CANADA COMMUNICABLE DISEASE REPORT

CCDR

March 20, 2014 • Volume 40•6
ISSN 1481–8531

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Venturini E, Turkova A, Chiappini E, Galli L, de Martino M, Thorne C. Tuberculosis and HIV co-infection in children. BioMed Central Infectious Diseases. 2014;14 Suppl 1:S5. doi: 10.1186/1471-2334-14-S1-S5.

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Public Health Agency of Canada | Agence de la santé publique du Canada

Canada

Upcoming conference

Association of Medical Microbiology and Infectious Diseases Canada (AMMI) Annual Conference.
April 2-5, 2014. Victoria, BC
http://www.ammi.ca/annual-conference/2014/

Useful links

Frequently Asked Questions about tuberculosis:
http://www.phac-aspc.gc.ca/tbpc-latb/faq-eng.php

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/index-eng.php

Making progress to stop tuberculosis

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March 24 is World TB Day – a day to reflect on the current situation of tuberculosis (TB) in Canada and on how we are contributing to the efforts to stop this disease globally.

The good news is that Canada has one of the lowest recorded rates of TB in the world. However, certain populations in Canada continue to be disproportionately affected. Aboriginal peoples and foreign-born individuals who have immigrated to Canada from countries where TB is widespread are at a higher risk of contracting TB than Canadian-born, non-Aboriginal people. Other at-risk populations include the homeless, federal inmates, and persons living with human immunodeficiency virus (HIV). For a summary of TB trends in Canada, see the article in this issue, *Tuberculosis in Canada: 1924-2012* (1).

Globally, the news about TB is sobering. TB continues to be one of the most common infectious diseases worldwide. Each year, TB infects almost nine million people and causes more than one million deaths (2). Worldwide, TB is the leading cause of death among people living with HIV. For a disease that is both preventable and curable, this is very disconcerting.

The Stop TB Partnership, hosted by the World Health Organization (WHO), has been working with TB experts and stakeholders from around the world on the *Global Plan to Stop TB 2006-2015* (2). The plan identified that globally we have what it takes to bring the TB epidemic to a halt. The plan's strategies include engaging care providers, empowering people with TB, strengthening health systems, and providing high quality treatment, especially for the challenging cases involving co-infection with HIV and multiple drug resistance.

Progress toward global targets for reductions in TB cases and deaths in recent years has been made; TB incidence has started to decline and TB mortality is decreasing (3). The Stop TB Partnership urges all WHO member countries to continue to align their efforts with this plan. I am proud to note that Canada is contributing to the success of the *Global Plan*. Federal, provincial, and territorial governments, through the Pan-Canadian Public Health Network (PHN) Council, identified 12 essential components of TB prevention and control programs**.** In 2012, the Public Health Network (PHN) published the *Guidance for Tuberculosis Prevention and Control in Canada.* The guidance document identifies not only the health system needs for early detection, reporting, and treatment, but also the needs for professional education and community-based awareness and best practices to address social and other determinants of health. For more information, see a summary of this document provided in this issue (4). Since this work was completed, British Columbia (5) and Saskatchewan (6) have released their own strategies for TB prevention and control that align closely with the best practices outlined by the PHN. The Public Health Agency of Canada (the Agency) applauds these initiatives and encourages other provinces and territories to develop their own population-based approaches.

The Agency, in partnership with the Canadian Thoracic Society, has recently released the 7th edition of the *Canadian Tuberculosis Standards*. This latest edition has been revised extensively. A summary of the changes are highlighted in this issue (7) and includes new diagnostic approaches for both active and latent TB infection, major changes in the treatment recommendations for active, latent, and drug-resistant TB as well as major changes to the treatment recommendations for co-infection with HIV. There is a new approach for contact follow up and outbreak management, as well as a chapter on culturally sensitive programming.

In addition, Canada has contributed to efforts to control TB beyond its borders. TB Reach, funded through a $120 million grant from the Government of Canada, is a prime example of Canada's vital partnership role in finding and treating people with TB in some of the world's poorest countries. Canada is also contributing to global efforts through innovative research. New investigation methods, combined with a shift toward prevention models that

focus on community mobilization rather than on individual behaviour, are showing promising results (8-11). Such pilot projects could have applicability both in Canada and around the world.

Despite all of these initiatives, Canada's work is not done. What is still vitally needed is the ongoing engagement of healthcare providers and the empowerment of people with TB. We must continue to work together locally and nationally in alignment with global partners to address this important issue. The partnerships being developed through the PHN and other federal, provincial, and territorial bodies will go a long way toward achieving our goal as a country and as a champion for improvements to global health.

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Tuberculosis in Canada: 1924-2012

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Abstract

Background: Tuberculosis (TB) has been a notifiable disease since 1924 and remains an important and serious global public health challenge. Understanding the patterns and characteristics of TB are key to controlling and preventing further spread of the disease.

Objective: To provide an overview of national TB surveillance data collected through two national surveillance systems and to highlight important trends in recent years.

Methods: Trends in the incidence of TB since 1924 are presented. Descriptive results from the Canadian Tuberculosis Reporting System (CTBRS) and the Canadian Tuberculosis Laboratory Surveillance System (CTBLSS) are presented, with a focus on the years from 2002 to 2012. No statistical tests of significance were performed.

Results: Since the 1940s, both the number of reported TB cases and the overall Canadian incidence rate have declined. Males have always accounted for the greatest percentage of cases overall and individuals between the ages of 25 and 34 have typically accounted for the largest number of reported cases relative to other age groups. From 2002 to 2012, 66% of reported TB cases were foreign-born, but the highest burden of TB was in the Canadian-born Aboriginal population, with an average incidence rate five times that of the overall Canadian rate. Reported drug resistance in Canada remains consistently below international levels.

Conclusion: Overall, Canada has one of the lowest TB disease rates in the world. However, foreign-born individuals and Aboriginal people continue to be disproportionately represented among cases diagnosed in Canada. Surveillance systems like the CTBRS and CTBLSS are fundamental in providing information needed to target resources where they can be most effective.

Introduction

The most recent report on tuberculosis (TB) by the World Health Organization (WHO) estimated that in 2012, 8.6 million people developed TB and 1.3 million died from the disease (1). As a result of improvements in general living conditions and overall population health (2), coupled with intensive efforts by the global Stop TB Strategy, the number of annual incident cases has been falling since 2006 (1).

A serious concern for TB prevention and control is TB drug resistance and the recent emergence of highly resistant strains which limit the available treatment options for those infected. In 2012, a WHO study revealed the highest ever global rates of multidrug-resistant tuberculosis (MDR-TB) cases (3).

The goal of this article is to provide a brief overview of the epidemiology of TB in Canada since reporting began in 1924, and to identify recent trends for the years 2002 to 2012. Data presented in this article should be considered in conjunction with two national surveillance reports: *Tuberculosis in Canada 2012 - Pre-release* (4), and *Tuberculosis drug resistance in Canada 2012* (5).

Methods

TB surveillance in Canada

In Canada, active TB disease and TB drug resistance are monitored at the national level using two independent surveillance systems: the Canadian Tuberculosis Reporting System (CTBRS) and the Canadian Tuberculosis Laboratory Surveillance System (CTBLSS).

Canadian Tuberculosis Reporting System (CTBRS)

TB has been notifiable in Canada since 1924 and is currently legally reportable in all provinces and territories. Provincial and territorial public health authorities voluntarily submit data on TB cases that meet the case definition for national-level surveillance to the CTBRS on an annual basis.

The CTBRS, managed by the Public Health Agency of Canada (the Agency), is a case-based surveillance system which maintains selected non-nominal data on people diagnosed with active TB disease including, but not limited to, demographics (e.g. age, sex, immigration status), clinical and treatment information, diagnostic information, risk-factor information including HIV status, and treatment outcome details. The data are collected either through manual completion of a standard reporting form or by electronic transmission.

Canadian Tuberculosis Laboratory Surveillance System (CTBLSS)

The CTBLSS was established in 1998 to monitor TB drug resistance patterns in Canada. The CTBLSS is an isolate-based surveillance system and, like the CTBRS, the data for the CTBLSS are collected either through manual completion of a standard reporting form or by electronic transmission. Information requested includes sex, year of birth, province or territory from which the specimen originated, province or territory where the drug sensitivity testing was performed, and drug susceptibility results. Drug resistance develops when the strain *of Mycobacterium tuberculosis* causing the disease is resistant to one or more of the four first-line drugs (described below). In the CTBLSS, isolates are classified as either susceptible to all first-line medications, or resistant to one or more of the TB drugs.

The following resistance patterns are described in this article:

Mono-resistance – defined as resistance to one of the first-line drugs: isoniazid (INH), rifampin (RMP), ethambutol (EMB), or pyrazinamide (PZA).

Poly-resistance (other patterns) – defined as resistance to two or more first-line drugs, not including the INH and RMP combination.

Multidrug-resistant tuberculosis (MDR-TB) – defined as TB that is resistant to at least the two best first-line anti-tuberculosis drugs, INH and RMP, but which does not meet the definition of extensively drug-resistant TB (XDR-TB).

Extensively drug-resistant TB (XDR-TB) – defined as TB that is resistant to at least the two best first-line anti-tuberculosis drugs, INH and RMP, 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).

Analysis

This article presents descriptive results from the CTBRS and the CTBLSS, primarily for the years from 2002 to 2012. Specifically, TB case counts and incidence rates are presented and are stratified by the following key variables where appropriate: reporting province or territory, age group, sex, origin status (defined as Canadian-born Aboriginal, Canadian-born non-Aboriginal and foreign-born) and diagnostic site. For drug resistance, the

number and percentage of MDR-TB and XDR-TB cases are presented in addition to the total number of isolates tested. No statistical tests of significance were performed.

In the context of this article, the term “incidence” refers to new diagnoses of active TB in each reporting year. The WHO notes that “TB incidence has never been measured at national level because this would require long-term studies among large cohorts of people (hundreds of thousands) at high cost and with challenging logistics.” Notifications of TB cases provide a good proxy indication of TB incidence in countries such as Canada, that have little underreporting of diagnosed cases and where the quality of and access to healthcare means that few cases are not diagnosed (1).

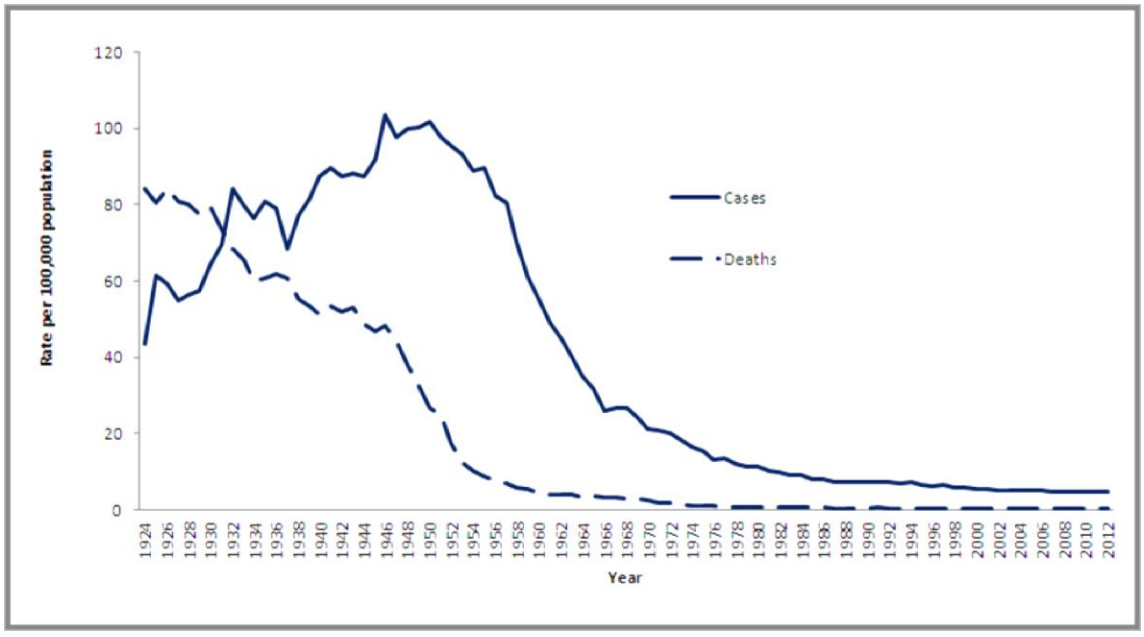
Results

TB trends in Canada, over time

After peaking in the 1940s, the number of reported TB cases and the corresponding rates declined rapidly (**Figure 1**). Similarly, mortality from TB disease declined significantly. These declines were attributed to improved living conditions, better nutrition, and the introduction of effective medication in the mid-1940s. Deaths from TB appeared to outnumber new diagnoses each year during the 1920s. This may reflect incomplete reporting of all cases and of deaths among cases diagnosed in previous years, or it may indicate that reported cases reflected only hospitalized cases, whereas deaths captured all terminal cases of TB whether they were hospitalized or not. Systematic reporting of TB cases was instituted on a national basis in 1933, providing a more accurate and complete record of the burden of TB in Canada through the century.

Over the past two decades, both the number and rates of reported TB cases have continued to decline, albeit much more gradually than the drop observed from 1950 to 1990. In 1992, the rate was 7.7 per 100,000 population, which fell to an all-time low in 2010 at 4.7 per 100,000 population. The overall incidence rate increased slightly in 2012 to 4.8 per 100,000 population. This increase was attributed to two significant outbreaks in remote regions of northern Quebec and in Nunavut. These outbreaks are currently under control.

Figure 1: Reported tuberculosis incidence and mortality rates – Canada (1924-2012)



Provincial and territorial distribution methods

Although the overall rate of TB in Canada continues to decline, the burden of disease is not shared equally across the country. On average, from 2002 to 2012, the three largest provinces (British Columbia, Ontario, and Quebec), which represent over 75% of the Canadian population, accounted for 72% of all reported cases. However, Nunavut, which represents less than 0.1% of the total Canadian population, reported 5% of all TB cases.

The reported incidence rates across the provinces and some territories have remained consistent for the past 11 years. In 2012, the Atlantic provinces, Ontario, Quebec, and the Yukon all reported incidence rates at or below the national rate of 4.8 per 100,000 population, whereas Alberta, British Columbia, and Saskatchewan reported rates above the national rate (ranging from 4.9 to 9.9 per 100,000 population), as did Manitoba and the Northwest Territories, with reported rates between 9.9 and 34.4 per 100,000 population. With the exception of two years, since becoming a separate territory in 1999, Nunavut has always reported the highest incidence rate of any province or territory. This trend continued in 2012, where the reported incidence rate for Nunavut was 234.4 per 100,000 population.

Table 1 provides the number of reported cases and the incidence rate broken down by province and territory for the years 2002 to 2012.

Table 1: Reported new active and re-treatment tuberculosis cases and incidence rate per 100,000 population – Canada and the provinces/territories (2002 to 2012)

Reporting Year		Canada	Province/territory												
			N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.
2002	Cases	1667	9	1	9	11	288	716	98	89	128	287	0	4	27
	Rate	5.3	1.7	0.7	1.0	1.5	3.9	5.9	8.5	8.9	4.1	7.0	0.0	9.6	93.7
2003	Cases	1631	7	3	6	12	257	693	127	91	110	305	1	12	7
	Rate	5.2	1.3	2.2	0.6	1.6	3.4	5.7	10.9	9.1	3.5	7.4	3.2	28.2	23.9
2004	Cases	1612	7	1	8	10	219	699	144	70	109	299	4	10	32
	Rate	5.0	1.4	0.7	0.9	1.3	2.9	5.6	12.3	7.0	3.4	7.2	12.7	23.1	107.2
2005	Cases	1640	9	1	7	6	255	642	114	139	146	265	3	8	45
	Rate	5.1	1.7	0.7	0.7	0.8	3.4	5.1	9.7	14.0	4.4	6.3	9.4	18.4	148.4
2006	Cases	1653	12	0	10	2	227	673	134	87	131	320	3	6	48
	Rate	5.1	2.4	0.0	1.1	0.3	3.0	5.3	11.3	8.8	3.8	7.5	9.3	13.9	155.8
2007	Cases	1575	7	0	7	5	229	680	103	105	112	278	3	15	31
	Rate	4.8	1.4	0.0	0.7	0.7	3.0	5.3	8.6	10.5	3.2	6.5	9.2	34.4	99.2
2008	Cases	1644	8	0	5	5	240	600	141	97	167	300	8	14	59
	Rate	4.9	1.6	0.0	0.5	0.7	3.1	4.6	11.7	9.6	4.6	6.8	24.2	32.0	186.6
2009	Cases	1655	22	1	8	11	196	629	156	90	176	294	4	12	56
	Rate	4.9	4.3	0.7	0.9	1.5	2.5	4.8	12.8	8.7	4.8	6.6	11.9	27.5	174.0
2010	Cases	1587	8	1	10	10	210	643	132	81	134	241	6	11	100
	Rate	4.7	1.6	0.7	1.1	1.3	2.7	4.9	10.7	7.8	3.6	5.3	17.3	25.1	304.7
2011	Cases	1618	8	3	9	5	217	658	116	83	170	258	4	13	74
	Rate	4.7	1.6	2.1	0.9	0.7	2.7	4.9	9.3	7.8	4.5	5.6	11.3	29.4	220.6
2012	Cases	1685	4	1	8	5	266	608	137	91	196	283	1	6	79
	Rate	4.8	0.8	0.7	0.8	0.7	3.3	4.5	10.8	8.4	5.1	6.1	2.8	13.8	234.4

Sex and age distribution

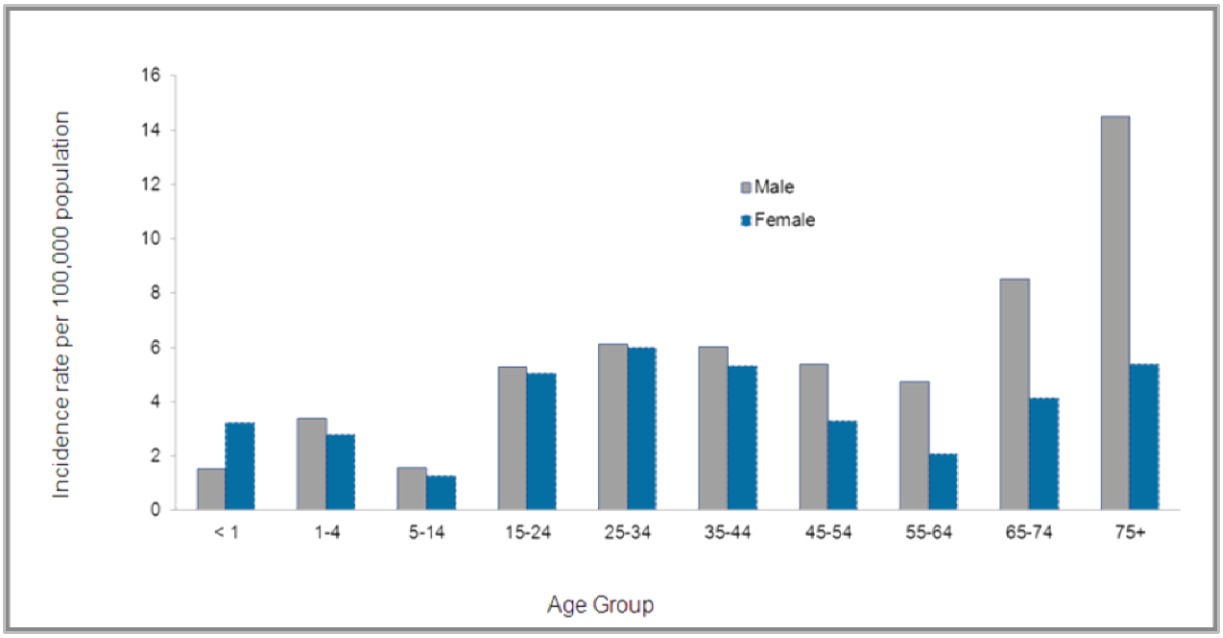
The reported TB incidence rate has always been higher among males than females in Canada; from 2002 to 2012, 55% of all reported cases were males. During the same time period, individuals aged 25 to 34 years old represented the largest percentage of reported TB cases at 17%. **Table 2** provides a breakdown of cases by age group for the years 2002 to 2012.

Table 2: Reported new active and re-treatment tuberculosis cases and incidence rate per 100,000 population by age group – Canada (2002 to 2012)

Reporting year		Canada	Age group									
			<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
2002	Cases	1667	11	43	45	211	314	264	202	162	199	216
	Rate	5.3	3.4	3.1	1.1	4.9	7.3	5.0	4.4	5.2	9.2	11.9
2003	Cases	1631	7	34	41	198	332	277	207	154	178	203
	Rate	5.2	2.1	2.5	1.0	4.6	7.7	5.3	4.4	4.7	8.1	10.8
2004	Cases	1612	6	33	45	198	323	272	198	167	177	193
	Rate	5.0	1.8	2.4	1.1	4.6	7.5	5.3	4.1	4.9	8.0	10.0
2005	Cases	1640	10	38	71	254	279	278	212	142	168	188
	Rate	5.1	2.9	2.8	1.8	5.8	6.4	5.4	4.3	4.0	7.5	9.5
2006	Cases	1653	10	46	50	261	253	287	201	158	168	219
	Rate	5.1	2.9	3.3	1.3	5.8	5.8	5.7	4.0	4.3	7.4	10.7
2007	Cases	1575	12	33	53	200	254	284	209	160	152	218
	Rate	4.8	3.3	2.4	1.4	4.4	5.7	5.7	4.0	4.2	6.5	10.4
2008	Cases	1644	8	30	51	205	298	281	231	166	170	204
	Rate	4.9	2.1	2.1	1.3	4.5	6.6	5.8	4.4	4.2	7.1	9.5
2009	Cases	1655	10	33	46	232	297	294	233	177	142	191
	Rate	4.9	2.6	2.3	1.2	5.1	6.4	6.2	4.3	4.3	5.7	8.7
2010	Cases	1587	9	27	39	201	282	273	214	176	149	217
	Rate	4.7	2.4	1.8	1.0	4.4	6.0	5.8	4.0	4.1	5.8	9.6
2011	Cases	1618	14	33	40	216	296	251	224	166	172	206
	Rate	4.7	3.7	2.2	1.1	4.7	6.2	5.4	4.1	3.8	6.4	8.9
2012	Cases	1685	9	48	53	238	294	267	233	152	177	214
	Rate	4.8	2.4	3.1	1.4	5.2	6.1	5.7	4.3	3.4	6.2	9.1

Considering age and sex together, the largest burden of TB, as measured by the annual incidence rate, was in males 75 years of age or over (**Figure 2**).

Figure 2: Tuberculosis incidence rate by age group and sex – Canada (2012)



Populations affected

Canadian-born Aboriginal people and foreign-born individuals are disproportionately represented among reported cases of active TB in Canada. A review of historical trends highlights changes in the epidemiology of TB by population group over time in Canada. From 1970 to 2012, years for which data on origin are available within the CTBRS, the proportion of active TB cases among the Canadian-born non-Aboriginal population decreased significantly, from 67.8% to 10.3%. During the same period, the proportion among foreign-born individuals increased from 17.7% to 65.3%, and the proportion among Canadian-born Aboriginal peoples increased from 14.7%to 22.5%

In 2002, the TB incidence rate for Canadian-born non-Aboriginal people was 1.0 per 100,000 population. This rate has fluctuated since then, but has remained steady at 0.7 per 100,000 population since 2010. The incidence rate for foreign-born cases was 20.0 per 100,000 in 2002, decreasing to a low of 13.4 per 100,000 in 2012. For Canadian-born Aboriginal people, the incidence rate was 22.0 per 100,000 population in 2002 and has since increased to 29.2 per 100,000 population in 2012.

In 2012, 10% of all reported cases in Canada were Canadian-born non-Aboriginal people, 23% were Canadian-born Aboriginal people, and 67% of cases were foreign-born.

The distribution of TB cases by affected population also varies by province and territory. In Alberta, British Columbia, Ontario, and Quebec, the majority of reported cases from 2002 to 2012 were foreign-born individuals (range: 60% to 90% of all reported cases), whereas in Manitoba, Saskatchewan, and the northern territories (Northwest Territories, Nunavut, and Yukon), Aboriginal people accounted for the majority of reported cases (range: 62% to 99% of all reported cases). In the Atlantic region (New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island), close to half of all reported cases (46%) were Canadian-born non-Aboriginal people.

These varied geographic patterns, in part, reflect differences in population distribution within the provinces and territories in that there are more foreign-born individuals in Ontario, Quebec, British Columbia, and Alberta, whereas Aboriginal people make up a higher proportion of the population in the prairies and in the north.

Disease type (respiratory vs. non-respiratory)

Active TB disease is classified as either respiratory or non-respiratory. Respiratory TB includes pulmonary TB, TB of the pleura, the intrathoracic or mediastinal lymph nodes, or of the larynx, nasopharynx, nose, or sinuses. Non-respiratory TB refers to all other disease sites (7).

From 2002 to 2012, 75% of all reported cases were diagnosed with respiratory TB. Of these, 87% (range: 82%to 89%) were diagnosed with pulmonary TB (which includes TB of the lungs and conducting airways) and 7% (range: 4.4% to 9.4%) were classified as "other TB respiratory disease". Within "other respiratory TB disease", pleurisy was the most frequently reported diagnosis, followed by TB of the intrathoracic lymph nodes. The remaining 6% (range: 3.9% to 8.8%) of respiratory cases were diagnosed with primary TB disease, a disease state which is characterized by pleuritis and pleural effusion, usually in an adolescent or young adult, but possibly in any age group, due to recent (within the preceding 24 months) infection with *M. tuberculosis* complex (7).

Twenty-four percent of the TB cases reported from 2002 to 2012 were classified as non-respiratory TB. Of these, 54% were diagnosed with peripheral TB lymphadenitis, 5% were diagnosed with TB of the central nervous system, and 2% were diagnosed with miliary or disseminated TB. The remaining 38% of cases were classified as "other" which includes primarily TB of the bones and joints, TB of the skin and subcutaneous cellular tissue, and TB of the intestines, peritoneum, and mesenteric glands.

Drug resistance

Drug-resistant TB threatens TB control and is considered a major public health concern in several countries (1). Although drug-resistant TB, including MDR-TB and XDR-TB, has not yet been identified as a major problem in Canada, the potential for the emergence of more cases of drug-resistant TB in Canada exists due to the increase and ease of international travel.

From 2002 to 2012, a total of 14,880 isolates were tested for TB drug resistance. Of these, 176 (1.2%) were MDR-TB and seven (0.05%) were XDR-TB. **Table 3** presents drug-resistance testing results for all isolates tested from 2002 to 2012.

Table 3: Total number of isolates tested and number and percentage identified as MDR-TB and XDR-TB – Canada (2002 to 2012)

Year	Total number of isolates evaluated	MDR-TB* (%)	XDR-TB (%)
2002	1419	20 (1.4%)	1 (0.1%)
2003	1405	20 (1.4%)	1 (0.1%)
2004	1376	12 (0.9%)	0
2005	1335	22 (1.6%)	0
2006	1389	15 (1.1%)	1 (0.1%)
2007	1267	11 (0.9%)	0
2008	1356	15 (1.1%)	1 (0.1%)
2009	1331	18 (1.4%)	0

Year	Total number of isolates evaluated	MDR-TB* (%)	XDR-TB (%)
2010	1279	17 (1.3%)	1 (0.1%)
2011	1319	18 (1.4%)	1 (0.1%)
2012	1404	8 (0.6%)	1 (0.1%)
Total	**14880**	**176 (1.2%)**	**7 (0.05%)**

*Does not include the XDR-TB

Discussion

Overall, Canada has one of the lowest TB disease rates in the world, and reported drug resistance in Canada remains consistently below international levels. Available surveillance data highlight the unique aspects of TB in Canada, including the disproportionate effect on Aboriginal people and immigrants to Canada from areas of the world with high rates of TB disease.

Many affected Aboriginal communities are in remote and isolated regions of Canada (8,9). Communities in the north often experience poor living conditions such as overcrowding and poorly ventilated housing. Some of these communities also suffer from poor nutrition, higher smoking levels, diabetes, and substance abuse (8,9). These conditions put people at greater risk of TB disease (7). Recent outbreaks in remote areas of northern Canada have been the focus of much planning, and efforts to identify, diagnose, and screen all potentially infected individuals in an attempt to stop the ongoing transmission.

In 2012, foreign-born people represented over 65% of all reported TB cases and the majority of drug-resistant TB cases in Canada. Canada is a leading destination for migrants; in 2012 Canada received approximately 260,000 immigrants and refugees (10). Over the past 40 years, there has been a major demographic shift in the make-up of source countries of new migrants to Canada. Before the 1960s, most individuals immigrating to Canada came from European countries. Since the 1970s, however, most immigrants (more than 70%) come from countries in Asia, Africa, and Latin America, with intermediate or high TB incidence rates (11).

Strengths and limitations of national TB surveillance in Canada

TB surveillance in Canada is well established, but important limitations remain. Both the CTBRS and the CTLSS are passive surveillance systems which rely on data retrospectively gathered from medical records or laboratory results, as opposed to active surveillance involving prospective actions aimed at identifying cases. As a result, coverage of the system (i.e. whether all people with TB disease are being identified) is always a concern. The accuracy of the data is partially a function of timely reporting and updates to the Agency from the provinces and territories. Reporting delays do occur but rarely affect the final data. From 2002 to 2012, the WHO estimated the average case detection rate in Canada to be 85% (range: 75% to 98%) per year (1).

The methods used to collect and analyze the data presented in this article have been designed to minimize error. However, the data may be subject to coding, reporting, and processing errors that could not be detected or that were not corrected at the source. As an example, not all provinces and territories use ICD 9 or ICD 10 coding systems for recording disease diagnoses, a means that the CTBRS requires to classify patients according to the main diagnostic site.

With the CTBLSS, typically only isolates with MDR-TB or other extensive resistance patterns will receive drug-sensitivity testing to select second-line drugs. Although the Clinical and Laboratory Standards Institute recommends that INH mono-resistant isolates, as well as other poly-resistant, non-MDR isolates be tested for second-line drug resistance (12), this is not universally performed or reported on in Canada. Isolates other than MDR-TB may be resistant to a fluoroquinolone because of its widespread use for respiratory infections. This limits our understanding of the emergence of second-line drug resistance in Canada.

Conclusion

In Canada, the management and control of TB is complex. Remote Aboriginal communities that have experienced TB outbreaks challenge the health system's ability to provide adequate treatment in an effort to stop ongoing transmission of the disease and to resolve many social issues related to the spread of disease. In foreign-born populations, the challenge is to identify immigrant populations at high risk for progressing to active TB disease, including those that may be resistant to some of the best TB treatments available and require prolonged treatment. Surveillance systems like the CTBRS and CTBLSS are key to providing the health information needed to target resources where they can be most effective.

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Acknowledgements

The authors would like to acknowledge the provincial and territorial tuberculosis programs and the Canadian Tuberculosis Laboratory Technical Network and their teams for their respective contributions to and participation in the CTBRS and the CTBLSS.

Conflict of interest

The authors have no known conflicts of interests to declare.

Funding

This work was supported by the Public Health Agency of Canada.

Summary of the Public Health Network's *Guidance for Tuberculosis Prevention and Control Programs in Canada*

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Introduction

Public health professionals engaged in the fight against tuberculosis (TB) in Canada face unique challenges due to the nature of the disease and its underlying risk factors. In 2012, provinces and territories reported 1,686 new active and re-treatment TB cases to the Public Health Agency of Canada. Foreign-born people accounted for the majority of reported TB cases, while the reported incidence rate remained highest among Canadian-born Aboriginal people (1). The purpose of this article is to summarize the key findings from *Guidance for Tuberculosis Prevention and Control Programs in Canada* published by the Pan-Canadian Public Health Network (2).

Approach

The Pan-Canadian Public Health Network (PHN) brings together individuals from many sectors and levels of government in Canada who are working together to strengthen public health. The work of the PHN is governed by the Public Health Network Council, which is composed of federal, provincial, and territorial government officials, including the Chief Public Health Officer of Canada and senior government officials from all jurisdictions, who are responsible for public health. The PHN ensures that Canada is better prepared for future public health events by fostering cooperative and collaborative approaches on public health matters and is accountable to the Conference of Federal/Provincial/Territorial Deputy Ministers of Health.

To identify best practices for the prevention and control of TB in Canada, an iterative approach was undertaken that included an in-depth review of TB programs in Canada. This is a summary of the full report (2).

Results

The PHN's *Guidance for Tuberculosis Prevention and Control Programs in Canada* describes the essential components of an evidence-based TB prevention and control program and how they can be put into practice. Part I situates TB prevention and control in a global context and outlines the goals set for Canada in conjunction with the *Global Plan to Stop TB 2006-2015*.

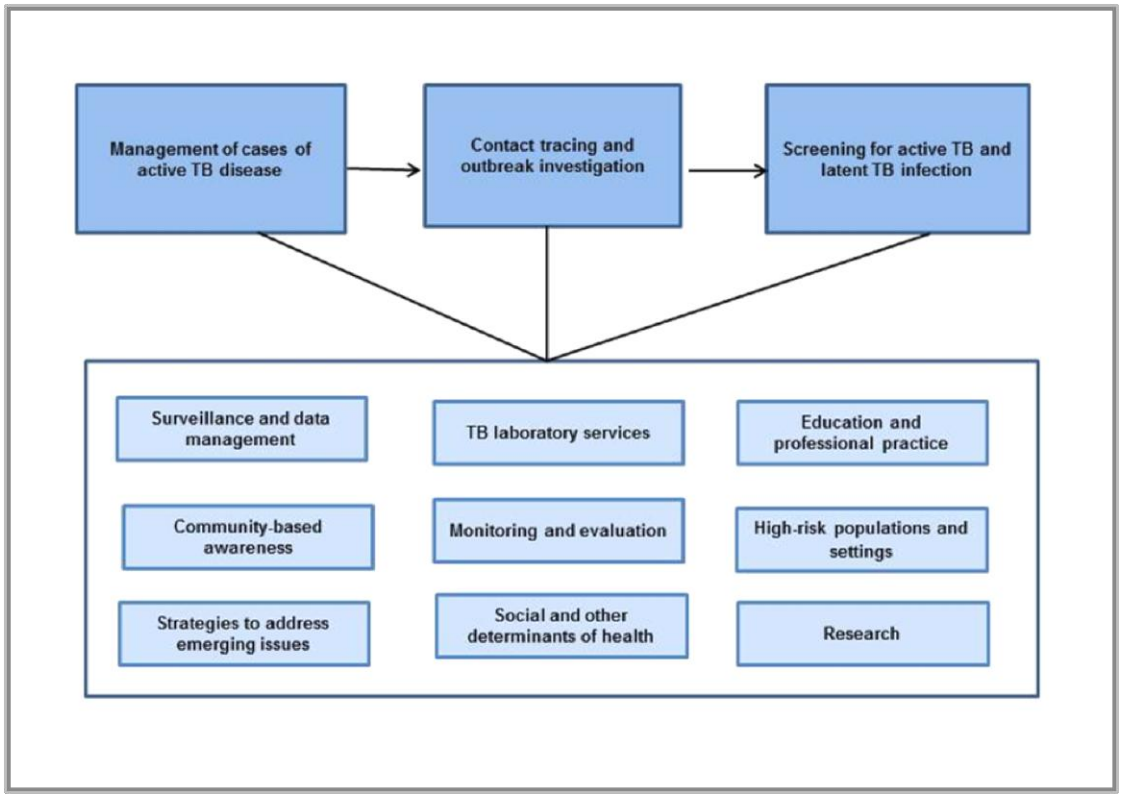
Part II describes more than 80 proven best practices for optimizing current TB prevention and control efforts through a structured TB program design based on 12 essential components (**Table 1**).

Table 1: Twelve essential components of TB prevention and control programs

1.	**Management of cases of active TB disease** Preventing the transmission of TB requires prompt diagnosis and treatment. Best practices underscore the importance of effective case management in controlling the spread of TB, from both a prevention and treatment perspective.
2.	**Contact tracing and outbreak investigation** Because the contacts of infectious TB cases are at risk of progressing to active TB disease, investigations must be carried out in a timely and organized fashion. Best practices are documented step by step with special consideration given to maximizing existing public health resources.
3.	**Screening for latent TB infection and active TB disease** Screening should be considered for groups at high risk for active TB disease or latent TB infection. With a focus on at-risk groups, best practices are drawn from proven strategies for early preventive intervention.
4.	**Surveillance and data management** The collection, analysis, and interpretation of epidemiological data are essential features of public health practice. The Public Health Agency of Canada maintains a comprehensive surveillance system for active TB disease which is used by all orders of government to ensure continuous improvements in service delivery and the monitoring of disease trends and treatment outcomes over time.
5.	**TB laboratory services** The diagnosis, treatment, and prevention of TB depend on a high standard of laboratory practice. Best practices provide a blueprint for coordinating laboratory services to best support provincial and territorial TB programs.
6.	**Education and professional practice** Ensuring that healthcare providers have the training and knowledge they require to enable optimal TB prevention and control is an aspect of a successful TB program that is sometimes overlooked. Best practices point to a diverse range of educational opportunities supported by strong partnerships with educational institutions, training providers, and professional organizations.
7.	**Community-based awareness** The history of TB in Canada has had a profound impact on the beliefs, attitudes, and behaviours of Canadians most at risk for the disease. Best practices emphasize community engagement and the need to tailor awareness activities to the cultural and linguistic needs of populations at risk.
8.	**Monitoring and evaluation** Measuring program performance is the key to ensuring that resources are being used effectively and having the intended impact. The establishment and monitoring of performance targets has been adopted as a best practice in a growing number of jurisdictions. (Appendix IV provides examples of potential TB program objectives and performance targets based on Canadian and American experience.)
9.	**High-risk populations and settings** In Canada, Aboriginal peoples and the foreign-born are the two populations with the highest reported rates of TB. Other at-risk groups include the homeless and residents of long-term care facilities. Best practices focus on improving detection and management of active TB disease and latent TB infection, recognizing that the approaches for addressing TB within these groups differ in a number of respects.
10.	**Strategies to address emerging issues** TB-HIV co-infection and drug-resistant TB are complicating control efforts globally. Best practices focus on internationally recognized standards for care and sources of special expertise.
11.	**Social and other determinants of health related to TB** It has been long understood that the burden of TB is strongly related to the social determinants of health. Best practices underscore the importance of partnerships that enhance our understanding of the non-medical factors that contribute to active TB disease and latent TB infection.
12.	**Research** Effective TB prevention and control strategies require major investments in research and development, without which TB elimination is unlikely.

These components are interconnected and rely on the support of highly trained personnel (**Figure 1**). Parts III and IV examine the partnerships and linkages in place to strengthen public health efforts in Canada and abroad.

Figure 1: Illustration of the interconnectedness among the 12 essential components of an effective TB prevention and control program



Conclusion

Addressing TB in a uniquely Canadian context requires a modern, evidence-based approach that recognizes both domestic and global disease trends. The intent of *Guidance for Tuberculosis Prevention and Control Programs in Canada* is to inform ongoing program delivery and development by providing decision-makers, healthcare providers, and program planners with proven best practices they can apply in their work.

Acknowledgements

The Public Health Network Council would like to thank the members of the Communicable and Infectious Disease Steering Committee, the former Canadian Tuberculosis Committee and the many individuals with the Public Health Agency of Canada and Health Canada who contributed to the development of the guidance document.

Conflict of interest statement

There are no conflicts of interest to declare.

Funding

This work was supported by the Public Health Agency of Canada.

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Highlights of the new 7th edition of the *Canadian Tuberculosis Standards*

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Introduction

In Canada, tuberculosis remains a significant health concern. The overall reported incidence of active tuberculosis cases continues to decline, but certain sub-populations, such as Aboriginal and foreign-born populations, are disproportionately affected. To date, dedicated research has allowed us to progress in our understanding of the pathogenesis, immunology, and epidemiology of tuberculosis as well as in the development of new diagnostic and therapeutic tools. This 7th edition of the *Canadian Tuberculosis Standards* (the *Standards*) has been extensively revised to incorporate this new information, building upon the six previous versions (1). Each chapter is written by authors from across Canada with expertise in the specific areas. The *Standards* are intended to provide best practice information but are not meant to replace consultations with healthcare professionals. They do not supersede any provincial or territorial legislative, regulatory, policy, and practice requirements, or professional guidelines that govern the practice of health professionals in their respective jurisdictions, whose recommendations may differ due to local epidemiology or context. This summary highlights some of the key changes in recommendations.

Approach

The *Standards* were co-produced by the Canadian Thoracic Society/Canadian Lung Association and the Public Health Agency of Canada in collaboration with the Association of Medical Microbiology and Infectious Disease Canada. As with previous editions, the 7th edition of the *Standards* is based upon the best available scientific evidence. Each chapter was developed by one or more authors with expertise in tuberculosis prevention and control. The authors of each chapter carefully reviewed all published evidence, particularly the most recent studies, and synthesized and rated this evidence using a modified Grading of Recommendations Assessment, Development and Evaluation framework (GRADE). Recommendations are considered strong or conditional on the basis of potential benefits, risks, and burden.

Results

The *Standards* contain important updates to best practices in tuberculosis prevention and control **(Table 1)**. These include a new approach to sputum collection, whereby sputum specimens from tuberculosis suspects can all be collected the same day, potentially reducing the drop-out rate and improving yield. A new cartridge-based nucleic acid amplification test for detection of *Mycobacterium tuberculosis* is outlined. Available real-time polymerase chain reaction testing permits detection of *M. tuberculosis* and resistance in two hours. Results should be confirmed by routine smears and cultures. There are new recommendations on the appropriate use of the tuberculin skin test, and interferon gamma release assays (IGRAs), including when neither test is indicated.

There are major changes in the recommendations for both the schedule and the duration of therapy to treat tuberculosis, latent tuberculosis infection (LTBI), drug-resistant tuberculosis, and pediatric tuberculosis. Several practice recommendations are provided for drug-resistant tuberculosis. The need for routine HIV testing of all tuberculosis patients is emphasized; similarly, routine screening for latent tuberculosis infection is indicated in all patients with HIV infection. Due to the potential for major drug interactions, individuals with tuberculosis-HIV co-infection should be managed by, or in close collaboration with, a physician expert in tuberculosis-HIV care. In the healthcare setting, there are major changes in recommendations for baseline testing of healthcare workers, as

well as new information on the risk of transmission. Changes in recommendations for the use of Bacille Calmette-Guérin (BCG) vaccine mean that BCG is no longer recommended for some groups, while for others use is on an exceptional basis only. In the area of contact follow up, details are provided on a change from the classic model to a prioritization of contacts based on characteristics of the source case and the susceptibility of the exposed.

Table 1: Highlights of key changes to the 7th edition of the *Canadian Tuberculosis Standards*

Chapter	Highlights and new recommendations
1. Epidemiology	Surveillance data provided up to 2010.
2. Pathogenesis and transmission of tuberculosis	Probability of transmission and progression is described with specific populations.
3. Diagnosis of active tuberculosis and drug resistance	New sputum collection approach consisting of three sputum specimens collected the same day with as little as one hour between specimens. Use of the diagnostic tool cartridge-based nucleic acid amplification test (NAAT) is outlined. Available real-time polymerase chain reaction testing permits detection of *M. tuberculosis* and resistance in two hours.
4. Diagnosis of latent tuberculosis infection (LTBI)	New recommendations on the tuberculin skin test (TST) and the interferon gamma release assays (IGRAs).
5. Treatment of tuberculosis disease	Major changes in recommendations for both the schedule of therapy and the duration of therapy. Information on drug doses for first- and second-line drugs, other intermittent treatment options, and tailored treatment for special populations.
6. Treatment of latent tuberculosis infection (LTBI)	Major changes in recommendations related to determining latent tuberculosis infection treatment, with recommendations for new shorter regimens, plus treatment of contacts of drug-resistant cases.
7. Non-respiratory tuberculosis	New information on sensitivity and specificity of diagnostic tests for different forms of extra-pulmonary tuberculosis and use of adjunctive steroids.
8. Drug-resistant tuberculosis	Major changes in treatment are recommended and ways to reduce drug resistance are outlined.
9. Pediatric tuberculosis	New information on risk groups and major changes in diagnosis and treatment.
10. Tuberculosis and human immunodeficiency virus (HIV)	Major changes in recommendations for treatment of latent tuberculosis infection and HIV as well as tuberculosis treatment in those requiring antiretroviral therapy (ART). Re-emphasizes need for routine HIV testing of all tuberculosis patients and routine screening for latent tuberculosis infection in HIV patients.
11. Nontuberculous mycobacteria	New recommendations identify when there is a need for an individual benefit risk assessment regarding treatment.
12. Contact follow-up and outbreak management in tuberculosis control	A change from the classic concentric circle model to a prioritization of contacts looks at infectiousness of source, and the susceptibility of the exposed.
13. Tuberculosis surveillance and screening in selected high-risk populations	Identifies challenges and barriers to uptake of LTBI screening and treatment in select migrant populations.

Chapter	Highlights and new recommendations
14. Tuberculosis prevention and care in First Nations, Inuit, and Métis people	Highlights need for culturally sensitive programming and outlines *Health Canada's Strategy Against Tuberculosis for First Nations On-Reserve*.
15. Prevention and control of tuberculosis transmission in healthcare and other settings	New information on risk of healthcare-associated transmission of tuberculosis and recommendations re: baseline TST for all healthcare workers, and airborne precautions.
16. Bacille Calmette-Guérin (BCG)	Major change to use of and contraindications to Bacille Calmette-Guérin vaccine: http://www.phac-aspc.gc.ca/tbpc-latb/bcgvac_1206-eng.php
Appendices **A. Glossary** **B. Surveillance systems** **C. Education and training resources**	All updated.
D. Tuberculosis and mycobacteriology laboratory standards	New information on specimen types and submission conditions for mycobacterial investigation.

Conclusions

The *Standards* are the foundation for tuberculosis prevention and control in Canada. The 7th Edition highlights the contribution of new diagnostic and therapeutic tools to early diagnosis and successful case management, in the context of emerging antimicrobial resistance and co-infection.

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Acknowledgements

Many thanks to the Editor, Dick Menzies and to the Associate Editors: Edward Ellis, Richard Long, Madhukar Pai, and Thomas Wong.

Many thanks to the chapter authors:

Alvarez GG, Archibald CP, Avendano M, Behr M, Christianson S, Cook V, Demers A-M, Ellis E, Elwood K, Embil J, Fisher D, Gallant V, Greenaway C, Halverson J, Houston S, Jamieson F, Jarand J, Khan K, Kitai I, Kunimoto D, Long R, Marras TK, Menzies D, Minion J, Ogunremi T, Orr P, Pai M, Rea E, Rivest P, Schwartzman K, Sharma M, Wobeser WL, Wolfe,J, Wong, T.

Conflict of interest

There are no conflicts of interest to declare.

Funding

This work was supported by the Public Health Agency of Canada.