

**Alberta Health**

**Tuberculosis  
Surveillance Report  
Alberta**

**2005 to 2009 with Preliminary  
Summary 2010**

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**A Report by the Office of the Chief Medical Officer of Health**

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## Executive Summary

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Tuberculosis (TB) in Alberta in 2005-2009 is largely a disease of the foreign-born and Aboriginal peoples. Most foreign-born cases occur in recently arrived immigrants from a relatively small number of high-incidence countries; an increasing proportion of cases have arrived from sub-Saharan African countries. Most cases in Aboriginal peoples occur in Status Indians, on-reserve greater than off-reserve, and to a lesser extent the Métis. Cases in non-Status Indians and Inuit are very rare. Within population groups there is a remarkable focality to the disease; most foreign-born cases being localized to the two major metropolitan areas, Calgary and Edmonton, and to a lesser extent the non-major metropolitan areas; most on-reserve Status Indian cases being localized to a minority of the reserve communities. Socio-economic and cultural factors pose particular challenges to TB prevention and control in both population groups; “technical” or “clinical” factors (anti-tuberculosis drug resistance and HIV/AIDS) pose particular challenges in the foreign-born (most drug resistant cases are in the foreign-born; most HIV co-infected cases are in the foreign-born arrived from sub-Saharan Africa). To a lesser extent HIV/AIDS co-infection is occurring in Aboriginal peoples. An enormous amount of effort is put into contact tracing and screening of high-risk groups. This activity would appear on balance to be well done and highly successful; although the program’s current capacity to fully evaluate this is limited.

TB elimination in Alberta is on target (Global Plan to Stop-TB: 2006-2015) in the Canadian-born, but not in the foreign-born. New strategies aimed at screening and providing preventive therapy to high-risk foreign-born persons are required. The current public health clinic collaboration (see section 1.1) around which the program is organized, and strong stakeholder relations, position the program to withstand the challenges to TB prevention and control in the future.

## Foreword

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In Alberta, tuberculosis (TB) is largely a disease of two groups, Aboriginal people, in particular Status Indians living on-reserve, and the foreign-born from TB endemic countries. Other smaller groups, such as the inner-city poor and homeless and the elderly may also have cases. Amongst the two leading groups, Aboriginal people and the foreign-born, the two major TB elimination strategies of 'interruption of transmission' and 'prevention of reactivation in those with latent infection and at increased risk to reactivate', are not equally applicable. A large body of evidence points to ongoing transmission as a major obstacle to TB elimination in Aboriginal people, and reactivation of latent TB infection (LTBI), acquired abroad, as a major obstacle to TB elimination in the foreign-born.

With respect to the interruption of transmission in Aboriginal peoples, its need has been rendered ever more pressing by the decision to systematically discontinue BCG (bacille Calmette-Guérin); a vaccine that, historically, has provided protection to First Nations children, but lately has been implicated in severe complications. Several initiatives including the identification of high-risk communities, or high risk members of communities; the continuing education of community members, facilitated by the First Nations and Inuit Health Branch (FNHIB) program of SCRAP-TB (Strategic Community Risk Assessment and Planning to Eliminate TB); and the continuing education of health care workers who serve high-risk communities, are all designed to identify source cases early, and treatment of LTBI by directly observed treatment, to interrupt transmission. Other initiatives, such as an expanded program of TB surveillance in preschoolers (new infections or disease in preschoolers signal the presence of a source case in the community), help identify source cases early and prevent disease in children, a vulnerable population at increased risk of severe forms of TB. Prenatal tuberculin testing of young mothers and research into the determinants of transmission are other initiatives in a concerted effort to diagnose source cases early, and to better understand environmental circumstances, numbers and susceptibility of contacts, and identify opportunities for program enhancement.

With respect to the prevention of reactivation TB in immigrants to Alberta from TB endemic countries, there are many challenges and opportunities. Alberta is one of four provinces in Canada that accept the majority of new immigrants. For the foreseeable future the numbers of new immigrants to Alberta is not expected to decrease and may actually increase. Until recently the leading countries of birth of new immigrants to Alberta were China/Hong Kong, the Philippines, India and Vietnam. Now immigrants are arriving, not only from these countries, but also from countries of sub-Saharan Africa. Many are refugees. A large proportion of these new immigrants will have LTBI and may be at risk of reactivation of TB. Therefore, many will be good candidates for receiving preventive therapy. These include those referred for medical surveillance by Citizenship and Immigration Canada; those having medical conditions that increase the risk of reactivation TB, such as HIV/AIDS; and those that are recently (within the past two years) arrived from high incidence countries and less than 35 years of age. Historically it has been difficult to know for certain which immigrants have LTBI; the majority have

been BCG vaccinated, and the vaccine is known to cause a false positive tuberculin skin test (TST). Recently, blood tests, referred to as IGRAs (Interferon Gamma Release Assays) offer the promise of distinguishing a false positive TST from a true positive TST. Conceivably these tests will facilitate an expanded program of targeted tuberculin testing and treatment of LTBI in immigrants.

There are three other challenges to TB control in Alberta. The first is the encroachment of HIV/AIDS in those with high risk behaviors such as intravenous drug use, and in those born in high HIV/high TB countries where heterosexual contact is the major exposure category. The second is developing collaborations with programs that manage patients with high risk medical conditions such as HIV/AIDS, transplant, dialysis and programs that use tumor necrosis factor (TNF) inhibitors to facilitate screening for LTBI. Finally, advocating for a strong public health presence in an era of declining TB incidence in the Canadian-born non-Aboriginal population, who are the majority of the Canadian population. The data gathered and reported in this document are an indication of the tireless efforts of all TB control staff, regional, provincial and federal. Their devotion to the task of TB elimination is reflected in the good outcomes and the willingness to confront sub-optimal performance in the not-so-good outcomes. To them is due the credit and in them is the hope of TB elimination in Alberta.

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## Acknowledgments

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# 1 Introduction

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## 1.1 Tuberculosis Control in Alberta

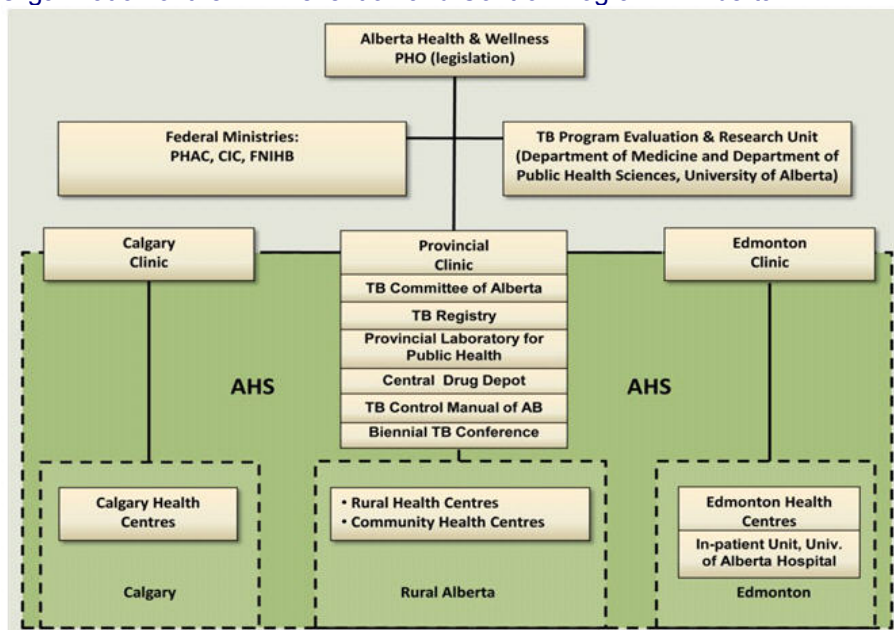
Tuberculosis is a reportable disease caused by a mycobacterium belonging to the *M. tuberculosis complex*. It often affects the respiratory tract, but may involve other organs and body structures as well. In its respiratory form, tuberculosis spreads from person to person through the air, and in this way poses a risk to public health. Some individuals who inhale airborne *M. tuberculosis* will develop active tuberculosis disease. If active tuberculosis disease is not recognized and treated, the spread of tuberculosis increases and the affected individual faces serious illness and sometimes death. Other individuals who inhale *M. tuberculosis* will remain latently infected, adding to the pool of people who may develop active disease in the future. The presence of risk factors, such as medical conditions that compromise the immune system, will increase the likelihood of progression from latent tuberculosis infection (LTBI) to active tuberculosis disease. In Alberta, tuberculosis affects all people, but Canadian-born Aboriginals and foreign-born Albertans from countries with a high incidence of tuberculosis are more likely to be affected than other Canadian-born individuals. If infected, young children are at increased risk of developing serious disease. Finding a child with tuberculosis disease, outside of routine contact tracing, suggests the presence of an infectious individual in the child's community.

TB must be controlled through a comprehensive program that includes diagnosis, treatment of active disease and latent infection, contact tracing, screening of groups at risk including immigrants, surveillance, research and education. In Alberta this program is provided in partnership between Alberta Health Services, Communicable Disease Control, First Nations and Inuit Health Branch, and five health zones. Specialized, stand-alone tuberculosis clinics serve Edmonton and Calgary and a specialized "virtual" clinic serves rural Alberta, including, the reserve communities, and leads the program. A tuberculosis isolation unit is located at the University of Alberta Hospital, for patients that require hospitalization, respiratory isolation, or specialized care that cannot be provided elsewhere. (Figure 1.1.1) A multi-disciplinary approach to management of tuberculosis is necessary and includes collaboration between medical disciplines as well as with other health care and social service professionals.

This document is the latest in a series of annual reports of Tuberculosis Control in Alberta. It spans five years, 2005-2009, and as such allows both a longitudinal and current view of key measures of tuberculosis (TB) control in the province. It will be followed by a companion document detailing the performance (a series of performance indicators) of the program on various levels including contact tracing and preventive therapy.



Figure 1.1.1: Organization of the TB Prevention and Control Program in Alberta



## 1.2 Methods

### Data Sources

Surveillance data can be invaluable in understanding patterns of infection and in identifying trends. This is necessary to plan and revise programs to be most relevant to the local epidemiology. Sources of data for the purposes of this report include:

- **Tuberculosis Registry Database (iPHIS)**

The Tuberculosis Registry is a database that is accessible by all three tuberculosis clinics in Alberta (Edmonton, Calgary, and Provincial).<sup>i</sup> This is a database that is used for clinical management of cases, contacts, and preventive therapy. All active cases with the date of diagnosis are recorded in the registry. Information collected on each case includes demographic information such as gender, birthdates, population group, health region, country of birth and the year of arrival in Canada if foreign-born. Relevant clinical data such as the site of disease, history of previous active disease, and microbiology results are also recorded. A record of data submitted to Health Canada is also retained in the registry.

- **Canadian Tuberculosis Data**

Each province and territory in Canada reports all active cases of tuberculosis to the Centre for Infectious Disease Prevention and Control<sup>ii</sup>, Health Canada.

- **Interactive Health Data Application (IHDA)**

The IHDA is an application maintained by the Surveillance and Assessment Branch of Alberta Health and Wellness. This application is available on-line and includes mid-year

<sup>i</sup> During the period of this report (2005 to 2009), the iPHIS Tuberculosis Registry was administered and maintained by Alberta Health and Wellness.

<sup>ii</sup> Prior to 1997, cases were reported to the Laboratory Centre for Disease Control (LCDC), Health Canada.

population estimates for the province. These estimates are based on the number of people registered in the Alberta Health Care Insurance Plan (AHCIP) as of June 30 according to the AHCIP Quarterly Population Registry Files. This application also uses the Alberta Health and Wellness Postal Code Translation File (PCTF) to determine population estimates by geographical area (i.e., health region) according to the registrant's postal code. Data elements include age and gender. The IHDA provided the denominator figures necessary for deriving case rates.<sup>iii</sup>

- **Statistics Canada Custom Tables**

Custom tables for the foreign-born population in Alberta was provided by Statistics Canada and based on three census periods (1996, 2001 and 2006). These tables grouped foreign-born countries according to World Bank regions, based on geography and economic development. The groups included in the custom population tables are: sub-Saharan Africa (e.g., Sudan, Ethiopia, South Africa); Asia (e.g., India, China, Vietnam, Hong Kong, Philippines, Indonesia); Latin America and the Caribbean (e.g., Guyana, Bolivia, Jamaica); Middle Eastern Crescent (e.g., Pakistan, Iran, Afghanistan); former socialist economies of Europe (e.g., Poland, Czech Republic); and established market economies (e.g., Norway, Italy, United Kingdom).

- **Aboriginal Affairs and Northern Development Canada (AANDC)**

First Nation and Inuit Health Branch (FNIHB), Alberta Region, provides ancillary TB services, over and above those provided by the province, to on-reserve Treaty Status and Non-Treaty Status First Nation. Alberta's First Nation population figures, for those living both on and off reserve were provided by Aboriginal Affairs and Northern Development Canada (AANDC).

- **Laboratory**

All specimens collected for the diagnosis of tuberculosis are submitted to the Provincial Laboratory for Public Health (PLPH) North, in Edmonton, or the PLPH South, in Calgary. These tests generally include: microscopy for acid fast bacilli; cultures to identify the specific organism; and, in the case of positive cultures, susceptibilities to anti-tuberculous drugs. The PLPH has also been involved with testing for human immunodeficiency virus (HIV) for cases and suspected cases of tuberculosis. Test results are forwarded for entry into the Tuberculosis Registry.

### ***Calculation of Rates***

Mid-year population figures for 2005 to 2009 from the Interactive Health Data Application (IHDA) provided the overall denominator figures for calculating the incidence rates for tuberculosis. The IHDA provided population figures for the province as a whole, and for each of nine health regions. The IHDA also includes population figures according to age and gender, used to calculate and compare rates and trends between age and gender groups.

The iPHIS database provided the numerator for the country of birth for confirmed tuberculosis cases. The denominator for calculation of rates for foreign-born was based

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<sup>iii</sup> Surveillance and Assessment Branch, Alberta Health and Wellness, Government of Alberta. *Interactive Health Data Application*. October 2010. [www.ahw.gov.ab.ca/HIDA\\_Retrieval/](http://www.ahw.gov.ab.ca/HIDA_Retrieval/)

on population figures provided in the Statistics Canada Custom Tables. As these tables were based on three census periods, intercensal population estimates were then calculated using linear interpolation between 1996 and 2001 and between 2001 and 2006. The population beyond 2006 was determined by linear extrapolation. Rates over the five-year period 2005-2009 are expressed in “person-years” – where the numerator is the cumulative number of cases over the five years, and the denominator is the cumulative population over the five years – expressed as cases/100,000 person-years.

Aboriginal Affairs and Northern Development Canada (AANDC) population data, for First Nation with Treaty status living both on and off reserve, provided the denominator for calculation of tuberculosis rates for Canadian-born First Nation cases. The iPHIS database includes as “Aboriginal” First Nations with and without Treaty Status, Métis and Inuit. Calculation of rates for First Nations includes only those who have Treaty status.

Rates specific to Canadian-born without Treaty status were calculated using population denominator figures for Alberta minus foreign-born and First Nation population figures.

### ***Limitations***

There are limitations to the denominator figures used for calculation of rates. For instance, it is possible that there may be tuberculosis cases diagnosed in individuals from groups which are not represented in the IHDA (i.e., inmates of federal correctional facilities or those who have not registered for Alberta health care insurance). In addition, Statistics Canada population figures, used to determine the foreign-born population, are based on a 20 percent sample of Alberta households during the census years and do not include institutional residents of facilities such as prisons and long term care centres. Denominator data provided by Indian and Northern Affairs Canada First Nation and Inuit Health are also limited if communities or individuals do not participate. The data also doesn't reflect on/off reserve movement of clients, between reserve movement of clients and doesn't capture non FN living on reserve.

With the change to the iPHIS as the platform for the tuberculosis registry, it may not be possible to duplicate all tables used in previous surveillance reports.

At the time of writing this report, Alberta had realigned the nine health regions to five health zones. This report is based on the nine health regions to facilitate easier comparison with the previous surveillance report.<sup>iv</sup>

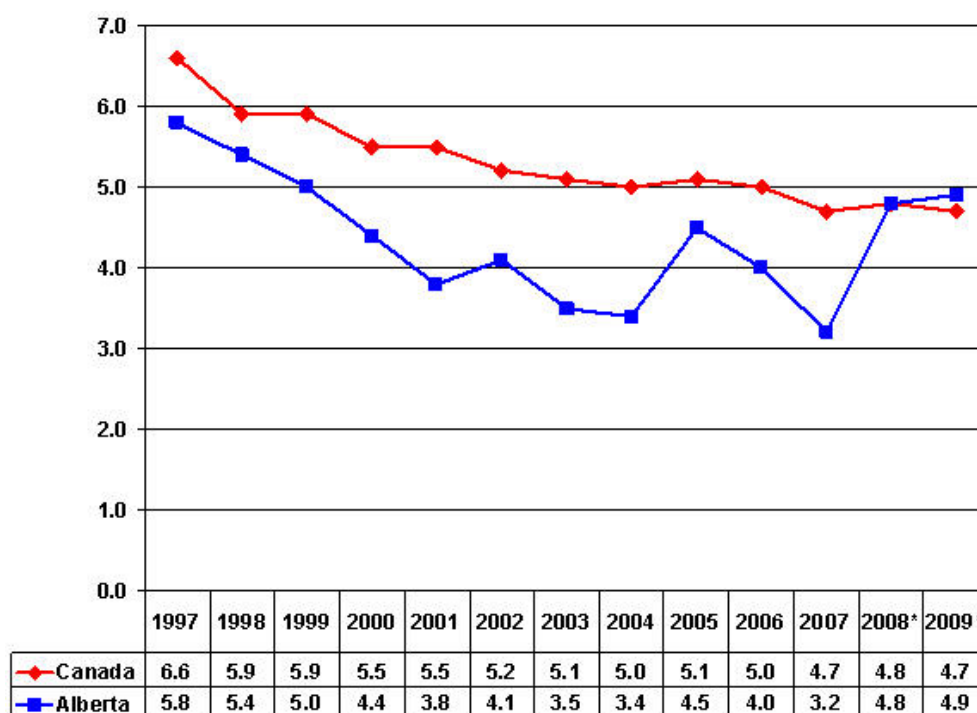
<sup>iv</sup> Prior to April 2003 there were 17 health regions in Alberta (See Appendix B).

## 2 Tuberculosis Cases

### 2.1 National

Since 1997, Alberta's yearly rates for active tuberculosis disease have consistently been lower than Canadian national rates and have generally followed a downward trend. However, Alberta rates rose in 2005 and again in 2008, bringing Alberta's rates equal to, or slightly higher than the national rate. (Figure 2.1.1)

**Figure 2.1.1:** Yearly Rates of Active Tuberculosis Disease per 100,000 Population for Alberta and Canada, 1997 to 2009



AB Data: iPHIS Tuberculosis Registry, Alberta Health Services

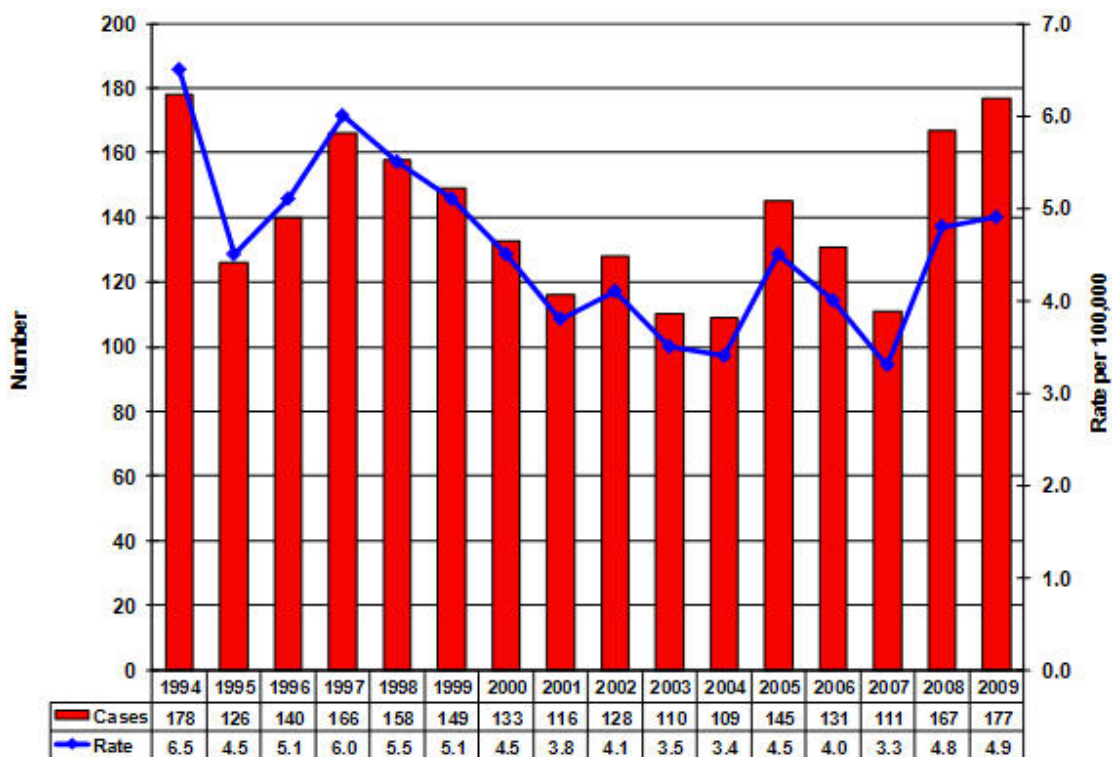
Canadian Data: Public Health Agency of Canada, Tuberculosis in Canada, Case Reporting Surveillance Reports, <http://www.phac-aspc.gc.ca/tbpc-latb/surv-eng.php>

\*2008 and 2009: Public Health Agency of Canada, Tuberculosis in Canada, Case Reporting Surveillance Reports, Pre-release.

## 2.2 Alberta – Cases and Rates

For the years 2005, 2006, 2007, 2008 and 2009 the number of active tuberculosis cases reported were 145, 131, 111, 167 and 177 respectively. The 177 reported cases in 2009 were the highest number of cases reported in Alberta since 1994. However, as the population of Alberta has grown since 1994, the rate of 4.9 per 100,000 in 2009 was lower than the 6.5 per 100,000 in 1994. (Figure 2.2.1) Interestingly, the 2009 rate is the highest rate since 1999 with the lowest rate of 3.3 per 100,000 occurring in 2007.

**Figure 2.2.1:** Numbers of Active Tuberculosis Cases Reported and Provincial Rates per 100,000 Population, Alberta, 1994 to 2009



Source: iPHIS Tuberculosis Registry, Alberta Health Services

## 2.3 Geographic Distribution

### *Health Regions\**

The Calgary Health Region reported 42.5 percent of all the active tuberculosis cases in Alberta during 2005 to 2009 and the Capital Health Region reported slightly less with 38.9 percent of cases. The remaining 19 percent of cases were reported from the seven predominately rural regions. Together the northern regions (Aspen, Peace Country, Northern Lights) reported 9.6 percent of cases; southern regions (Palliser and Chinook) reported 4.5 percent of cases; and central regions (East Central, David Thompson) reported 4.1 percent. (Table 2.3.1) Actual numbers of cases with yearly rates, reported by each Health Region by year are shown in Table 2.3.2.

The highest rate of tuberculosis per 100,000 person years (7.5) was noted in the Northern Lights Health Region, where the majority of cases were reported in the Aboriginal population. The next highest rates were in the largely urban regions of Capital (5.3) followed by Calgary (5.0) where cases were noted among both foreign born and Aboriginal persons. The fourth highest rates were in Palliser Region in Southeastern Alberta, largely the result of tuberculosis in the foreign-born.

**Table 2.3.1:** Active Tuberculosis Cases According to Health Region with 5 Year Rates per 100,000 Person Years, 2005 to 2009, Alberta

Health Region	Total Cases	Percent of Cases	Rate per 100,000 Person Years
Chinook	13	1.8	1.6
Palliser	20	2.7	3.8
Calgary	311	42.5	5.0
David Thompson	23	3.1	1.5
East Central	7	1.0	1.2
Capital	284	38.9	5.3
Aspen	16	2.2	1.8
Peace Country	24	3.3	3.4
Northern Lights	30	4.1	7.5
Unspecified	3	0.4	
<b>Total</b>	<b>731</b>	<b>100.0</b>	<b>4.3</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

\* In April 2003, Alberta health care was realigned from 17 regions to 9 Health Regions. Appendix A shows a map of Alberta according to the 9 Health Regions, and Appendix B depicts Health Regions in Alberta according to the previous 17 Regions (See Appendix B).



**Table 2.3.2:** Number of Active Tuberculosis Cases with Yearly Rates per 100,000 Population, reported by 9 Health Regions\*, Alberta, 2005 to 2009

Health Region	2005		2006		2007		2008		2009	
	Cases	Rates	Cases	Rates	Cases	Rates	Cases	Rates	Cases	Rates
Chinook	2	1.3	2	1.3	3	1.9	3	1.8	3	1.8
Palliser	4	4.0	5	4.9	6	5.7	4	3.7	1	0.9
Calgary	58	5.0	58	4.8	45	3.6	86	6.7	64	4.8
David Thompson	3	1.0	1	0.3	3	1.0	6	1.9	10	3.1
East Central	3	2.7	0	-	0	-	3	2.6	1	0.8
Capital	60	6.0	52	5.1	43	4.0	54	4.9	75	6.6
Aspen	4	2.3	5	2.8	5	2.8	1	0.5	1	0.5
Peace Country	5	3.7	7	5.0	1	0.7	5	3.4	6	4.0
Northern Lights	6	8.1	1	1.3	5	6.3	3	3.6	15	16.8
Unspecified	0	-	0	-	0	-	2	-	1	-
<b>Total</b>	<b>145</b>	<b>4.5</b>	<b>131</b>	<b>4.0</b>	<b>111</b>	<b>3.3</b>	<b>167</b>	<b>4.8</b>	<b>177</b>	<b>4.9</b>

\*First Nations have been included in the 9 Health Regions  
Source: iPHIS Tuberculosis Registry, Alberta Health Services

Table 2.3.3 shows cases and the proportion of cases by health region according to three population groups: Canadian-born Aboriginal (First Nation, Métis, and Inuit), Canadian-born other (non-Aboriginal), and foreign-born. In general, northern regions

tended to have more tuberculosis cases in the Canadian-born Aboriginal group, while southern regions and those with large urban centres, such as Edmonton and Calgary, have more cases among the foreign-born, reflecting immigration patterns.

**Table 2.3.3:** Active Tuberculosis Cases for Three Population Groups According to Health Region, 2005 to 2009, Alberta

Health Region	Ethnic Group	Cases	Percent
<b>Chinook</b>	CB Aboriginal	2	15.4
	CB Other	4	30.8
	Foreign-Born	7	53.8
	Total	13	100.0
<b>Palliser</b>	CB Aboriginal	0	0.0
	CB Other	2	10.0
	Foreign-Born	18	90.0
	Total	20	100.0
<b>Calgary</b>	CB Aboriginal	16	5.1
	CB Other	29	9.3
	Foreign-Born	266	85.5
	Total	311	100.0
<b>David Thompson</b>	CB Aboriginal	5	21.7
	CB Other	4	17.4
	Foreign-Born	14	60.9
	Total	23	100.0
<b>East Central</b>	CB Aboriginal	0	0.0
	CB Other	2	28.6
	Foreign-Born	5	71.4
	Total	7	100.0
<b>Capital</b>	CB Aboriginal	32	11.3
	CB Other	31	10.9
	Foreign-Born	221	77.8
	Total	284	100.0
<b>Aspen</b>	CB Aboriginal	10	62.5
	CB Other	4	25.0
	Foreign-Born	2	12.5
	Total	16	100.0
<b>Peace Country</b>	CB Aboriginal	10	41.7
	CB Other	7	29.2
	Foreign-Born	7	29.2
	Total	24	100.0
<b>Northern Lights</b>	CB Aboriginal	22	73.3
	CB Other	2	6.7
	Foreign-Born	6	20.0
	Total	30	100.0
<b>Unspecified</b>	CB Aboriginal	1	33.0
	CB Other	0	0.0
	Foreign-Born	2	66.7
	Total	3	100.0
<b>Total Cases</b>	CB Aboriginal	98	13.4
	CB Other	85	11.6
	Foreign-Born	548	75.0
	Total	731	100.0

CB Aboriginal – Canadian-born Aboriginal, includes First Nation, Métis, Inuit  
CB Other – Canadian-born, non-Aboriginal

Source: IPHIS Tuberculosis Registry, Alberta Health Services



### First Nations Treaty Areas

During 2005 to 2009 there were a total of 76 individuals identified as First Nation with Treaty status who were confirmed to have active tuberculosis. (Table 2.3.4) Forty-eight (63%) of these 76 were living in a reserve community at the time of their diagnosis. In 2009, the 28 total cases reported were more than double the cases reported in each of the previous five years. Of these 28 cases, 13 individuals were living 'on reserve' and 15 were living 'off reserve' at the time of their diagnosis. Using 2009 population figures provided by Indian and Northern Affairs Canada, the rate for TB in First Nation with treaty status living 'on reserve' in Alberta was 14.9 per 100,000 person years and the rate for First Nation living 'off reserve' was 15.4 per 100,000 person years.

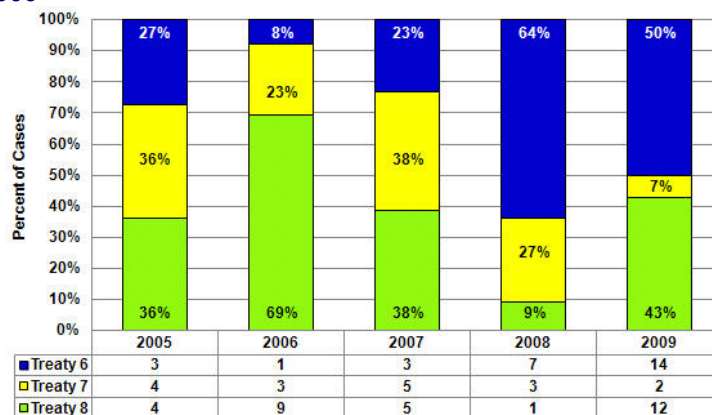
**Table 2.3.4:** Active Tuberculosis Cases and Yearly Rates per 100,000 Population for First Nations\* with the 5 Year Rate per 100,000 Person Years, 2005 to 2009, Alberta

First Nation	2005		2006		2007		2008		2009		Total Cases	Rate per 100,000 Person Years
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate		
On Reserve	7	11.2	11	17.3	10	15.4	7	11.0	13	19.4	48	14.9
Off Reserve	4	11.8	2	5.7	3	8.2	4	10.7	15	38.8	28	15.4
Both	11	11.4	13	13.1	13	12.9	11	10.9	28	26.5	76	15.1

\*Treaty status, living both on and off reserve  
Source of case data: iPHIS Tuberculosis Registry, Alberta Health Services

There are three Treaty areas (6, 7 and 8) in Alberta. Treaty 6 stretches across the middle of the province; Treaty 7 covers the south of the province; and Treaty 8 covers the northern regions of Alberta. Figure 2.3.1 shows the proportion of TB cases in those with treaty status according to treaty area. Treaty 6 and 8 have the majority of cases. (Appendix C shows a map of the Treaty Areas in Alberta.)

**Figure 2.3.1:** Proportion and Number of Active Tuberculosis Cases Reported by Treaty Area, Alberta, 2005-2009



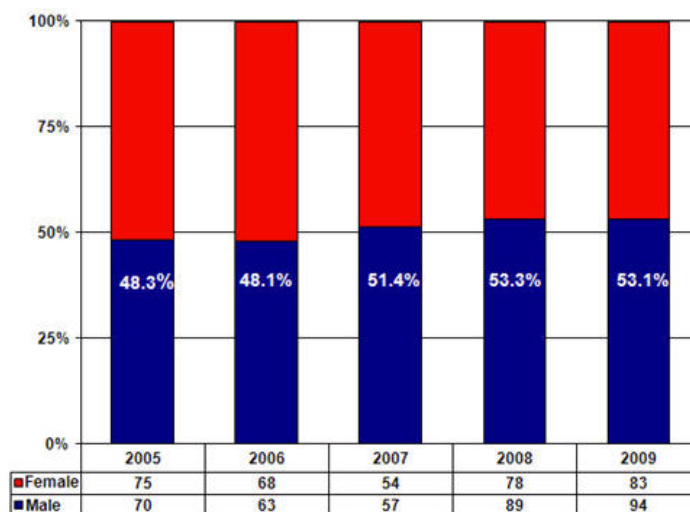
Source: iPHIS Tuberculosis Registry, Alberta Health Services

## 2.4 Host Characteristics

### Gender – Cases and Rates

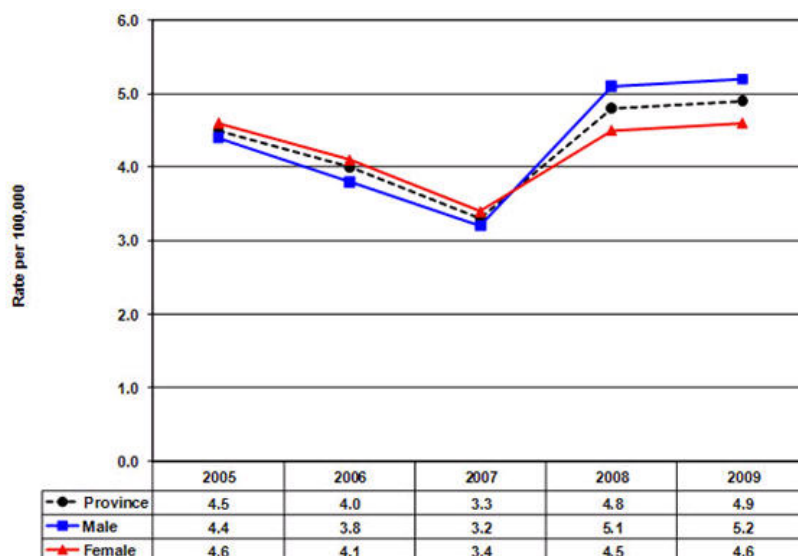
Throughout 2005 to 2009, cases of tuberculosis were split between males and females (Figure 2.4.1); however the number of cases in males rose slightly higher in 2008, resulting in slightly higher active tuberculosis incidence rates in males. (Figure 2.4.2)

**Figure 2.4.1:** Number and Proportion of Active Tuberculosis Cases by Gender, Alberta, 2005-2009



Source: iPHIS Tuberculosis Registry, Alberta Health Services

**Figure 2.4.2:** Incidence Rates per 100,000 Population of Active Tuberculosis for Males and Females, Alberta, 2005-2009



Source: iPHIS Tuberculosis Registry, Alberta Health Services

## Age Group

Although those age 65 years and older had the highest rate (9.8 per 100,000 person years), the largest proportion (38.9%) of active tuberculosis cases was amongst those aged 35-64 year olds, followed by 30.2% of cases in those aged 15 to 34. (Table 2.4.1)

**Table 2.4.1:** Active Tuberculosis Cases by Age Group with 5 year Rates per 100,000 Person Years, 2005 to 2009, Alberta

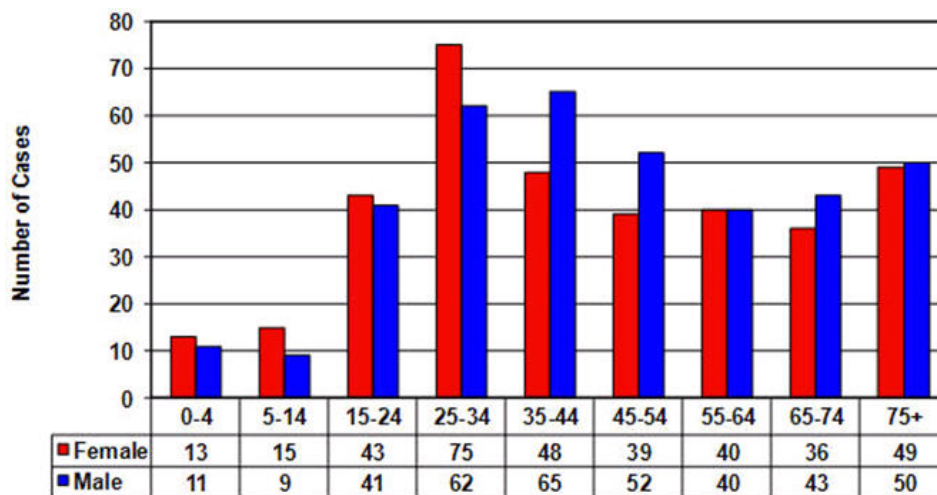
Age Group in Years	Cases	Percent	Rate per 100,000 Person Years
0-14	48	6.6	1.5
15-34	221	30.2	4.4
35-64	284	38.9	4.1
65&>	178	24.4	9.8
<b>Total</b>	<b>731</b>	<b>100.0</b>	<b>4.3</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

## Age Group and Gender – Cases and Rates

Figure 2.4.3 shows the total number of cases during 2005 to 2009 for males and females according to nine age groupings as determined by the age at diagnosis.

**Figure 2.4.3:** Number of Active Tuberculosis Cases by Age Group According to Gender, Alberta, 2005-2009



Source: iPHIS Tuberculosis Registry, Alberta Health Services

Tables 2.4.2 and 2.4.3 give the numbers of cases and yearly rates by age group for males and females, respectively, for each of the five years. Each table also includes the five year rate per 100,000 person years.

**Table 2.4.2:** Active Tuberculosis Cases with Yearly Rates per 100,000 Population by Age Group for Males and 5 Year Rates per 100,000 Person Years for 2005-2009, Alberta

Male Age Group	2005		2006		2007		2008		2009		Total	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate*
0-4	2	2.0	3	2.8	0	-	4	3.4	2	1.6	11	2.0
5-14	0	-	3	1.3	2	0.9	3	1.3	1	0.4	9	0.8
15-24	8	3.3	5	2.0	11	4.4	7	2.7	10	3.8	41	3.3
25-34	8	3.4	12	5.1	8	3.2	16	6.1	18	6.5	62	4.9
35-44	13	5.2	7	2.8	9	3.5	16	6.2	20	7.5	65	5.0
45-54	6	2.4	6	2.3	7	2.6	16	5.8	17	6.0	52	3.9
55-64	9	5.8	4	2.5	8	4.7	7	3.9	12	6.2	40	4.6
65-74	12	13.3	11	11.9	5	5.3	11	11.2	4	3.9	43	9.0
75+	12	19.1	12	18.2	7	10.2	9	12.6	10	13.5	50	14.5
<b>Total</b>	<b>70</b>	<b>4.4</b>	<b>63</b>	<b>3.8</b>	<b>57</b>	<b>3.4</b>	<b>89</b>	<b>5.1</b>	<b>94</b>	<b>5.2</b>	<b>373</b>	<b>4.4</b>

\*Rate for Total Cases = Rate per 100,000 Person Years, 2005-2009  
Source: iPHIS Tuberculosis Registry, Alberta Health Services

**Table 2.4.3:** Active Tuberculosis Cases with Yearly Rates per 100,000 Population by Age Group for Females and 5 Year Rates per 100,000 Person Years for 2005-2009, Alberta

Female Age Group	2005		2006		2007		2008		2009		Total	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate*
0-4	0	-	3	2.9	2	1.9	1	0.9	7	5.9	13	2.4
5-14	2	0.9	4	1.9	2	0.9	3	1.4	4	1.8	15	1.4
15-24	14	6.0	5	2.1	5	2.0	10	4.0	9	3.5	43	3.5
25-34	14	6.0	11	4.6	11	4.4	20	7.6	19	6.8	75	5.9
35-44	13	5.1	10	3.9	7	2.7	11	4.3	7	2.7	48	3.7
45-54	11	4.5	7	2.8	6	2.3	6	2.2	9	3.2	39	3.0
55-64	7	4.6	12	7.5	6	3.6	7	4.0	8	4.3	40	4.7
65-74	9	9.5	5	5.2	4	4.0	7	6.8	11	10.3	36	7.2
75+	5	5.3	11	11.3	11	11.0	13	12.7	9	8.6	49	9.8
<b>Total</b>	<b>75</b>	<b>4.6</b>	<b>68</b>	<b>4.1</b>	<b>54</b>	<b>3.2</b>	<b>78</b>	<b>4.5</b>	<b>83</b>	<b>4.6</b>	<b>358</b>	<b>4.2</b>

\*Rate for Total Cases = Rate per 100,000 Person Years, 2005-2009  
Source: iPHIS Tuberculosis Registry, Alberta Health Services

### Population Group

During 2005 to 2009, the majority of active tuberculosis cases (75%) were among foreign-born. Table 2.4.4 gives the cases, the proportion and the rate per 100,000 person years for 2005-2009 for Canadian-born who are not First Nation, Canadian-born First Nation (on and off reserve) and foreign-born.

**Table 2.4.4:** Active Tuberculosis Cases and Five Year Rates per 100,000 Person Years for Canadian-born (Not First Nation), Canadian-born First Nation, and Foreign-born, 2005-2009, Alberta

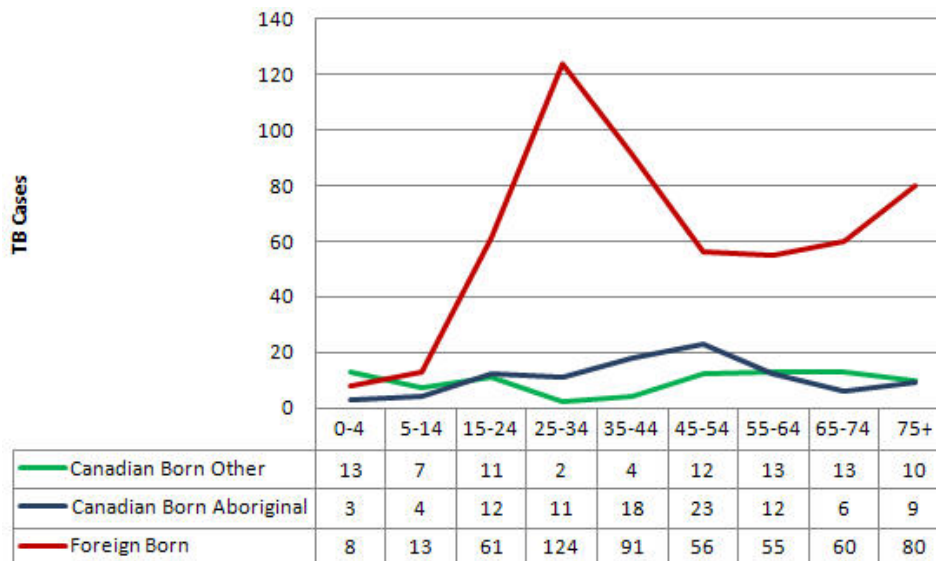
Ethnic Group	Cases	Percent of Cases	Rate per 100,000 Person Years
Canadian Born Not First Nation	107	14.6	0.8
Canadian Born First Nation	76	10.4	15.1
Foreign-Born	548	75.0	18.8
<b>Total</b>	<b>731</b>	<b>100.0</b>	<b>4.3</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

### Population Group and Age Group

There is variation in age distribution of tuberculosis cases between the three main population groups. Figure 2.4.4 shows the number of cases of active tuberculosis by age group for three population groups. Foreign-born cases are highest in the 25-34 year age group and among those age 75 years and older. Canadian-born Aboriginal cases were highest in the 45-54 year age group; and, in the Canadian-born non-Aboriginal group, cases were slightly higher in those less than 5 years of age (many of these were Canadian-born children to foreign-born parents), and in those age 65 and older.

**Figure 2.4.4:** Tuberculosis Cases by Age Group for 3 Population Groups, Alberta, 2005-2009



Canadian-born Other (non-Aboriginal); Canadian-born Aboriginal (First Nation, Métis, and Inuit)  
 Source: iPHIS Tuberculosis Registry, Alberta Health Services



Table 2.4.5 shows the contribution of active tuberculosis cases according to age group and population group with the Canadian-Born Aboriginal category divided further according to “Treaty” (First Nation), “Métis”, and “Inuit” for 2005 to 2009. The TB program has been very successful at limiting transmission of tuberculosis to Aboriginal children (those under the age of 15 years); an outcome attributed in large part to the strong and close working relationship with FNIHB. Appendix D provides the number of cases according to each of the individual years.

**Table 2.4.5:** Tuberculosis Cases by Age Group and Population Group, Alberta, 2005-2009

Age Group	Canadian-Born Aboriginal			Canadian-Born Non-Aboriginal	Foreign-Born	Total
	Registered Treaty	Metis	Inuit			
0 - 4	3			13	8	24
5 - 14	4			7	13	24
15 - 24	12			11	61	84
25 - 34	10	1		2	124	137
35 - 44	14	4		4	91	113
45 - 54	14	7	2	12	56	91
55 - 64	9	2	1	13	55	80
65 - 74	4	2		13	60	79
75 +	6	3		10	80	99
<b>Total</b>	<b>76</b>	<b>19</b>	<b>3</b>	<b>85</b>	<b>548*</b>	<b>731</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

\* Only 8 foreign-born cases were listed as refugees or refugee claimants at the time of diagnosis

### **Foreign-Born – Country of Birth**

During 2005 to 2009, there were 548 reported cases of active tuberculosis in the foreign-born. These individuals were born in 71 different countries. The greatest proportions of these cases were born in Philippines (17.3%), India (14.4%), China (10.0%), Vietnam (9.5%), and Ethiopia (7.5%). Together these five countries of birth accounted for 59 percent of the foreign-born cases in Alberta. A total of ten countries accounted for 75% of the foreign-born cases (Table 2.4.6) Appendix E shows the countries of birth for foreign-born cases for each of the five years.

**Table 2.4.6: Total Foreign-Born Tuberculosis Cases According to Country of Birth, Alberta, 2005-2009**

Country of Birth	Number of Cases	% of Total FB Cases	Country of Birth	Number of Cases	% of Total FB
1 PHILIPPINES	95	17.3	37 AUSTRIA	1	0.2
2 INDIA	79	14.4	38 BELGIUM	1	0.2
3 CHINA	55	10.0	39 BOLIVIA	1	0.2
4 VIETNAM	52	9.5	40 BRAZIL	1	0.2
5 ETHIOPIA	41	7.5	41 BULGARIA	1	0.2
6 SUDAN	24	4.4	42 BURUNDI	1	0.2
7 PAKISTAN	22	4.0	43 TAIWAN	1	0.2
8 SOMALIA	18	3.3	44 CZECH REPUBLIC	1	0.2
9 HONG KONG	13	2.4	45 DENMARK	1	0.2
10 KENYA	13	2.4	46 FIJI	1	0.2
11 ERITREA	10	1.8	47 GHANA	1	0.2
12 AFGHANISTAN	9	1.6	48 GUATEMALA	1	0.2
13 CAMBODIA	9	1.6	49 GUYANA	1	0.2
14 MYANMAR(BURMA)	6	1.1	50 HUNGARY	1	0.2
15 CONGO	6	1.1	51 IRAQ	1	0.2
16 KOREA, SOUTH	5	0.9	52 ISRAEL	1	0.2
17 THAILAND	5	0.9	53 JAMAICA	1	0.2
18 ITALY	4	0.7	54 KOREA, NORTH	1	0.2
19 SOUTH AFRICA	4	0.7	55 KUWAIT	1	0.2
20 ZIMBABWE	4	0.7	56 LAOS	1	0.2
21 BANGLADESH	3	0.5	57 LIBERIA	1	0.2
22 COLUMBIA	3	0.5	58 LIBYAN ARAB JAMAHIRIYA	1	0.2
23 EL SALVADOR	3	0.5	59 MALI	1	0.2
24 HAITI	3	0.5	60 NORWAY	1	0.2
25 INDONESIA	3	0.5	61 PERU	1	0.2
26 POLAND	3	0.5	62 RUSSIAN FEDERATION	1	0.2
27 SIERRA LEONE	3	0.5	63 SINGAPORE	1	0.2
28 BHUTAN	2	0.4	64 SLOVANIA	1	0.2
29 BRUNEI	2	0.4	65 SPAIN	1	0.2
30 SRI LANKA	2	0.4	66 SWAZILAND	1	0.2
31 IRAN	2	0.4	67 TRINIDAD & TOBAGO	1	0.2
32 MEXICO	2	0.4	68 UKRAINE	1	0.2
33 NETHERLANDS	2	0.4	69 EGYPT	1	0.2
34 NIGERIA	2	0.4	70 TANZANIA	1	0.2
35 ROMANIA	2	0.4	71 YUGOSLAVIA	1	0.2
36 UNITED KINGDOM	2	0.4	Total	548	100

Source: iPHIS Tuberculosis Registry, Alberta Health Services

Variation in tuberculosis rates was noted among the foreign-born who were born in different World Bank Regions. Statistics Canada Custom Tables provided population denominators to determine foreign-born tuberculosis rates according to these World Bank Regions. During 2005 to 2009, the majority of Alberta's tuberculosis cases confirmed in the foreign-born were in those born in Asia (includes China, Vietnam, India, Philippines, etc.). The second largest foreign-born group with active tuberculosis were born in sub-Saharan Africa (includes Ethiopia, Sudan, Somalia, etc.). Case rates for 2005 to 2009, per 100,000 person years, were highest (72.0) among those born in sub-Saharan Africa, followed by 31.6 for those born in Asia, and 16.5 for those born in the Middle Eastern Crescent (includes Pakistan, Afghanistan, Iran, etc.) (Table 2.4.7). Information on time from arrival to diagnosis of foreign-born cases by World Bank Region will be available in a publication currently in press.<sup>v</sup>

<sup>v</sup> Jensen M, Lau A, Langlois-Klassen D, Boffa J, Manfreda J, Long R. A population based study of tuberculosis epidemiology and innovative service delivery in Canada. Int J Tuberc Lung Dis (In Press).

**Table 2.4.7:** Active Tuberculosis Cases with Crude and Age Adjusted Rates for Foreign Born According to World Bank Region of Birth, 2005-2009, Alberta

World Bank Region	Cases	Crude Rate per 100,000 Person Years	Age Adjusted Rate
Sub-Saharan Africa	131	72.0	71.9
Asia	336	31.6	28.2
Latin America & Caribbean	18	7.6	9.4
Middle Eastern Crescent	38	16.5	22.5
Former Soviet Economies	12	4.0	1.9
Established Market Economies	13	1.4	0.9
<b>Total Foreign-Born</b>	<b>548</b>	<b>18.8</b>	<b>18.3</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

During 2000 to 2004, 13.6 percent of foreign-born cases were in those born in a sub-Saharan African country.<sup>vi</sup> During 2005 to 2009, this proportion rose to 23.9 percent. The year 2007 had the highest proportion of sub-Saharan African born cases at close to 29 percent. Most tuberculosis cases with a sub-Saharan country of birth were born in eastern African countries: Ethiopia, Sudan, Somalia, Kenya and Eritrea. (Table 2.4.8)

**Table 2.4.8:** Number of Tuberculosis Cases among those Born in Sub-Saharan Africa and Percent of Foreign-Born Cases Born in Sub-Saharan Africa by Year, Alberta, 2005-2009

Country of Birth Sub-Saharan Africa	2005	2006	2007	2008	2009	Total
1 Burundi				1		1
2 Congo	1	1	1	1	2	6
3 Eritrea	3	1	2	3	1	10
4 Ethiopia	8	7	6	14	6	41
5 Ghana				1		1
6 Kenya		2	5	4	2	13
7 Liberia		1				1
8 Mali				1		1
9 Nigeria	1				1	2
10 Sierra Leone	1		1		1	3
11 Somalia	2	2	2	4	8	18
12 South Africa			2		2	4
13 Sudan	10	6	4	2	2	24
14 Swaziland				1		1
15 Tanzania				1		1
16 Zimbabwe	1	1	1	1		4
<b>Total</b>	<b>27</b>	<b>21</b>	<b>24</b>	<b>34</b>	<b>25</b>	<b>131</b>
<b>All Foreign-Born</b>	<b>117</b>	<b>92</b>	<b>83</b>	<b>132</b>	<b>124</b>	<b>548</b>
<b>% of Foreign-Born TB Cases Born in Sub-Saharan Africa</b>	<b>23.1</b>	<b>22.8</b>	<b>28.9</b>	<b>25.8</b>	<b>20.2</b>	<b>23.9</b>

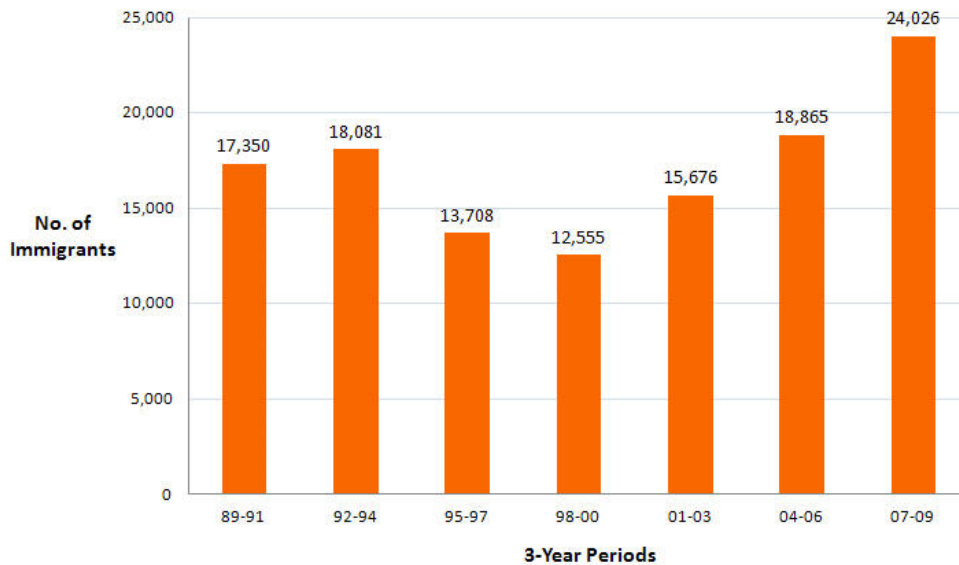
Source: iPHIS Tuberculosis Registry, Alberta Health Services

<sup>vi</sup> Disease Control and Prevention Branch, Alberta Health and Wellness, Government of Alberta. *Tuberculosis in Alberta Surveillance Report, 2000-2004*.



A progressive increase in the number of new immigrants entering Alberta annually may account for the increase in the number of foreign-born tuberculosis cases in 2008 and 2009. (Figure 2.4.5).

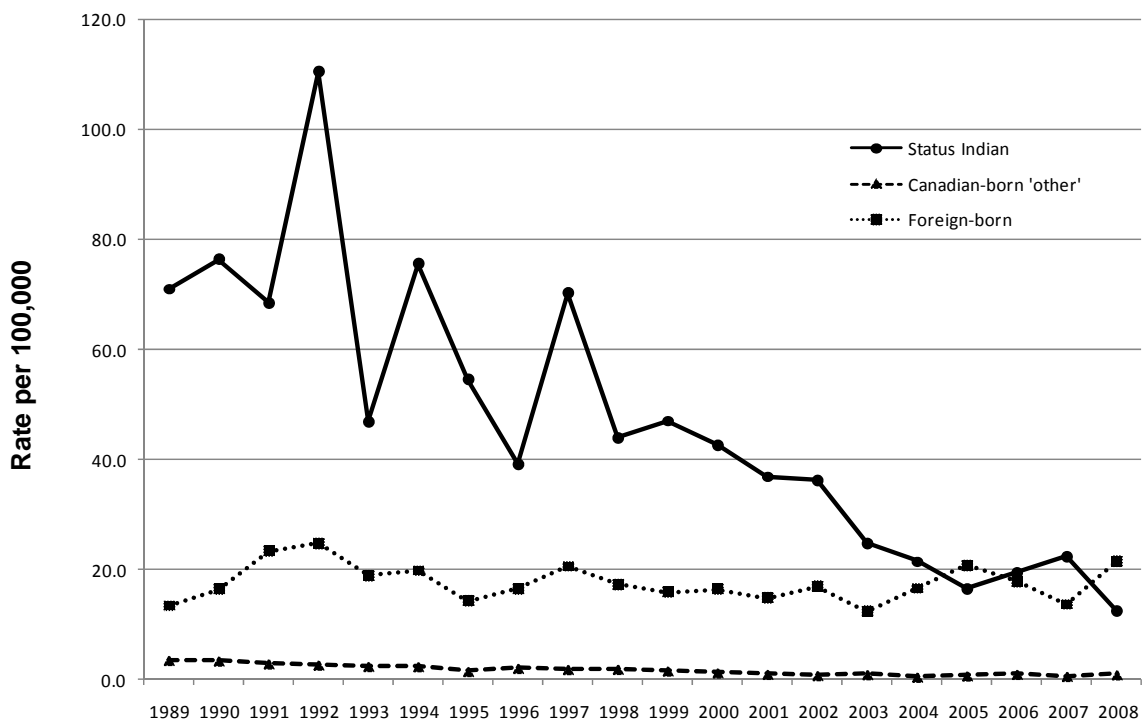
**Figure 2.4.5:** Immigration to Alberta, 1989-2009



Source: Citizenship and Immigration Canada, Canada Immigrant Overview 2009  
(<http://www.cic.gc.ca/english/pdf/research-stats/facts2009.pdf>)

In a recent publication covering the twenty-year period 1989 to 2008, TB is on track to be eliminated in the Canadian-born but not in the foreign-born (Figure 2.4.6)<sup>v</sup>

**Figure 2.4.6:** Annual age- and sex-adjusted tuberculosis case rates per 100,000 person-years for Status Indians, Canadian-born 'others' and foreign-born, Alberta, 1989-2008.



Source: [Int J Tuberc Lung Dis.](#) 2012 Jan; 16(1):43-9

<sup>v</sup>Jensen M, Lau A, Langlois-Klassen D, Boffa J, Manfreda J, Long R. A population based study of tuberculosis epidemiology and innovative service delivery in Canada. [Int J Tuberc Lung Dis.](#) 2012 Jan; 16(1):43-9

## 2.5 Disease Characteristics

### *Sites of Tuberculosis Disease*

Tuberculosis infection can affect a single site in the body, such as the lung, or it can affect multiple sites, such as the lungs, kidney, lymph nodes and/or brain. Of 731 tuberculosis cases confirmed during 2005 to 2009, the majority, 650 (88.9%), were found to have tuberculosis involving a single site, while 67 (9.2%) involved two sites, 11 (1.5%) involved three sites and, in 3 cases (0.4%), tuberculosis affected 4 to 5 sites. (Table 2.5.1)

**Table 2.5.1:** Cases of Active Tuberculosis in Alberta, 2005-2009, According to the Number of Sites Involved

Number of Sites of Infection	2005	2006	2007	2008	2009	Total	Percent
One	128	118	93	153	158	650	88.9
Two	15	8	13	13	18	67	9.2
Three	2	5	3	0	1	11	1.5
Four	0	0	1	1	0	2	0.3
Five	0	0	1	0	0	1	0.1
<b>Total Cases</b>	<b>145</b>	<b>131</b>	<b>111</b>	<b>167</b>	<b>177</b>	<b>731</b>	<b>100.0</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

In 479 (65.5%) of the 731 cases, the primary site of disease was considered to be respiratory. “Respiratory” tuberculosis includes “pulmonary tuberculosis” which involves infection of the lung and airways (i.e., trachea, larynx); “primary tuberculosis complex”, most often affecting children; and, tuberculosis of the pleura or intrathoracic lymph nodes. Table 2.5.2, shows the number and proportion of cases according to the primary site of disease for 2005 to 2009. Table 2.5.3, shows the number and proportion of cases according to primary site of disease for each of the five years.

**Table 2.5.2:** Active Tuberculosis Cases According to the Primary Site of Disease, Alberta, 2005-2009

Primary Site of Disease	Number of Cases	Percent of Cases
Respiratory	479	65.5
Lymph Node	116	15.9
Miliary	32	4.4
Central Nervous System	7	1.0
Other*	97	13.3
<b>Total</b>	<b>731</b>	<b>100.0</b>

\*Other includes: bone, joint, intestines, genitourinary, skin, eye

Source: iPHIS Tuberculosis Registry, Alberta Health Services

**Table 2.5.3:** Active Tuberculosis Cases According to Primary Site of Disease, by Year, Alberta, 2005-2009

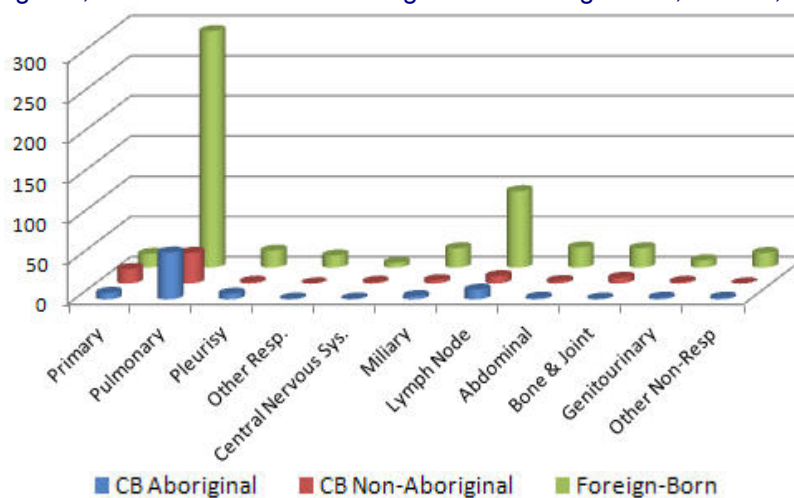
Primary Site	2005		2006		2007		2008		2009		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
<b>Respiratory</b>												
Primary	2	1.4	14	10.7	5	4.5	7	4.2	15	8.5	43	5.9
Pulmonary	75	51.7	65	49.7	61	55.0	88	52.7	101	57.1	390	53.4
Pleurisy	9	6.2	5	3.8	2	1.8	7	4.2	7	4.0	30	4.1
Other	3	2.1	2	1.5	3	2.7	5	3.0	3	1.7	16	2.2
Subtotal Respiratory	89	61.4	86	65.6	71	64.0	107	64.1	126	71.2	479	65.5
Central Nervous System	1	0.7	1	0.8	1	0.9	3	1.8	1	0.6	7	1.0
Miliary	6	4.1	5	3.8	4	3.6	9	5.4	8	4.5	32	4.4
Lymph Node	26	17.9	21	16.0	18	16.2	29	17.4	22	12.4	116	15.9
<b>Other</b>												
Abdominal	7	10.7	7	5.3	3	1.6	7	0.9	5	2.8	29	4.0
Bone & Joint	8	49.6	7	5.3	4	3.6	4	2.4	5	2.8	28	3.8
Genitourinary	2	3.8	2	1.5	5	4.5	4	2.4	5	2.8	18	2.5
Other	6	1.5	2	1.5	5	4.5	4	2.4	5	2.8	22	3.0
Subtotal Other	23	15.9	18	13.7	17	15.3	19	11.4	20	11.3	97	13.3
<b>Total</b>	<b>145</b>	<b>100.0</b>	<b>131</b>	<b>100.0</b>	<b>111</b>	<b>100.0</b>	<b>167</b>	<b>100.0</b>	<b>177</b>	<b>100.0</b>	<b>731</b>	<b>100.0</b>

Source: IPHIS Tuberculosis Registry, Alberta Health Services

### Sites of Tuberculosis Disease and Population Group

Between 2005 and 2009, the majority of active tuberculosis disease in Canadian-born Aboriginals, Canadian-born non-Aboriginals, and foreign-born was respiratory in nature, but the proportion varied between groups. Figure 2.5.1 shows tuberculosis by primary disease site for these three groups and tables 2.5.4, 2.5.5, and 2.5.6 give the numbers and proportion of cases by primary site for the three population groups by year.

**Figure 2.5.1:** Proportion of Tuberculosis Cases According to Primary Site of Disease for Canadian-Born Aboriginal\*, Canadian-Born Non-Aboriginal and Foreign-Born, Alberta, 2005-2009



CB Aboriginal includes First Nation, Métis, Inuit  
Source: IPHIS Tuberculosis Registry, Alberta Health Services

**Table 2.5.4:** Primary Site of Disease for Canadian-Born Aboriginal by Year, Alberta, 2005-2009

Primary Site	2005		2006		2007		2008		2009		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
<b>Respiratory</b>												
Primary	1	7.1	2	10.5	1	6.7	1	6.3	3	8.8	8	8.2
Pulmonary	6	42.9	8	42.1	10	66.7	13	81.3	22	64.7	59	60.2
Pleurisy	3	21.4	0	0.0	0	0.0	1	6.3	3	8.8	7	7.1
Other	1	7.1	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
Subtotal Respiratory	11	78.6	10	52.6	11	73.3	15	93.8	28	82.4	75	76.5
Central Nervous System	0	0.0	0	0.0	0	0.0	0	0.0	1	2.9	1	1.0
Miliary	1	7.1	2	10.5	0	0.0	0	0.0	1	2.9	4	4.1
Lymph Node	2	14.3	3	15.8	3	20.0	0	0.0	4	11.8	12	12.2
<b>Other</b>												
Abdominal	0	0.0	2	10.5	0	0.0	0	0.0	0	0.0	2	2.0
Bone & Joint	0	0.0	1	5.3	0	0.0	0	0.0	0	0.0	1	1.0
Genitourinary	0	0.0	1	5.3	1	6.7	0	0.0	0	0.0	2	2.0
Other	0	0.0	0	0.0	0	0.0	1	6.3	0	0.0	1	1.0
Subtotal Other	0	0.0	4	21.1	1	6.7	1	6.3	0	0.0	6	6.1
<b>Total</b>	14	100.0	19	100.0	15	100.0	16	100.0	34	100.0	98	100.0

Source: iPHIS Tuberculosis Registry, Alberta Health Services  
Canadian-born Aboriginal includes First Nation, Métis, Inuit

**Table 2.5.5:** Primary Site of Disease for Canadian-Born Non-Aboriginal by Year, Alberta, 2005-2009

Primary Site	2005		2006		2007		2008		2009		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
<b>Respiratory</b>												
Primary	0	0.0	5	25.0	4	30.8	2	10.5	7	36.8	18	21.2
Pulmonary	5	35.7	12	60.0	6	46.2	9	47.4	6	31.6	38	44.7
Pleurisy	2	14.3	0	0.0	0	0.0	0	0.0	0	0.0	2	2.4
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Subtotal Respiratory	7	50.0	17	85.0	10	76.9	11	57.9	13	68.4	58	68.2
Central Nervous System	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Miliary	0	0.0	0	0.0	0	0.0	3	15.8	1	5.3	4	4.7
Lymph Node	3	21.4	2	10.0	0	0.0	3	15.8	1	5.3	9	10.6
<b>Other</b>												
Abdominal	1	7.1	0	0.0	0	0.0	1	5.3	0	0.0	2	2.4
Bone & Joint	1	7.1	0	0.0	1	7.7	0	0.0	1	5.3	3	3.5
Genitourinary	1	7.1	0	0.0	2	15.4	1	5.3	3	15.8	7	8.2
Other	1	7.1	1	5.0	0	0.0	0	0.0	0	0.0	2	2.4
Subtotal Other	4	28.6	1	5.0	3	23.1	2	10.5	4	21.1	14	16.5
<b>Total</b>	14	100.0	20	100.0	13	100.0	19	100.0	19	100.0	85	100.0

Source: iPHIS Tuberculosis Registry, Alberta Health Services



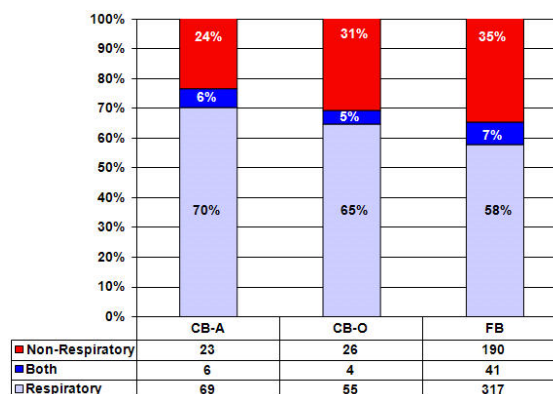
**Table 2.5.6:** Primary Site of Disease for Foreign-Born by Year, Alberta, 2005-2009

Primary Site	2005		2006		2007		2008		2009		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
<b>Respiratory</b>												
Primary	1	0.9	7	7.6	0	0.0	4	3.0	5	4.0	17	3.1
Pulmonary	64	54.7	45	48.9	45	54.2	66	50.0	74	59.7	294	53.6
Pleurisy	4	3.4	5	5.4	2	2.4	6	4.5	4	3.2	21	3.8
Other	2	1.7	2	2.2	3	3.6	5	3.8	3	2.4	15	2.7
Subtotal Respiratory	71	60.7	59	64.1	50	60.2	81	61.4	86	69.4	347	63.3
Central Nervous System	1	0.9	1	1.1	1	1.2	3	2.3	0	0.0	6	1.1
Miliary	5	4.3	3	3.3	4	4.8	6	4.5	6	4.8	24	4.4
Lymph Node	21	17.9	16	17.4	15	18.1	26	19.7	17	13.7	95	17.3
<b>Other</b>												
Abdominal	6	5.1	5	5.4	3	3.6	6	4.5	5	4.0	25	4.6
Bone & Joint	7	6.0	6	6.5	3	3.6	4	3.0	4	3.2	24	4.4
Genitourinary	1	0.9	1	1.1	2	2.4	3	2.3	2	1.6	9	1.6
Other	5	4.3	1	1.1	5	6.0	3	2.3	4	3.2	18	3.3
Subtotal Other	19	16.2	13	14.1	13	15.7	16	12.1	15	12.1	76	13.9
<b>Total</b>	<b>117</b>	<b>100.0</b>	<b>92</b>	<b>100.0</b>	<b>83</b>	<b>100.0</b>	<b>132</b>	<b>100.0</b>	<b>124</b>	<b>100.0</b>	<b>548</b>	<b>100.0</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

Type of tuberculosis disease is often referred to as respiratory, non-respiratory or both respiratory and non-respiratory. The majority of active tuberculosis for Canadian-born Aboriginals, Canadian-born non-Aboriginals, and foreign-born is respiratory in nature, but the proportion varies between groups. Respiratory disease, with or without involvement of another disease site, accounted for 76.5% of cases in Canadian-born Aboriginal; 69.4% in Canadian-born non-Aboriginal groups; and 65.3% in the foreign-born. The largest proportion of non-respiratory disease was in the foreign-born at 34.7%. (Figure 2.5.2) Table 2.5.7 gives numbers of cases of disease type for the three population groups according to year.

**Figure 2.5.2:** Disease Type: Respiratory\*, Non-Respiratory, and Both Respiratory and Non-Respiratory According to Population Group\*\*, Alberta, 2005-2009



\* Respiratory – includes primary, pulmonary, pleurisy and intrathoracic lymph nodes. Miliary disease is not included.

\*\* CB-A = Canadian-born Aboriginal (First Nation, Métis, Inuit), CB-O = Canadian-born non-Aboriginal, FB = foreign-born

Source: iPHIS Tuberculosis Registry, Alberta Health Services

**Table 2.5.7: Disease Type for Three Population Groups by Year, Alberta, 2005-2009**

Disease Site	2005	2006	2007	2008	2009	Total	Percent
<b>Canadian-born Aboriginal</b>							
Respiratory	10	9	8	15	27	69	70.4
Non-Respiratory	3	9	4	1	6	23	23.5
Both	1	1	3	0	1	6	6.1
Total	14	19	15	16	34	98	100.0
<b>Canadian-born Non-Aboriginal</b>							
Respiratory	7	16	9	11	12	55	64.7
Non-Respiratory	7	3	3	7	6	26	30.6
Both	0	1	1	1	1	4	4.7
Total	14	20	13	19	19	85	100.0
<b>Foreign-born</b>							
Respiratory	63	52	44	77	81	317	57.8
Non-Respiratory	43	33	30	48	36	190	34.7
Both	11	7	9	7	7	41	7.5
Total	117	92	83	132	124	548	100.0

Source: iPHIS Tuberculosis Registry, Alberta Health Services

Canadian-born Aboriginal includes First Nation, Métis, Inuit

### **Drug Resistance**

Prior to 2005, there were five drugs (Isoniazid, Rifampin, Pyrazinamide, Ethambutol, Streptomycin) considered to be first-line anti-tuberculosis medications. In 2005, owing to rising resistance and difficulty accessing the drug, streptomycin was no longer considered a first-line anti-tuberculosis drug. As a consequence, numbers of cases resistant to first-line drugs appear to have decreased compared to the previous five year surveillance report.<sup>vii</sup>

During 2005 to 2009, drug susceptibility was known for all 611 culture-positive cases (83.6% of the total cases). Of these, 51 cases (8.3%) were resistant to one or more of the first-line anti-tuberculosis drugs. Of cases with drug resistance, 47 cases involved the foreign-born, 3 cases involved Canadian-born Aboriginals, and 1 case involved a Canadian-born non-Aboriginal individual. Ten of the foreign-born with drug resistance had a prior diagnosis of tuberculosis. (Table 2.5.8) Table 2.5.9 shows drug resistance for the foreign-born by country of birth.

<sup>vii</sup> Disease Control and Prevention Branch, Alberta Health and Wellness, Government of Alberta. *Tuberculosis in Alberta Surveillance Report, 2000-2004*.

**Table 2.5.8:** Susceptibility to First-Line Anti-Tuberculosis Drugs in Alberta During 2005 to 2009 According to Population Group, and Previous Diagnosis of Tuberculosis

Population Group	Susceptible		Resistant		Total
	New Active	Relapse	New Active	Relapse	Culture Positive
Canadian-born Non-Aboriginal	50	1	1	0	52
Canadian-born Aboriginal	76	10	3	0	89
Foreign-born	400	23	37	10	470
<b>Total</b>	<b>526</b>	<b>34</b>	<b>41</b>	<b>10</b>	<b>611</b>

Canadian-born Aboriginal includes First Nation, Métis, Inuit

Source: iPHIS Tuberculosis Registry, Alberta Health Services

**Table 2.5.9:** Drug Resistance in Foreign-born Cases by Country of Birth, Alberta, 2005-2009

Country of Birth	Total Cases	Culture Positive Cases	Drug Resistant Cases	Percent Resistant of Culture Positive
Philippines	95	87	12	13.8
Vietnam	52	42	9	21.4
India	79	69	7	10.1
China	55	47	4	8.5
Myanmar	6	4	2	50.0
Indonesia	3	3	2	66.7
Taiwan	1	1	1	100.0
South Korea	5	5	1	20.0
Cambodia	9	7	1	14.3
Thailand	5	5	1	20.0
Ethiopia	41	31	1	3.2
Eritrea	10	8	1	12.5
Nigeria	2	2	1	50.0
Sudan	24	20	1	5.0
Swaziland	1	1	1	100.0
Pakistan	22	18	1	5.6
Mexico	2	2	1	50.0
<b>Total</b>	<b>412</b>	<b>352</b>	<b>47</b>	<b>13.4</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services



Table 2.5.10 indicates the drugs that were found to be resistant in each population group. “Multi-drug resistance” (MDR) refers to resistance to Isoniazid and Rifampin, with or without resistance to other anti-tuberculous drugs.

**Table 2.5.10:** Number of Cases Resistant to Anti-Tuberculous Drugs According to Population Group for 2005-2009

Population Group	First-Line Drugs	Total Resistant
Canadian-born Non-Aboriginal	H	1
Canadian-born Aboriginal	H	1
	Z	2
Foreign-born	H	33
	Z	3
	H,E	2
	H,Z	1
	R	1
	H,R*	1
	H,E,R*	2
	H,R,Z,E*	4
<b>Total Resistant</b>		<b>51</b>

Legend: H = Isoniazid; Z = Pyrazinamide; E = Ethambutol; R = Rifampin

\*Multi-Drug Resistant

Canadian-Born Aboriginal includes: First Nation, Métis, and Inuit  
Source: iPHIS Tuberculosis Registry, Alberta Health Services

During 2005 to 2009, there were seven cases that were found to be MDR, and all but two of them had arrived in Canada within four years of their diagnosis. These seven individuals were born in: Cambodia, China, South Korea, Vietnam, India, Ethiopia and Nigeria. In 2009, there was also one foreign-born, individual diagnosed with resistance to Rifampin only. This case involved a male who was born in the Philippines. (Table 2.5.11) There was no MDR or resistance to Rifampin noted in any cases born in Canada during 2005 to 2009.

**Table 2.5.11:** MDR and Rifampin Mono-Resistant Cases Diagnosed in Alberta during 2005 to 2009, According to Country of Birth and Year of Arrival in Canada

Diagnosis Year	Drug Resistance	Country of Birth	Year of Arrival to Canada
2005	H,R	Nigeria	2003
	H,E,R,Z	China	2005
	H,E,R,Z	South Korea	2004
	H,E,R	Vietnam	1998
2006	H,E,R	Cambodia	1986
2008	H,E,R,Z	Ethiopia	2005
	H,E,R,Z	India	2004
2009	R	Philippines	1982

Legend: H = Isoniazid; Z = Pyrazinamide; E = Ethambutol; R = Rifampin

Source: iPHIS Tuberculosis Registry, Alberta Health Services

Of the of the total 611 culture positive cases, 44 foreign-born cases were known to have had a prior diagnosis of tuberculosis. Of these 44 cases, 10 had resistance to one or more of the first-line anti-tuberculous drugs. Six of 33 foreign-born who showed resistance to Isoniazid had prior tuberculosis disease; 1 of 2 who showed resistance to both Isoniazid and Ethambutol had prior tuberculosis; and 3 of the 7 MDR cases had a prior diagnosis of tuberculosis. Table 2.5.12 shows cases of drug resistance by country of birth for those with a prior diagnosis of tuberculosis. Table 2.5.13 shows infectiousness of respiratory TB cases by population group.

**Table 2.5.12:** Drug Resistance by Country of Birth for those with a Prior Tuberculosis Diagnosis, Alberta, 2005-2009

Resistance to:	Country of Birth	Number of Cases
H	Philippines	4
	Myanmar	1
	Vietnam	1
H, E	Indonesia	1
H, E, R, Z	China	1
	South Korea	1
	India	1
<b>Total Resistant Cases with Prior TB Diagnosis</b>		<b>10</b>

Legend: H = Isoniazid; Z = Pyrazinamide; E = Ethambutol; R = Rifampin

Source: iPHIS Tuberculosis Registry, Alberta Health Services

**Table 2.5.13:** Infectiousness of respiratory TB by population group, 2005-2009

Population Group	Infectiousness			Total
	Smear-Positive Culture-Positive No. (%)	Smear-Negative Culture-Positive No. (%)	Smear-Negative Culture-Negative No. (%)	
Canadian-born Aboriginal	32 (42)	41 (53)	4 (5)	77 (100)
Canadian-born Other*	16 (25)	28 (45)	19 (30)	63 (100)
Foreign-Born	168 (45)	176 (48)	26 (7)	370 (100)
<b>Total</b>	<b>216 (42)</b>	<b>245 (48)</b>	<b>49 (10)</b>	<b>510 (100)</b>

\*Includes non-status Indians and Inuit

### ***HIV Co-infection***

In 2003 an 'opt-out' approach, whereby testing of TB patients for HIV was routine unless they chose not to be tested, was introduced to achieve universal HIV testing of tuberculosis patients in Alberta. In a statistical analysis of HIV-TB co-infection in Alberta over the years 2003-2008, HIV co-infection was significantly greater in middle-aged adults (35-64 years) compared to young adult (15-34 years) TB patients and in Aboriginal and sub-Saharan Africans compared to Canadian-born non-Aboriginal and foreign-born 'other' TB patients.<sup>viii</sup>

During 2005 to 2009, 39 individuals with TB were found to be co-infected with Human Immunodeficiency Virus (HIV). Twenty-nine (74%) of those that were found to be HIV positive were foreign-born, and the remaining ten (26%) were Canadian-born Aboriginal. Of the 29 foreign-born co-infected cases, the majority (20 cases) were born in sub-Saharan Africa. Table 2.5.14 shows TB HIV co-infected cases according to country of birth.

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<sup>viii</sup> Long R, Boffa J. High HIV-TB Co-infection Rates in Marginalized Populations: Evidence from Alberta in Support of Screening TB Patients for HIV. Canadian Journal of Public Health 2010; 101 (3):202-4

**Table 2.5.14:** Number of TB Cases Co-infected with HIV by Country of Birth (FB=Foreign-born; CB=Canadian-born) According to Year of Diagnosis, 2005 –2009

Country of Birth	Cases	Total TB Cases	Percent HIV Co-Infected
<b>Foreign-born, Sub-Saharan Africa</b>			
Burundi	1		
Congo	3		
Ethiopia	5		
Eritrea	2		
Mali	1		
Nigeria	1		
Sierra Leone	1		
Zimbabwe	1		
Sudan	4		
Swaziland	1		
<b>Subtotal</b>	<b>20</b>	<b>131</b>	<b>15.3</b>
<b>Foreign-born, Other</b>			
Bolivia	1		
Myanmar	1		
Guyana	1		
India	1		
Indonesia	1		
Iraq	1		
Mexico	1		
Philippines	1		
Vietnam	1		
<b>Subtotal</b>	<b>9</b>	<b>417</b>	<b>2.2</b>
<b>Total Foreign-born</b>	<b>29</b>	<b>548</b>	<b>5.3</b>
<b>Canadian-born</b>			
Aboriginal	10	98	10.2
Non-Aboriginal	0	85	0.0
<b>Total Canadian-born</b>	<b>10</b>	<b>183</b>	<b>5.5</b>
<b>Overall Total</b>	<b>39</b>	<b>731</b>	<b>5.3</b>

Canadian-Born Aboriginal includes: First Nation, Métis, and Inuit  
Source: iPHIS Tuberculosis Registry, Alberta Health Services

### **TB Mortality**

Not unexpectedly, most TB related deaths (69.2%) occurred in people older than 64 years of age and only two (3.8%) TB related deaths occurred in children aged <15 years. The age-specific TB related death rate was 41.7, 27.7, and 202.2 per 1000 cases in those aged <15, 15-64 and >64 years respectively. An equal proportion of TB related deaths occurred in males and females. The population group specific TB related deaths were 102.0, 70.6, and 65.7 per 1000 cases in Canadian-born non-Aboriginals, Canadian-born Aboriginals and the foreign-born respectively. HIV co-infected persons were only associated with two TB related deaths.

**Table 2.5.15: Tuberculosis Deaths in Alberta, 2005 –2009\***

Demographic Group and HIV Status	Cause of Death				TOTAL
	A	B	C		
	TB was the cause of death	TB Contributed to death	TB Related Deaths (sum of A and B)	TB did not contribute to death	
No. Assessed	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
<b>Age (years)</b>	17 (27.9)	35 (57.4)	52 (85.2)	9 (14.8)	61 (100.0)
<15	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)
15-64	2 (11.8)	12 (70.6)	14 (82.4)	3 (17.6)	17 (100.0)
>64	13 (31.0)	23 (54.8)	36 (85.7)	6 (14.3)	42 (100.0)
<b>Sex</b>					
Male	7 (23.3)	19 (63.3)	26 (86.7)	4 (13.3)	30 (100.0)
Female	10 (32.3)	16 (51.6)	26 (83.9)	5 (16.1)	31 (100.0)
<b>Population Group<sup>†</sup></b>					
Canadian-born non-Aboriginal	3 (50.0)	3 (50.0)	6 (100.0)	0 (0.0)	6 (100.0)
Canadian-born Aboriginal	4 (28.6)	6 (42.9)	10 (71.4)	4 (28.6)	14 (100.0)
Foreign-born	10 (24.4)	26 (63.4)	36 (87.8)	5 (12.2)	41 (100.0)
<b>HIV Status</b>					
Positive	0 (0.0)	2 (100.0)	2 (100.0)	0 (0.0)	2 (100.0)
Negative	6 (20.0)	20 (66.6)	26 (86.6)	4 (13.3)	30 (100.0)
Unknown or not done	11 (37.9)	13 (44.8)	24 (82.7)	5 (17.2)	29 (100.0)

\*TB deaths include those in whom tuberculosis was diagnosed after death and those who were diagnosed with TB during life but died during treatment of active disease.

<sup>†</sup>Among Canadian-born Aboriginal peoples, ten were Registered First Nations, one was non-registered First Nations and three were Métis.

## 2.6 Summary

During 2005 to 2009, the majority of cases (75%) of tuberculosis in Alberta involved people who were foreign-born and of these most were from high incidence countries. Compared to the previous five-year period, numbers of cases among those born in countries of sub-Saharan Africa increased, reflecting a change in immigration patterns to the province. The remainder of cases were split between Canadian-born Aboriginal and non-Aboriginal groups (13% and 12%) respectively. A progressive increase in the number of new immigrants to the province in 2008 and 2009 and an increase in the number of off-reserve Aboriginal cases in 2009 are thought to account for the increase in the incidence rate of tuberculosis in 2008 and 2009.

The dominant role that foreign-born cases (and the non-dominant role that Canadian-born cases) play in the epidemiology of tuberculosis in Alberta, is now influencing 'host characteristics'. For example, population group rates are now highest in the foreign-born; case rates are highest in the two major cities (with the exception of Northern Lights Region – see below), which together receive most of the new immigrants. 'Site characteristics' are also influenced by the immigrant case load. A sizable proportion (15%) of the cases have cervical lymph node disease (a disease site that is especially common in young to middle-aged Southeast Asian women), and drug resistance is an increasing concern (foreign-born cases, particularly foreign-born cases with a history of prior tuberculosis, are much more likely than Canadian-born cases to be drug-resistant). HIV co-infection was most common amongst the foreign-born from sub-Saharan Africa – a reflection of high HIV infection rates in that region of the world – and, next most common amongst Aboriginal groups.

The relatively small numbers of highly infectious (smear-positive) respiratory cases in the Canadian-born groups (n=32), Aboriginal and Canadian-born non-Aboriginal (n=16), compared to the foreign-born (n=168) suggests the current elimination trajectory in these groups is likely to continue, albeit slowly.

For the foreign-born, an expanded program of tuberculosis surveillance in high-risk new arrivals is likely to be implemented in coming months/years. For First Nations communities, emphasis on early diagnosis of source cases, prompt and thorough contact tracing and attention to socio-cultural factors and access-to-care issues that may be contributing to ongoing disease in certain high incidence communities, are all important. Some on-reserve and some off-reserve communities in Alberta may be influencing each other's tuberculosis case load; there being considerable mobility between these communities as well as some differences in the conduct of the tuberculosis prevention and control programs serving them. This may be impacting case rates in the Northern Lights Region of Alberta. The soon-to-be-released First Nations and Inuit Health Branch Tuberculosis Elimination Strategy is anticipated to provide further direction to tuberculosis control activity in reserve communities.

Two other initiatives could decrease tuberculosis case rates in the future. These are: (i) closer ties with the managers of programs serving patients with medical conditions that place them at increased risk of tuberculosis disease should they have latent tuberculosis infection and (ii) the application of social network analysis to tuberculosis prevention and control in the inner city.

Finally, more systematic collection of tuberculosis surveillance data in the future will allow us to draw a more comprehensive picture of the disease. This will also influence the capacity of the program to evaluate itself.

## 3 Preventive Therapy

### 3.1 Contacts

Locating and screening contacts of infectious tuberculosis cases is important in preventing the spread of infection. The tuberculin skin test (TST) is one tool for assessing tuberculosis infection in contacts. TST results for a contact may include: 1) negative reaction, 2) positive reaction, or 3) converter. The TST result is the major consideration taken into account when offering the identified contact anti-tuberculosis medication to prevent active disease. Preventive therapy in contacts is not mandatory.

People who are negative reactors to the TST may be offered preventive therapy, particularly if there is a high risk of disease and concern their TST may convert to positive. Unless a prior negative TST result is known, it is not possible to know for certain if a person's positive test is the result of recent or remote contact with a tuberculosis case. Not all contacts with positive TST results will develop tuberculosis disease. However, all individuals with "latent tuberculosis infection" (LTBI) are at risk of developing tuberculosis disease at some point during their lifetime. Therefore, "positive reactors and converters" may be offered preventive therapy to prevent the future occurrence of active tuberculosis. Not all contacts that are offered preventive therapy will complete their course of treatment. Treatment runs the course of several months, and over time, some will be non-compliant and stop treatment. Others may experience side effects and it may become necessary to discontinue treatment. Table 3.1.1 provides numbers of contacts that were recommended, accepted and completed preventive therapy.

**Table 3.1.1:** Number of Contacts who were Recommended, Accepted and Completed LTBI Treatment, Alberta, 2005-2009

Contacts	Number Recommended	Number Accepted	Percent Accepted	Number Completed	Percent of "Accepted" who Complete
Negative Reactor	174	161	92.5	20	12.4*
Positive Reactor	1,291	1,031	79.9	734	71.2
Converter to Positive	141	113	80.1	97	85.8

Source: iPHIS Tuberculosis Registry, Alberta Health Services

\*Although the percent of those negative reactors completing LTBI treatment was low, 116 negative reactors were re-tested and were found to have remained "negative". Preventive therapy that had been started in these individuals was then stopped. Of the remaining contacts that were initially "negative reactors" who accepted preventive therapy (161-116 = 45) but did not complete (45-20 = 25), 14 were non-compliant, 10 stopped for "other" reasons, and 1 had side effects.



### 3.2 High Risk

Not all individuals with latent tuberculosis infection will develop active tuberculosis disease. However, there are certain medical conditions that may increase the likelihood of progression to disease. For instance, conditions that may weaken the immune system such as cancer, HIV and renal failure may result in latent infection becoming active. Certain medications that suppress the immune system such as TNF inhibitors and medications taken to prevent organs that have been transplanted from rejection can also increase the risk of LTBI becoming active tuberculosis disease. Therefore, many people with these risk factors are screened for LTBI, and if positive, may be offered anti-tuberculous treatment. Preventing the development of active tuberculosis is not only important for maintaining the health of the individual but is also important in preventing further spread of the disease. The programs that manage patients with high-risk diseases are independent of tuberculosis control; accordingly tuberculosis managers and high-risk disease managers must work together. This is an on-going challenge as high-risk disease managers have many competing priorities. Preventive therapy is not mandatory in high-risk tuberculin reactors. Table 3.2.1 provides numbers of those at high risk that were recommended, accepted and completed preventive therapy.

**Table 3.2.1:** Number of High Risk Individuals who were Recommended, Accepted and Completed LTBI Treatment, Alberta, 2005-2009\*

High Risk Category	Number Recommended	Number Accepted	Percent Accepted	Number Completed	Percent of "Accepted" who Complete
Cancer	65	55	84.6	36	65.5
Renal Failure	81	80	98.8	60	75.0
HIV	120	118	98.3	92	78.0
TNF Inhibitors	278	253	91.0	202	79.8
Transplant	83	77	92.8	50	64.9
<b>Total</b>	<b>627</b>	<b>583</b>	<b>93.0</b>	<b>440</b>	<b>75.5</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

\*Individuals within these high-risk groups had a positive tuberculin test or QuantiFERON TB-Gold In-tube test; some may have been tuberculin converters.

Of a total of 583 high risk individuals who accepted preventive therapy, 143 (24.5%) did not complete LTBI treatment. Reasons for discontinuing treatment included non-compliance for 53 (37.1%) individuals; side effects for 34 (23.8%) individuals; and "other reasons" in 56 (39.2%) individuals.



### 3.3 Other

An expanded program of tuberculosis surveillance in recently arrived immigrants is in the process of being evaluated. (Those under the age of 35 years [i.e., those less likely to have side effects from preventive therapy] arriving within the past two years from high incidence countries.)

### 3.4 Summary

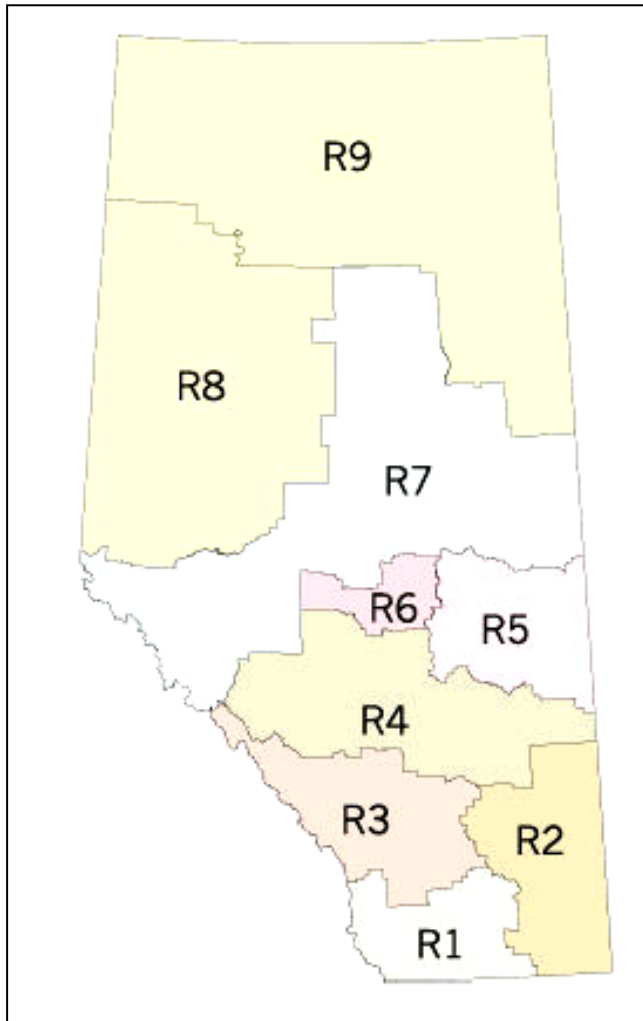
Tracing and management of contacts and identification and management of high-risk tuberculin reactors constitute a large part of the work undertaken by the TB control program. The activity is very important but hugely labour intensive. Tracing and management of contacts is important in all population groups, but especially so in vulnerable persons (children under the age of 5 years and the immuno-compromised) and First Nation peoples. This contact tracing and management will be vital with the planned BCG withdrawal, discontinuation of school screening (see reference<sup>ix</sup>) and the possible further discontinuation of pre-school screening. Ongoing collaboration with programs that serve high-risk patients (for example, HIV/AIDS, dialysis, transplant) will be increasingly important; but steps must be taken to better evaluate and monitor the activity. An expanded program of surveillance and preventive therapy is expected in new immigrants and refugees. A significant recent advance has been the development of T-cell based interferon-gamma (IFN- $\gamma$ ) release assays. IFN- $\gamma$  release assays are in-vitro blood tests that are based on IFN- $\gamma$  release after stimulation by TB-specific antigens. They are more specific than the TST for latent TB infection in BCG vaccinated populations. They are gradually being introduced into Alberta and are one day expected to replace the TST.<sup>x</sup>

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<sup>ix</sup> Jacobs S, Warman A, Richardson R, Yacoub W, Lau A, Whittaker D, Cockburn S, Verma G, Boffa J, Tyrell G, Kunimoto D, Manfreda J, Langlois-Klassen D, Long R. The tuberculin skin test is unreliable in school children BCG vaccinated in infancy and at low risk of tuberculosis infection. *Ped Inf Dis J* 2011; 30: 754-58

<sup>x</sup> Canadian Tuberculosis Committee (CTC). Recommendations on interferon gamma release assays for the diagnosis of latent tuberculosis infection – 2010 Update. An Advisory Committee Statement (ACS). *Can Commun Dis Rep* 2010; 36:5.

## Appendix A: Map of 9 Health Regions, Alberta



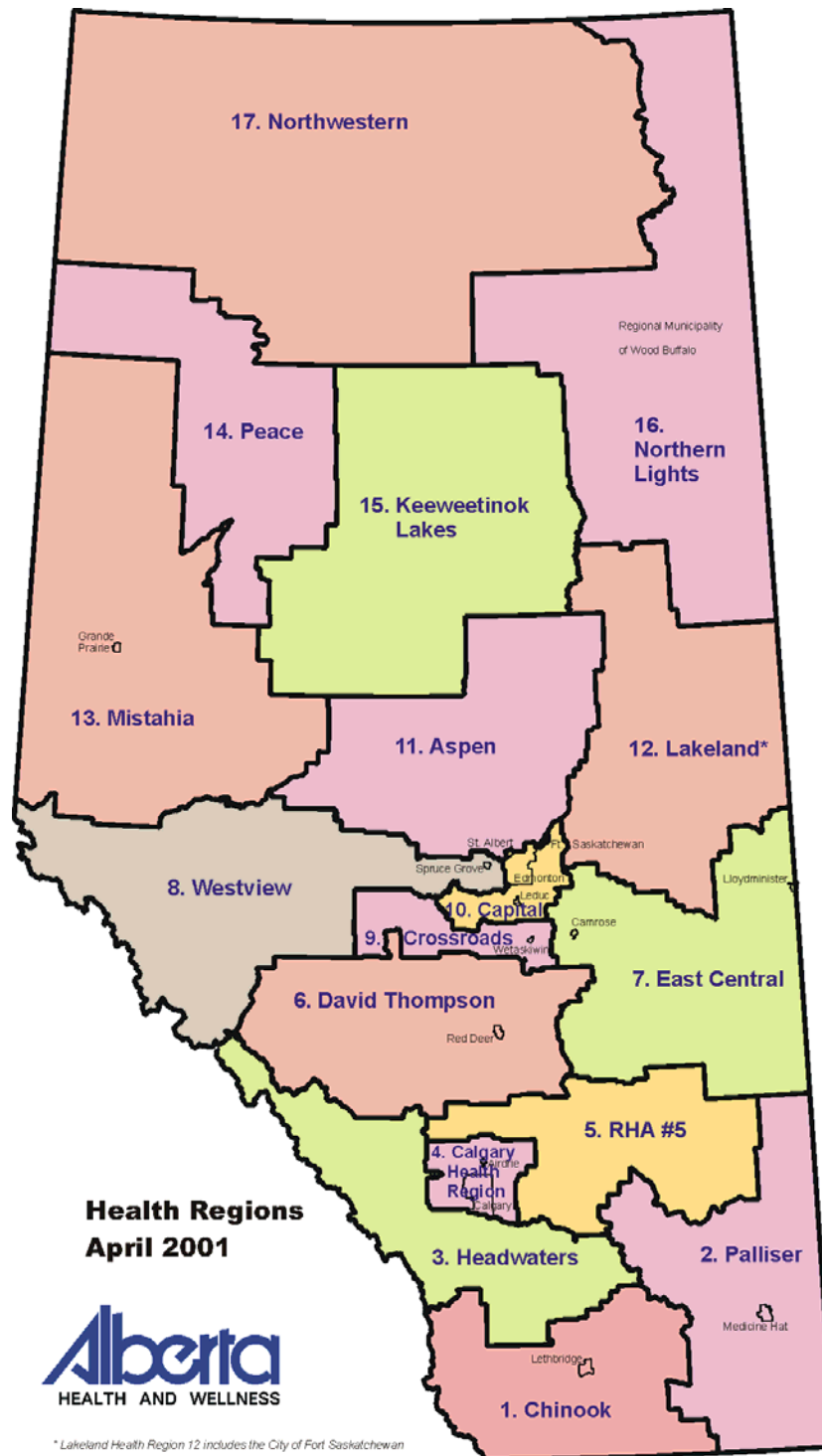
### Regional Health Authorities

1. Chinook Regional Health Authority
2. Palliser Health Region
3. Calgary Health Region
4. David Thompson Regional Health Authority
5. East Central Health
6. Capital Health
7. Aspen Regional Health Authority
8. Peace Country Health
9. Northern Lights Health Region

Source: Health and Wellness, Government of Alberta. Regional Health Authorities (RHA) Map & List as of April 1, 2003 (Regions 3&4 updated as of December 1, 2003). April 16, 2004. May 18, 2004.

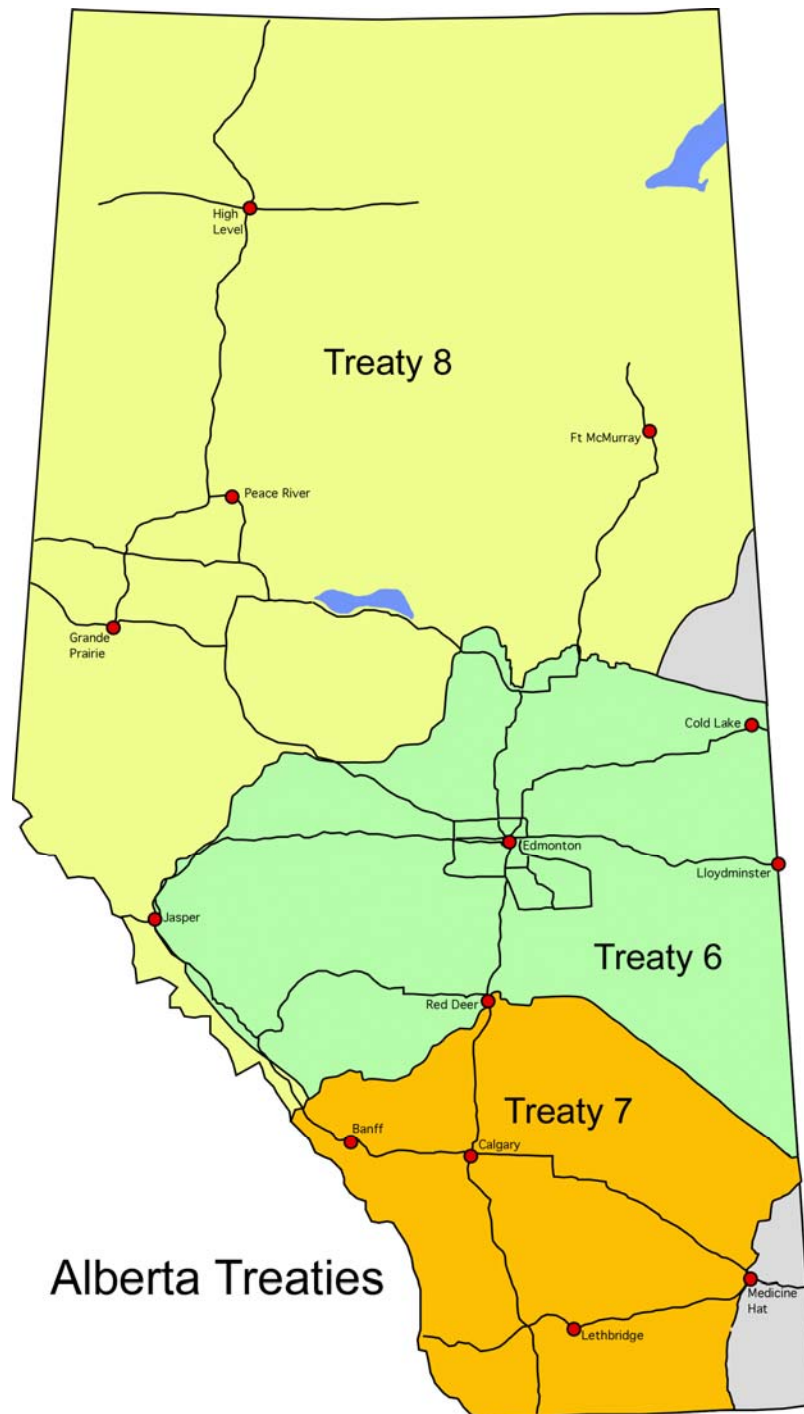
<[http://www.health.gov.ab.ca/regions/map\\_lookup.htm](http://www.health.gov.ab.ca/regions/map_lookup.htm)>.

## Appendix B: Map of 17 Health Regions, Alberta



Source: Health Surveillance, Alberta Health and Wellness, 13

## Appendix C: Map of Treaty Areas, Alberta



Source: Health Surveillance, Alberta Health and Wellness

## Appendix D: Active TB by Age Group and Population Group

Active Tuberculosis by Age Group and Population Group, by Year, Alberta, 2005 – 2009

### 2005

Age Group	Canadian-Born Aboriginal			Canadian-Born Non-Aboriginal	Foreign-Born	Total
	Registered Treaty	Metis	Inuit			
0 - 4	1				1	2
5 - 14				1	1	2
15 - 24	1			3	18	22
25 - 34	2				20	22
35 - 44					26	26
45 - 54	4		1	2	10	17
55 - 64	1			4	11	16
65 - 74	2	1		2	16	21
75 +		1		2	14	17
<b>Total</b>	<b>11</b>	<b>2</b>	<b>1</b>	<b>14</b>	<b>117</b>	<b>145</b>

### 2006

Age Group	Canadian-Born Aboriginal			Canadian-Born Non-Aboriginal	Foreign-Born	Total
	Registered Treaty	Metis	Inuit			
0 - 4	1			2	3	6
5 - 14	1			2	4	7
15 - 24	2			2	6	10
25 - 34	1				22	23
35 - 44	1	2		1	13	17
45 - 54	1	3		3	6	13
55 - 64	4			3	9	16
65 - 74	1	1		3	11	16
75 +	1			4	18	23
<b>Total</b>	<b>13</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>92</b>	<b>131</b>

### 2007

Age Group	Canadian-Born Aboriginal			Canadian-Born Non-Aboriginal	Foreign-Born	Total
	Registered Treaty	Metis	Inuit			
0 - 4				2		2
5 - 14				1	3	4
15 - 24	2			2	12	16
25 - 34				1	18	19
35 - 44	3			1	12	16
45 - 54	2	1		1	9	13
55 - 64	2	1		2	9	14
65 - 74				2	7	9
75 +	4			1	13	18
<b>Total</b>	<b>13</b>	<b>2</b>	<b>0</b>	<b>13</b>	<b>83</b>	<b>111</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

## Appendix D: (Cont'd)

### 2008

Age Group	Canadian-Born Aboriginal			Canadian-Born Non-Aboriginal	Foreign-Born	Total
	Registered Treaty	Metis	Inuit			
0 - 4				3	2	5
5 - 14	1			1	4	6
15 - 24	2			3	12	17
25 - 34	3			1	32	36
35 - 44	4				23	27
45 - 54		2	1	4	15	22
55 - 64			1	2	11	14
65 - 74				4	14	18
75 +	1	1		1	19	22
<b>Total</b>	<b>11</b>	<b>3</b>	<b>2</b>	<b>19</b>	<b>132</b>	<b>167</b>

### 2009

Age Group	Canadian-Born Aboriginal			Canadian-Born Non-Aboriginal	Foreign-Born	Total
	Registered Treaty	Metis	Inuit			
0 - 4	1			6	2	9
5 - 14	2			2	1	5
15 - 24	5			1	13	19
25 - 34	4	1			32	37
35 - 44	6	2		2	17	27
45 - 54	7	1		2	16	26
55 - 64	2	1		2	15	20
65 - 74	1			2	12	15
75 +		1		2	16	19
<b>Total</b>	<b>28</b>	<b>6</b>	<b>0</b>	<b>19</b>	<b>124</b>	<b>177</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services



## Appendix E: Active TB According to Country of Birth

### Active Tuberculosis Among Foreign-Born According to Country of Birth, Alberta, 2005-2009

2005			2006			2007		
Country of Birth	Number of Cases	% of Total FB	Country of Birth	Number of Cases	% of Total FB	Country of Birth	Number of Cases	% of Total FB
1 PHILIPPINES	17	14.5	1 INDIA	16	17.4	1 PHILIPPINES	15	18.1
2 CHINA	16	13.7	2 PHILIPPINES	16	17.4	2 INDIA	12	14.5
3 VIETNAM	15	12.8	3 VIETNAM	12	13.0	3 VIETNAM	9	10.8
4 INDIA	10	8.5	4 CHINA	8	8.7	4 ETHIOPIA	6	7.2
5 SUDAN	10	8.5	5 ETHIOPIA	7	7.6	5 CHINA	5	6.0
6 ETHIOPIA	8	6.8	6 SUDAN	6	6.5	6 KENYA	5	6.0
7 PAKISTAN	6	5.1	7 CAMBODIA	3	3.3	7 SUDAN	4	4.8
8 ERITREA	3	2.6	8 AFGHANISTAN	2	2.2	8 BHUTAN	2	2.4
9 HONG KONG	3	2.6	9 HONG KONG	2	2.2	9 CAMBODIA	2	2.4
10 BRUNEI	2	1.7	10 KENYA	2	2.2	10 ERITREA	2	2.4
11 COLUMBIA	2	1.7	11 POLAND	2	2.2	11 HONG KONG	2	2.4
12 ITALY	2	1.7	12 SOMALIA	2	2.2	12 PAKISTAN	2	2.4
13 KOREA, SOUTH	2	1.7	13 BRAZIL	1	1.1	13 SOMALIA	2	2.4
14 SOMALIA	2	1.7	14 MYANMAR(BURMA)	1	1.1	14 SOUTH AFRICA	2	2.4
15 THAILAND	2	1.7	15 TAIWAN	1	1.1	15 THAILAND	2	2.4
16 AFGHANISTAN	1	0.9	16 CONGO	1	1.1	16 AFGHANISTAN	1	1.2
17 BANGLADESH	1	0.9	17 ERITREA	1	1.1	17 MYANMAR(BURMA)	1	1.2
18 BULGARIA	1	0.9	18 GUATEMALA	1	1.1	18 COLUMBIA	1	1.2
19 MYANMAR(BURMA)	1	0.9	19 HAITI	1	1.1	19 CONGO	1	1.2
20 SRI LANKA	1	0.9	20 INDONESIA	1	1.1	20 EL SALVADOR	1	1.2
21 CONGO	1	0.9	21 IRAQ	1	1.1	21 FUJI	1	1.2
22 INDONESIA	1	0.9	22 KOREA, SOUTH	1	1.1	22 LAOS	1	1.2
23 IRAN	1	0.9	23 LIBERIA	1	1.1	23 RUSSIAN FEDERATION	1	1.2
24 ISRAEL	1	0.9	24 ZIMBABWE	1	1.1	24 SIERRA LEONE	1	1.2
25 KUWAIT	1	0.9	25 EGYPT	1	1.1	25 ZIMBABWE	1	1.2
26 NIGERIA	1	0.9	26 UNITED KINGDOM	1	1.1	26 SPAIN	1	1.2
27 ROMANIA	1	0.9						
28 SIERRA LEONE	1	0.9						
29 SINGAPORE	1	0.9						
30 SLOVANIA	1	0.9						
31 ZIMBABWE	1	0.9						
32 YUGOSLAVIA	1	0.9						
<b>Total</b>	<b>117</b>	<b>100.0</b>	<b>Total</b>	<b>92</b>	<b>100.0</b>	<b>Total</b>	<b>83</b>	<b>100.0</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

## Appendix E: (Cont'd)

### Active Tuberculosis Among Foreign-Born According to Country of Birth, Alberta, 2005-2009

2008			2009		
Country of Birth	Number of Cases	% of Total FB	Country of Birth	Number of Cases	% of Total FB
1 INDIA	23	17.4	1 PHILIPPINES	28	22.6
2 PHILIPPINES	19	14.4	2 INDIA	18	14.5
3 CHINA	15	11.4	3 CHINA	11	8.9
4 ETHIOPIA	14	10.6	4 VIETNAM	10	8.1
5 PAKISTAN	8	6.1	5 SOMALIA	8	6.5
6 VIETNAM	6	4.5	6 ETHIOPIA	6	4.8
7 KENYA	4	3.0	7 PAKISTAN	6	4.8
8 SOMALIA	4	3.0	8 HONG KONG	4	3.2
9 AFGHANISTAN	3	2.3	9 AFGHANISTAN	2	1.6
10 CAMBODIA	3	2.3	10 BANGLADESH	2	1.6
11 ERITREA	3	2.3	11 CONGO	2	1.6
12 MYANMAR(BURMA)	2	1.5	12 EL SALVADOR	2	1.6
13 HAITI	2	1.5	13 KENYA	2	1.6
14 HONG KONG	2	1.5	14 MEXICO	2	1.6
15 SUDAN	2	1.5	15 SOUTH AFRICA	2	1.6
16 AUSTRIA	1	0.8	16 SUDAN	2	1.6
17 BELGIUM	1	0.8	17 BOLIVIA	1	0.8
18 BURUNDI	1	0.8	18 MYANMAR(BURMA)	1	0.8
19 SRI LANKA	1	0.8	19 CAMBODIA	1	0.8
20 CONGO	1	0.8	20 DENMARK	1	0.8
21 CZECH REPUBLIC	1	0.8	21 ERITREA	1	0.8
22 GHANA	1	0.8	22 ITALY	1	0.8
23 GUYANA	1	0.8	23 JAMAICA	1	0.8
24 HUNGARY	1	0.8	24 KOREA, NORTH	1	0.8
25 INDONESIA	1	0.8	25 KOREA, SOUTH	1	0.8
26 IRAN	1	0.8	26 LIBYAN ARAB JAMAHIRIYA	1	0.8
27 ITALY	1	0.8	27 NETHERLANDS	1	0.8
28 KOREA, SOUTH	1	0.8	28 NIGERIA	1	0.8
29 MALI	1	0.8	29 NORWAY	1	0.8
30 NETHERLANDS	1	0.8	30 PERU	1	0.8
31 POLAND	1	0.8	31 SIERRA LEONE	1	0.8
32 ROMANIA	1	0.8	32 TRINIDAD & TOBAGO	1	0.8
33 ZIMBABWE	1	0.8	33 UNITED KINGDOM	1	0.8
34 SWAZILAND	1	0.8			
35 THAILAND	1	0.8			
36 UKRAINE	1	0.8			
37 TANZANIA	1	0.8			
<b>Total</b>	<b>132</b>	<b>100.0</b>	<b>Total</b>	<b>124</b>	<b>100.0</b>

Source: iPHIS Tuberculosis Registry, Alberta Health Services

## Appendix F: Preliminary Summary of Tuberculosis Surveillance 2010

In 2010, the system of nine Regional Health Authorities was abandoned in favour of a single large Health Authority - Alberta Health Services - along with five Health Zones. These are described in the Figure (See Appendix G). For purposes of tuberculosis control, the Edmonton and Calgary Clinics manage cases in the Edmonton and Calgary Health Zones (these health zones approximate the previous RHA's 6 and 3, respectively) with the exception of those living on-reserve who, along with North, Central and South Zones (previously approximated by RHA's 7-9, 5-4 and 1-2, respectively) are managed by the Provincial Clinic. All clinics continue to work with Zone Medical Officers of Health and their Communicable Disease Control staff. The Provincial TB Clinic continues to work with First Nations and Inuit Health Branch, Alberta Region, and the Community Health Nurses and Community Health Representatives in Reserve Communities.

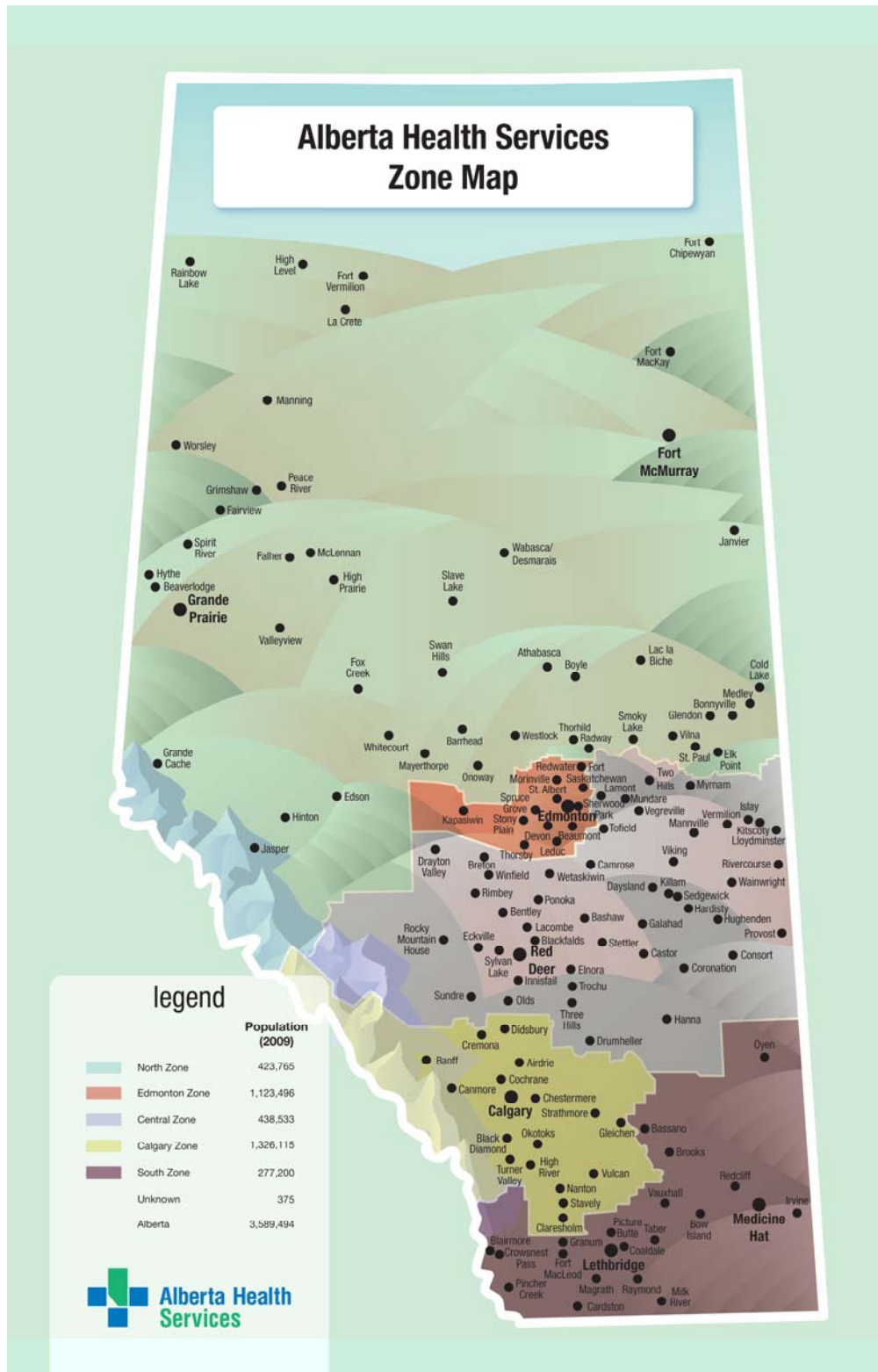
In 2010, there were 132 notified cases of tuberculosis in Alberta, with a crude disease rate of 3.6 per 100,000 population. The disease rate was 1.1, 4.6, 0.9, 3.9, 3.6 per 100,000 population, respectively in the South, Calgary, Central, Edmonton, and North Health Zones, respectively.

The age, sex and disease characteristics of the 2010 cases by population group are given in the table.

Age, Sex and Disease Characteristic		Population Group				Total No. (%)
		Treaty Status Indian	Métis	Canadian-born 'Other'	Foreign-born	
		No. (%)	No. (%)	No. (%)	No (%)	
No. Notified		9 (7)	4 (3)	12 (9)	107 (81)	132 (100)
Age (yrs)	0-14	1 (17)	0 (0)	0 (0)	5 (83)	6 (100)
	15-34	1 (2)	0 (0)	4 (10)	36 (88)	41 (100)
	35-64	5 (9)	2 (4)	6 (11)	43 (77)	56 (100)
	>64	2 (7)	2 (7)	2 (7)	23 (79)	29 (100)
Sex	Male	6 (8)	3 (4)	9 (12)	57 (76)	75 (100)
	Female	3 (5)	1 (2)	3 (5)	50 (88)	57 (100)
Disease Type	New Active	8 (6)	4 (3)	12 (10)	102 (81)	126 (100)
	Retreatment	1 (17)	0 (0)	0 (0)	5 (83)	6 (100)
Disease Site	Respiratory					
	S (+ve)	3 (9)	0 (0)	2 (6)	27 (84)	32 (100)
	S (-ve)	3 (6)	3 (6)	7 (13)	40 (75)	53 (100)
	Non-respiratory	3 (6)	1 (2)	3 (6)	40 (85)	47 (100)
HIV Status	(+ve)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)
	(-ve)	8 (6)	3 (2)	12 (9)	104 (82)	127 (100)
	Unk	0 (0)	1 (25)	0 (0)	3 (75)	4 (100)
Drug Resistant*	INH Mono-resistant	0 (0)	0 (0)	1 (17)	5 (83)	6 (100)
	Other mono-resistant	0 (0)	0 (0)	0 (0)	0 (0)	0 (100)
	Poly-resistant	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)
	MDR	0 (0)	0 (0)	0 (0)	3 (100)	3 (100)

Abbreviations: S smear; HIV human immuno-deficiency virus; Unk unknown; INH isoniazid; MDR Multidrug-resistant  
\* polyresistant = resistant to two or more first-line anti-tuberculous drugs but not MDR

## Appendix G: Map of Alberta Health Services Zones



## References

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