constitution Act, 1982* recognizes three major groups of Aboriginal peoples in Canada: First Nations (Status Indians are registered with the federal government as Indians according to the terms of the *Indian Act*; non-Status are not registered), Métis and Inuit.

Active TB disease – the presence of current active TB disease, most often on the basis of positive bacteriology but in approximately 15%-25% of cases on the basis of appropriate clinical and/or radiological and/or pathological presentation as well as treatment response.

AFB – Acid-fast bacteria: also known as acid-fast bacilli; microorganisms that are distinguished by their retention of specific stains even after being rinsed with an acid solution; the majority of AFB in patient specimens are mycobacteria, including species other than *Mycobacterium tuberculosis* complex.

AIDS – Acquired immunodeficiency syndrome

Case holding – this term refers to all aspects of the diagnosis and initiation of therapy of an active case of TB disease, including the completion of an adequate course of therapy.

CIC – Citizenship and Immigration Canada

CIDA – Canadian International Development Agency

CIHR – Canadian Institutes of Health Research

Contact – a person identified as having come in contact with an **active** case of TB disease. The degree of contact is usually further defined as close household, close non-household, casual and community contacts. The level and duration of contact usually suggest the risk of becoming infected.

CPHLN – Canadian Public Health Laboratory Network

CTBRS – Canadian Tuberculosis Reporting System

CTC – Canadian Tuberculosis Committee

CTLSS – Canadian Tuberculosis Laboratory Surveillance System

CTLTN – Canadian Tuberculosis Laboratory Technical Network

DOT – directly observed therapy (also known as directly observed treatment), the process whereby a health care worker or independent observer watches the patient swallow each dose of medication, helping to ensure that higher treatment completion rates are achieved.

DOTS – Directly Observed Treatment, Short-course; the internationally recommended strategy for TB control.

First Nations – a term that came into common usage in the 1970s to replace the word “Indian”, which some people found offensive. Although the term “First Nations” is widely used, no legal definition of it exists. The term ‘First Nations peoples’ refers to the Indian peoples in Canada, both Status and non-Status. Some Indian peoples have also adopted the term “First Nation” to replace the word “Band” in the name of their community.

FNIHB – First Nations and Inuit Health Branch, Health Canada

HIV – Human immunodeficiency virus

ICS – International Circumpolar Surveillance

IGRA – interferon-gamma release assay: *in-vitro* T-cell based assays that measure interferon-γ (IFN-γ) production and that have been developed for the diagnosis of latent TB infection. These assays operate on the basis that T cells previously sensitized to TB antigens produce high levels of IFN-γ when re-exposed to the same mycobacterial antigens. At the present time, two different types of IGRA are registered for use in Canada and present possible alternatives to tuberculin skin testing (TST). These are the QuantiFERON-TB Gold In-Tube® (Cellestis Limited, Carnegie, Victoria, Australia) and the T-SPOT.TB® (Oxford Immunotec, Oxford, UK) assays.

Index case – the first or initial active case from which the process of contact investigation begins.

Inuit – an Aboriginal people in Canada who live primarily in Nunavut, the Inuvialuit region of the Northwest Territories, Nunavik in northern Quebec and Nunatsiavut in Labrador. Inuit means "people" in the Inuit language.

ISTC – International Standards for Tuberculosis Care

LTBI – latent TB infection, the presence of latent or dormant infection with *Mycobacterium tuberculosis* with no evidence of clinically active TB disease. The immunocompetent host generally has a lifetime risk of infection progressing to active TB disease (**reactivation**) in the range of 10%. Subjects deemed to have LTBI are by definition non-infectious.

MDGs – Millennium Development Goals: eight goals (including 21 quantifiable targets that are measured by 60 indicators) to be achieved by 2015 that respond to the world's main development challenges. The MDGs are drawn from the actions and targets contained in the Millennium Declaration that was adopted by 189 nations and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000.

MDR-TB – **multidrug-resistant tuberculosis:** TB that is resistant to at least the two best first-line anti-tuberculosis drugs, isoniazid and rifampin, but which does not meet the definition of extensively drug-resistant TB (XDR-TB);

Métis – a people of mixed Aboriginal and European ancestry who identify themselves as Métis, as distinct from First Nations, Inuit or non-Aboriginal people.

NML – National Microbiology Laboratory of the Public Health Agency of Canada

Outbreak – the following working definition of outbreak has been proposed by the U.S. Centers for Disease Control and Prevention for planning investigations and has been used successfully by various Canadian TB programs:

- During (and because of) a contact investigation, two or more contacts are identified as having active TB disease, regardless of their assigned (contact investigation) priority; or

- Any two or more cases occurring (within) ≤ 1 year of each other are discovered to be linked, and the linkage is established outside of a contact investigation (e.g., two patients who received a diagnosis of TB outside of a contact investigation are found to work in the same office, and only one or neither of the persons was listed as a contact of the other). The linkage between cases should be confirmed by genotyping results if isolates have been obtained.

PHAC – Public Health Agency of Canada

Screening – a process to discover conditions suitable for early preventive or curative intervention. These conditions may not be sufficiently symptomatic to induce individuals to seek medical help on their own. The condition being screened for should be sufficiently prevalent for the screening procedure to be cost-effective, have agreed-upon diagnostic criteria, have a known natural history and be amenable to a definitive intervention.

Short-course treatment – TB treatment regimens using different combinations of anti-tubercular drugs, which allow treatment to be completed in 6 months as opposed to the regular 9 months.

Source case – the person who was the original source of infection for secondary case(s) or contacts. The source case can be, but is not necessarily, the **index case**.

Surveillance – an ongoing process of (a) systematic collection of pertinent data; (b) orderly consolidation and evaluation of these data; and (c) prompt dissemination of the results to those who need to know, particularly those who are in a position to take action.

TB – tuberculosis

Transferred Communities – First Nations and Inuit communities for whom the responsibility for health service delivery has been transferred by the federal government. Only First Nations and Inuit communities situated *south of the 60th parallel* are eligible to enter into the health services transfer process managed by FNIHB.

Treatment success (active TB disease) – cure (culture negative at the completion of treatment) or treatment completion (treatment completed without culture at the end of treatment).

TST – **tuberculin skin test,** a test to identify whether a person has or has had LTBI using reaction to tuberculin antigens.

UNITAID – an international facility for the purchase of diagnostics and drugs for diagnosis and treatment of HIV/AIDS, malaria and TB.

WHO – World Health Organization

XDR-TB – **extensively drug-resistant tuberculosis:** TB that is resistant to at least the two best first-line anti-tuberculosis drugs, isoniazid and rifampin, plus resistant to second-line drugs including any fluoroquinolone, and to at least one of three injectable second-line anti-tuberculosis drugs (amikacin, capreomycin and kanamycin).

Appendix II – Epidemiology of TB in Canada

Overall

Reported active TB disease incidence rates have fallen dramatically in Canada and most other developed countries since the beginning of the 20th century. Reported active TB disease and death rates declined rapidly after the mid-1940s, for the most part as a result of improvements in general living conditions and public health measures to interrupt transmission, followed later by the development of effective drug treatment.

Currently, Canada has one of the lowest reported incidence rates of TB in the world, largely because it is a developed country with a high overall standard of living, a well-established public health infrastructure and good access to health care services. However, immigrants may arrive in Canada from regions of the world with a high burden of TB, and many First Nations and Inuit communities remain in need of better housing and social conditions. Together these factors help explain persistent TB control challenges in Canada.

For the latest data on the epidemiology of TB in Canada, please visit
http://www.phac-aspc.gc.ca/tbpc-latb/surv-eng.php

Over the past two decades the reported incidence and number of cases of TB has slowly decreased. In 2009, the provisional incidence rate of new active and re-treatment TB cases was 4.7 per 100,000 of the Canadian population, reflecting a total of 1,599 new active and re-treatment cases.

The incidence of active cases of TB disease is only one measure of TB. The prevalence of LTBI is much higher, and it is from this group that future reactivated disease will be generated (Table 1).

Table 1.

Estimates of Latent TB Infection in Various Populations and Communities in Canada

Population	Expected Prevalence of TST ≥ 10mm
Canadian-born non-aboriginal children	< 3%
Canadian-born non-aboriginal adults, not BCG vaccinated	< 10%
Canadian-born non-aboriginal adults, BCG vaccinated	20% - 25%
Aboriginal Canadian children	≤ 5%; one study of Cree students in Quebec reported 15%
Aboriginal Canadian adults	20% - 30%
Foreign-born children from high TB incidence countries	15% - 25%
Foreign-born adults who lived for 20 years or more in high TB incidence countries	40% - 50%; one study of Tibetan refugees reported > 90%
Health care workers	20% - 40%
Residents ≥ age 65 in long-term care facilities	20% - 30%
Residents in homeless shelters	40%
Correctional facility inmates	20%
Injection drug users	20%

(Source: *Canadian TB Standards, 6th ed.*)

Origin and age

Against the background of decreasing national incidence rates, the major change in the epidemiology of TB in Canada over the past five decades has occurred with respect to the proportional origin of reported cases. While the number of cases in the foreign-born population has been relatively stable, there has been a significant increase in the ***proportion*** of TB in foreign-born individuals in Canada. Between 1970 and 2009, the proportion of TB cases among foreign-born persons in Canada increased from 18% of all cases reported to 63%.

Between 1999 and 2009 there were 12,046 foreign-born cases reported in Canada. Of those, 87% were from countries with high TB incidence (defined as a WHO-estimated three year average rate of smear-positive pulmonary TB cases of 15/100,000 or greater and based on the 2010 WHO estimates). Those arriving with LTBI are at highest risk of active TB disease occurring within the first 5 years of their arrival[32,33,34]. Of foreign-born TB cases in Canada reported in 2009, 9% were diagnosed and reported to have active TB disease in the year of arrival, 27% within 2 years and 40% within 5 years. The risk of active TB disease persists for many years after arrival, dropping at a rate of approximately 10% per year.

Other highly developed countries with large immigration programs have had similar experiences with respect to foreign-born TB cases. During the past 20 to 30 years the proportion of active TB disease among the foreign-born has increased in Australia[35], New Zealand[36], the United Kingdom[37,38,] the United States[33] and Western Europe[39,] (Table 2). In general, TB cases in the foreign-born most often occur in the 25-34 year age group.

Table 2.

Proportion of New Reported Cases of TB in Foreign-born Populations in Selected Nations, 2007–2009

Nation	Year	Number of Reported Cases	Rate per 100,000	% Foreign Born
Australia[40]	2007	1,135	5.4	86
Canada	2009	1,599	4.7	63
New Zealand[41]	2009	300	7.0	73
UK	2009	9,040	14.1	72
US[42]	2009	11,545	4.2	59

Among First Nations, Inuit and Métis, the overall proportion of disease contributing to the total Canadian TB case load continues to be substantial, although the reported TB incidence rate has declined. According to the 2006 Census[43], Canadian-born Aboriginal peoples accounted for 4% of the overall population. In 2009, reported cases of TB in this group accounted for 21% of the Canadian active TB disease burden.

While the reported incidence rate of TB among First Nations, Inuit and Métis populations as a whole is much higher than in the Canadian-born non-Aboriginal population, there is wide provincial/territorial variation in rates. In 2009 the provincial/territorial reported incidence rate of active TB disease among Registered First Nations persons ranged from 0 to 61/100,000. Among the Inuit the national reported incidence rate of TB was extremely high at 155.8/100,000 in 2009. TB is proportionately more common in the very young of First Nations and Inuit populations compared with Canadian-born non-Aboriginals, thus denoting ongoing transmission of infection.

Cases of active TB disease among Canadian-born non-Aboriginal individuals continues to decrease. The incidence of new cases in this population is very low. In 2009, the reported rate of incident cases was 1.0 per 100,000 (Table 3, Figure 1). In this population, TB in the elderly accounts for a large proportion of notified cases.

Table 3.

Reported Active TB Disease in Canada by Origin, 2005–2009

Birthplace

First Nations*		2005	2006	2007	2008	2009	5 Year Average
On Reserve	Cases	133	135	130	118	124	27.9
	Population	438,079	449,195	460,304	471,419	482,555	
	Rates	30.4	30.1	28.2	25.0	25.7	
Off Reserve	Cases	78	88	83	97	86	25.2
	Population	340,253	342,936	345,447	347,804	350,016	
	Rates	22.9	25.7	24.0	27.9	25.6	
Unknown		2	0	13	6	13	
Inuit		2005	2006	2007	2008	2009	
Cases		63	61	46	89	89	127.6
Population		52,187	53,389	54,615	55,860	57,124	
Rates		120.7	114.3	84.2	159.3	155.8	
Métis		2005	2006	2007	2008	2009	
Cases		35	29	32	27	25	8.9
Population		324,343	328,955	333,569	338,178	342,791	
Rates		10.8	8.8	9.6	8.0	7.3	
Foreign-born		2005	2006	2007	2008	2009	
Cases		1057	1076	1067	1068	1003	14.7
Population		6,857,745	6,935,003	7,127,778	7,350,012	7,565,386	
Rates		15.4	15.5	15.0	14.5	13.3	

Reported Active TB Disease in Canada by Origin, 2005–2009 (cont...)

Birthplace

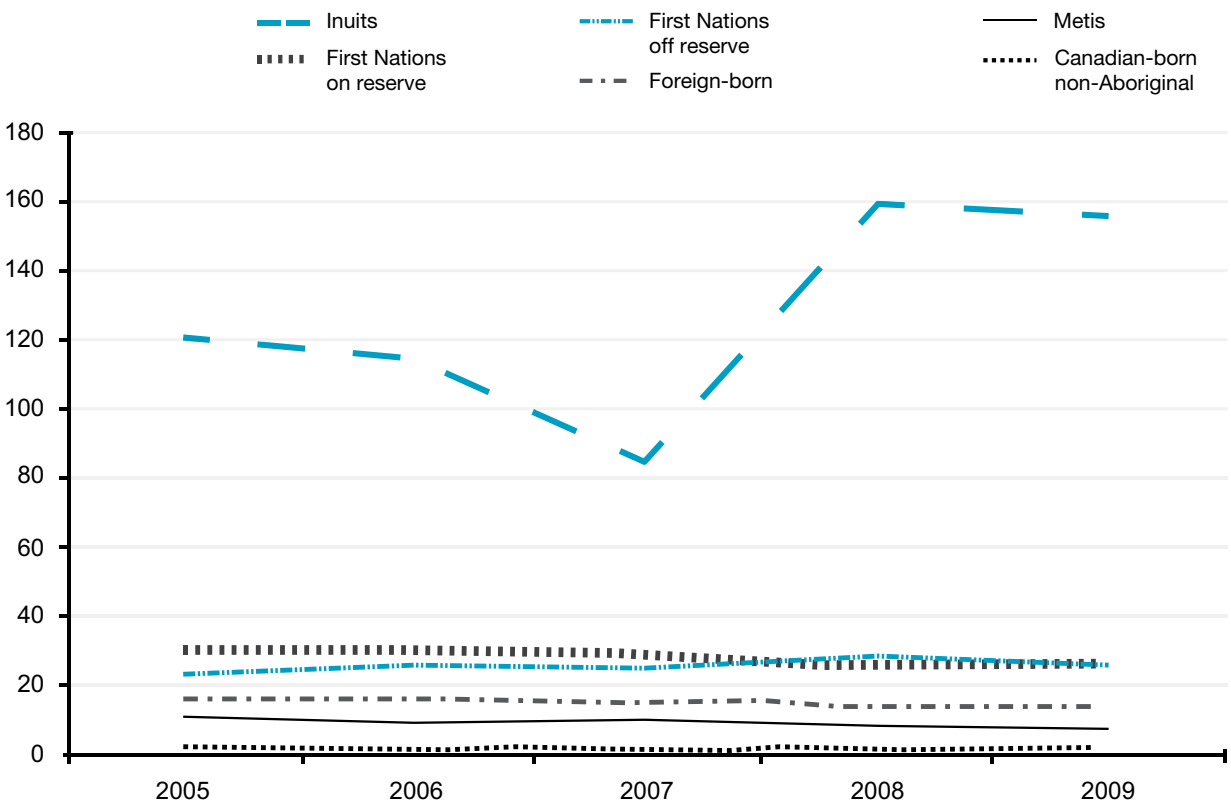
Canadian-born non-Aboriginal†	2005	2006	2007	2008	2009	5 Year Average
Cases	218	201	171	221	237	
Population	24,240,326	24,473,438	24,615,830	24,767,997	24,943,877	0.9
Rates	0.9	0.8	0.7	0.9	1.0	
	2005	2006	2007	2008	2009	
Unknown Birthplace	49	57	30	9	17	
Non-status Indian	6	7	4	9	5	
Total Canada	2005	2006	2007	2008	2009	
Cases	1641	1654	1576	1644	1656	
Population	32,245,209	32,576,074	32,931,956	33,327,337	33,739,859	4.9
Rates	5.1	5.1	4.8	4.9	4.9	
Ratios	2005	2006	2007	2008	2009	
First Nations On Reserve/Canadian-born non-Aboriginal	33.8	37.6	40.3	27.8	25.7	33.0
First Nations Off Reserve/Canadian-born non-Aboriginal	25.4	32.1	34.3	31.0	25.6	29.7
Inuit/Canadian-born non-Aboriginal	134.1	142.9	120.3	177.0	155.8	146.0
Métis/Canadian-born non-Aboriginal	12.0	11.0	13.7	8.9	7.3	10.6

* First Nations population source: *Registered Indian Population, Household and Family Projections 2004–2029,* Indian and Northern Affairs Canada, 2007.

† Statistics Canada, Demography Division, Demographic Estimates Section, July Population Estimates, 2009. Preliminary post-census estimates.

Figure 1

Reported active TB disease rates in Canada by origin: 2005–2009



Aging is associated with an increased risk of progression of LTBI to active TB disease. As Canada's population ages, surveillance of TB in the elderly, particularly those born in regions of the world with high TB incidence, will become increasingly important. In 2009, for example, the reported TB incidence rate in those older than 75 years of age was almost twice that of the national reported incidence rate (8.5 vs. 4.7/100,000).

Geographic

Reflecting the urbanization of developed countries, TB in Canada is increasingly an urban disease. In 2008, 51% of the Canadian population resided in census metropolitan areas of 500,000 persons or more[44]. By 2009, 77% of all TB cases in Canada were reported from these areas. The three most populous provinces (Ontario, Quebec and British Columbia), which collectively make up 75% of Canada's population, accounted for 66% of the total reported cases in 2009[45].

Site of disease

TB most commonly occurs in the lung, giving rise to pulmonary TB. Overall, TB of the respiratory system (which includes primary, pulmonary, and other respiratory) represented 78% of reported cases in 2009. However, TB can also affect organs outside the lung, TB of the peripheral lymph nodes being the second most commonly reported diagnostic site (12%).

Laboratory investigation

The majority of cases in Canada are diagnosed through laboratory investigation, 1,296 of the 1,599 reported cases in 2009 (77%) were laboratory confirmed. Of the 1,086 cases of pulmonary TB reported in 2009, 47% (506 cases) were sputum smear-positive denoting probable infectious pulmonary TB. Over the past decade, the proportion of TB cases reported as pulmonary smear-positive has averaged approximately 27% of the total reported cases and 42% of the reported pulmonary cases.

Drug resistance

Although high rates of drug-resistant TB have been reported in other countries, drug resistance in Canada has remained low. Each year the drug resistance testing results for all positive TB cultures are reported to PHAC. In 2009, 125 (9.5%) of 1,321 isolates were resistant to one or more drugs. Of the 1,321 cases, 112 (8.5%) showed resistance to isoniazid (this includes mono-resistance, multidrug resistance and other patterns). A total of 96 isolates tested were mono-resistant, representing 7.3% of all isolates tested and 77% of all resistant isolates. Of the isolates that were mono-resistant, the majority, 88%, were resistant to isoniazid, representing 6.3% of all the isolates tested.

In 2009, MDR-TB was reported in 1.4% of isolates. Five XDR-TB isolates were reported during the period 1997–2009, with three likely acquired outside Canada. Since systematic national drug resistance monitoring began in 1998, there has been no significant increase in reported drug resistance. However, foreign-born cases are three times more likely to be drug-resistant than are Canadian-born non-Aboriginal cases and six times more likely to have MDR-TB.

TB-HIV

HIV/AIDS is an important risk factor for TB. Internationally it is estimated that 1.37 million people are co-infected with TB and HIV. TB is one of the main causes of death among people infected with HIV.

The percentage of reported TB cases in Canada with known HIV status has increased from 6% in 1997 to 39% in 2009. In 2009 the prevalence of HIV in those TB cases for which an HIV test was reported was 10%. Testing was likely biased towards those with known risk factors for HIV infection. In the unlikely event that these were the only co-infected cases, the overall co-infection rate would have been 4%. The corresponding figures for foreign-born cases were 10% and 4%. HIV co-infected cases were more likely to be Canadian-born non-Aboriginal, male, younger, to have the central nervous system as the primary site and to die than non-co-infected cases. Foreign-born cases accounted for 55% (364) of the 662 reported cases from 1997–2009 for whom HIV status was known. For 331 of these, country of origin was also reported and 40% were born in African countries with high HIV prevalence.

Treatment outcomes

In 2008, of the 1,643 cases diagnosed 1,565 cases had a treatment outcome report. When treatment outcome status was known, the majority of cases were reported as “cured” or “treatment completed” (1,310 cases, 84%). Another 9% (141 cases) died before either starting or completing treatment. From 1997 to 2008 the average cure/treatment completion rate for Canada was 83%.

Appendix III – Legislation with application to TB prevention and control

Federal legislation

The Immigration and Refugee Protection Act, S.C. 2001, c. 27
http://laws.justice.gc.ca/PDF/Statute/I/I-2.5.pdf

Indian Act, R.S. 1985, C.I-5
http://laws.justice.gc.ca/PDF/Statute/I/I-5.pdf

Public Health Agency of Canada Act, S.C. 2006, c. 5
http://laws.justice.gc.ca/PDF/Statute/P/P-29.5.pdf

The Quarantine Act S.C. 2005, c. 20. Q 1.1
http://laws.justice.gc.ca/PDF/Statute/Q/Q-1.1.pdf

Provincial/territorial

Alberta

Public Health Act (Alberta), R.S.A. 2007, C P-37
http://www.qp.alberta.ca/574.cfm?page=P37.cfm&leg_type=Acts&isbncln=9780779739561

Communicable Diseases Regulation, Alta. Reg. 238/1985
http://www.canlii.org/en/ab/laws/regu/alta-reg-238-1985/latest/alta-reg-238-1985.html

British Columbia

Public Health Act, S.B.C. 2008, ch.28
http://www.canlii.org/en/bc/laws/stat/sbc-2008-c-28/latest/sbc-2008-c-28.html

Manitoba

The Public Health Act, C.C.S.M. c. P210
http://web2.gov.mb.ca/laws/statutes/ccsm/p210e.php

Diseases and Dead Bodies Regulation, 333/88 R
http://www.iijcan.org/en/mb/laws/regu/man-reg-26-2009/latest/man-reg-26-2009.pdf

New Brunswick

Public Health Act, S.N.B. 1998, Chap. P-22.4
http://www.gnb.ca/0062/acts/acts/p-22-4.htm

Newfoundland and Labrador

Communicable Diseases Act, R.S.N.L. 1990, Chap. C-26
http://www.assembly.nl.ca/legislation/sr/statutes/c26.htm

Health and Community Services Act, S.N.L. 1995, Chap. P-37.1
http://www.canlii.org/en/nl/laws/stat/snl-1995-c-p-37.1/latest/snl-1995-c-p-37.1.html

Northwest Territories

Public Health Act, S.N.W.T. 2007, c. 17
http://www.justice.gov.nt.ca/PDF/ACTS/Public%20Health.pdf

Disease Surveillance Regulations, N.W.T. Reg. 96-2009
http://www.justice.gov.nt.ca/PDF/REGS/PUBLIC%20HEALTH/Disease%20Surveillance.pdf

Nova Scotia

Health Protection Act, 2004, c.4, s.1
http://nslegislature.ca/legc/statutes/healthpr.htm

Nunavut

Public Health Act, R.S.N.W.T. (Nu.) 1988, c. P-12
http://www.justice.gov.nu.ca/apps/authoring/dspPage.aspx?page=STATUTES+AND+REGULATIONS+PAGE

Ontario

Health Protection and Promotion Act, R.S.O. 1990, ch. H.7
http://www.e-laws.gov.on.ca/index.html

Prince Edward Island

Public Health Act, R.S.P.E.I. 1988, Chap. P-30
http://www.gov.pe.ca/law/statutes/pdf/p-30.pdf

Notifiable and Communicable Diseases Regulations
http://www.canlii.org/en/pe/laws/regu/pei-reg-ec330-85/latest/pei-reg-ec330-85.pdf

Quebec

Public Health Act, R.S.Q., chapter S-2.2
http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=2&file=/S_2_2/S2_2_A.html

Saskatchewan

The Public Health Act, 1994, c.P-37.1
http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/P37-1.pdf

Yukon

Public Health and Safety Act, R.S.Y. 2002, c.176
http://www.gov.yk.ca/legislation/acts/puhesa.pdf

Communicable Diseases Regulations, C.O. 1961/048
http://www.canlii.ca/en/yk/laws/regu/yco-1961-48/latest/yco-1961-48.pdf

Appendix IV – Potential TB program objectives and performance targets

This list of program objectives and performance targets is based upon review of existing provincial/territorial/local objectives and targets, U.S. Centers for Disease Control and Prevention National TB Program Objectives and Performance Targets for 2015 (See: **http://www.cdc.gov/tb/programs/evaluation/indicators/default.htm**) and the following standards and guidelines:

- *Canadian Tuberculosis Standards* 6th Edition. 2007. [cited 2010 Nov 22]. Available from: **http://www.phac-aspc.gc.ca/tbpc-latb/pubs/tbstand07-eng.php**
- Tuberculosis Coalition for Technical Assistance. International standards for tuberculosis care (ISTC). The Hague: Tuberculosis Coalition for Technical Assistance, 2006. [cited 2010 Nov 22]. Available from: **http://www.who.int/tb/publications/2006/istc_report.pdf**.
- Public Health Agency of Canada, *Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care, 1999.* [cited 2010 Nov 22]. Available from: **http://www.collectionscanada.gc.ca/webarchives/20071124130656/http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/99pdf/cdr25s4e.pdf**.

	Program Objective	Performance Target/ Turnaround Time to Completion or Report for Laboratory Procedures
Microbiological diagnosis of active TB disease	Specimen collection and arrival at the laboratory	24 hours
	AFB smear microscopy	24 hours from specimen receipt
	Nucleic acid amplification testing for *M. tuberculosis* complex detection	24 hours from smear result
	Bacteriological diagnosis—culture	Up to 6 weeks for broth cultures and 8 weeks for solid media cultures from specimen receipt
	Identification of mycobacterial species	21 days from specimen receipt
	Primary susceptibility testing	7-14 days from a positive culture
	Reporting of all test results (electronically)	24 hours from test completion
	Reporting of all test results (hard copy by fax or hand delivery)	48 hours from test completion
HIV serologic testing	HIV status known and reported on PHAC Active TB Case Report Form	> 90% of cases by 2015

(cont...)

	Program Objective	Performance Target/ Turnaround Time to Completion or Report for Laboratory Procedures
Treatment of active TB disease	Started on anti-TB drugs within 48 hours of diagnosis	≥ 95% of cases
	Treated by standard or enhanced directly observed therapy	≥ 90% of cases
	Treatment started with 4 or more anti-TB drugs until drug sensitivity test results are available, unless there are current local drug sensitivity data showing that resistance is not a risk	≥ 90% of cases
	Sputum culture conversion in culture-positive, drug-sensitive respiratory cases	≥ 80% have 3 consecutive negative sputum cultures within 60 days of treatment initiation
	Treatment success (cure or completion) within 12 months of treatment initiation for patients who did not die or transfer out during treatment	≥ 90% of cases
	Re-treatment rate within 2 years after the end of previous treatment in Canada	≤ 3%
	Acquired drug resistance rate	0%
Contact follow-up	Initial list of contacts for each infectious TB case is completed within 7 calendar days	100%
	Assessment of close contacts completed and LTBI treatment started, if indicated and not contraindicated or refused, within 28 calendar days	100%
	Proportion of contacts with a diagnosis of LTBI who begin treatment	≥ 80%
	Proportion of contacts beginning treatment for LTBI who complete treatment	≥ 80%
	Proportion of contacts completing treatment who show active TB disease within 2 years after completion	< 0.5 %
	Proportion of contacts with LTBI at high risk of progression to active TB disease, but unable or unwilling to be treated for LTBI who have chest radiography and sputum smear plus culture at 6, 12 and 24 months	≥ 90%

(cont...)

	Program Objective	Performance Target/ Turnaround Time to Completion or Report for Laboratory Procedures
Targeted screening for active TB disease and LTBI	HIV-positive individuals	100%
	End-stage renal disease	100%
	Transplant-related immunosuppression	100%
	Tumour necrosis factor alpha inhibitor use	100%
	Long-term (≥ 1 month) corticosteroid use (prednisone ≥ 15 mg/day or equivalent)	≥ 75%
Immigration medical surveillance	Proportion of individuals referred for immigration medical surveillance who (1) keep the first appointment with the clinic/physician or who have been evaluated by public health and (2) the relevant provincial/territorial authorities have reported such information to Citizenship and Immigration Canada	≥ 90%

Appendix V – Related documents and resources

Health Canada's Strategy Against Tuberculosis for First Nations On-Reserve
http://www.hc-sc.gc.ca/fniah-spnia/pubs/diseases-maladies/_tuberculos/tuberculos-strateg/fact-fiche-eng.php

Public Health Agency of Canada tuberculosis reporting forms:
http://www.phac-aspc.gc.ca/tbpc-latb/reports-eng.php

Advisory Committee Statements:
http://www.phac-aspc.gc.ca/tbpc-latb/pubs-eng.php#guidelines

Canadian Tuberculosis Standards:
http://www.respiratoryguidelines.ca/home

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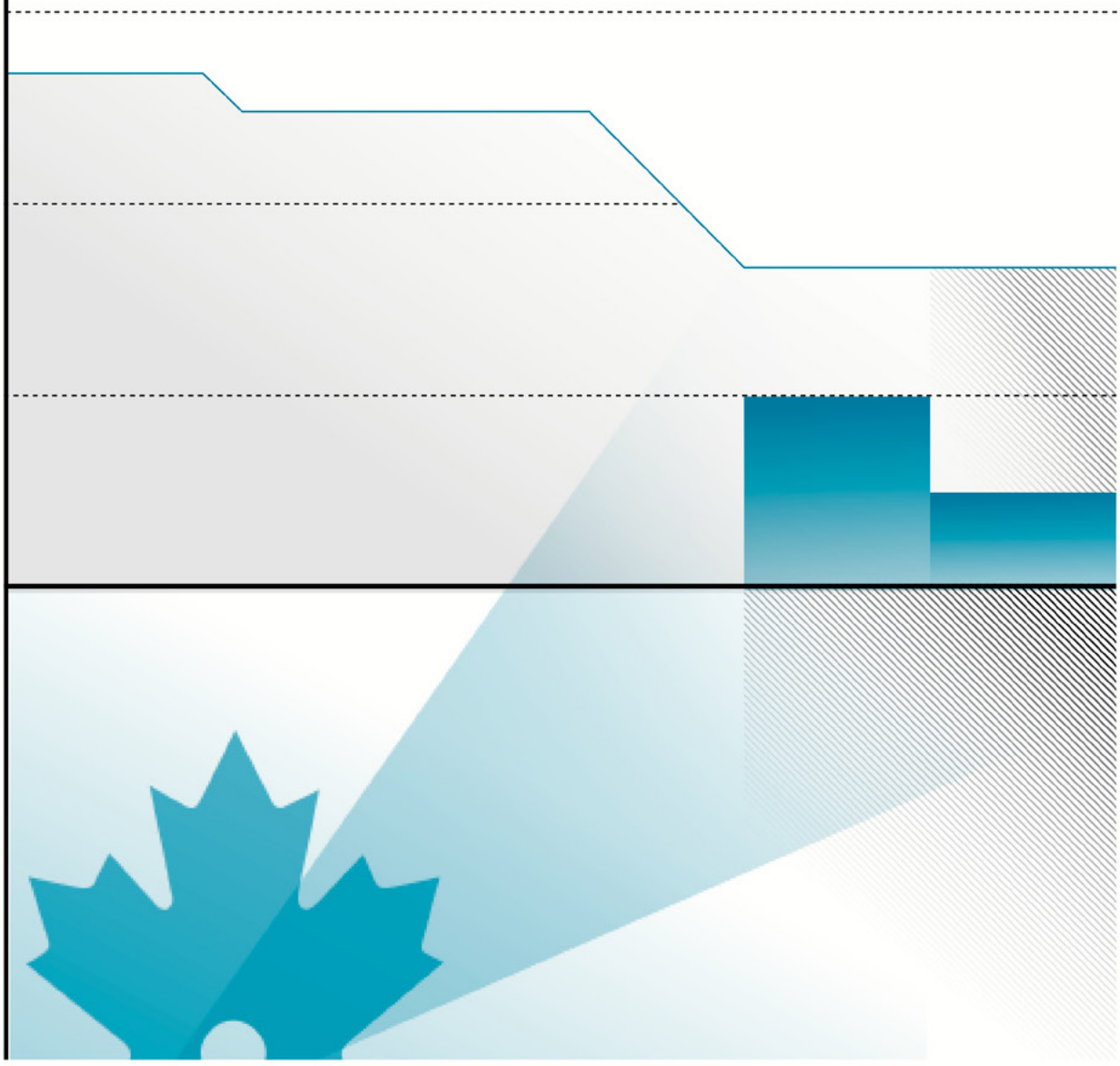

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