BC Centre for Disease Control
AN AGENCY OF THE PROVINCIAL HEALTH SERVICES AUTHORITY

TB

Annual Report
2011

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Preface

This report presents selected statistical and epidemiological information referring to tuberculosis (TB) in the province of British Columbia (BC) for the calendar years 2003–2011. Clinical and laboratory reporting mechanisms help to ensure that TB Control is advised of all active and suspect TB diagnosed and/or treated in the province. As such, the information contained within this report is presented with a high degree of certainty in its accuracy.

Globally, active tuberculosis (TB) incidence and mortality are declining despite the challenges of HIV co-infection and drug-resistance. Canada remains a low incidence TB country with a reported rate of 4.9 per 100,000 in 2008. Although the incidence of TB in BC has decreased to very low levels, the rate of decline has slowed and incidence remains consistently higher than the national level. Over the last decade, approximately 300 people were diagnosed annually with TB in BC, with an average incidence rate of 7.0 cases per 100,000 people. Despite the stability in numbers, substantial outbreaks have occurred in the time frame of reporting. TB has become increasingly concentrated among three populations in BC: foreign-born persons from TB-endemic countries, Aboriginal peoples, and socially marginalized individuals. Efforts by which to impact disease rates should focus on treatment and prevention in these groups.

Much of the information within this report has been previously documented in prior TB Annual Reports (2003, 2004, 2005-2008). The decision was made to include available information since the inception of the integrated Public Health Information System (iPHIS) in an effort to improve TB surveillance moving forward. This work, along with other enhanced surveillance activities, is in alignment with the vision and goals of the BC Strategic Plan for Tuberculosis Prevention, Treatment and Control - a framework for improving the health of people in BC by guiding and supporting efforts to reduce TB incidence, prevalence, morbidity and mortality.

Additional content that had not previously been reported or is now provided in more detail is as follows:

1. Degree of smear positivity (p.22) allows for the interpretation of overall infectiousness of active pulmonary cases
2. Contacts per case (p. 38), by type (p. 39), and by Origin (p.40) allows for a more detailed look at this important public health intervention.
3. Interferon Gamma Release Assay (IGRA) results added to the clinical definition of Latent TB Infection (LTBI) (p. 46) highlights the important role of this test in clarifying TB infection status and ensuring treatment is offered to those most likely to benefit

Thank you to all for your patience and input into the preparation of this comprehensive, multi-year report.

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Summary of Trends

Tuberculosis (TB)

Active TB

- In 2011, the rate of active TB in BC was 5.9 per 100,000 population (269 cases), the second lowest rate since 1993
- The highest rates of TB in 2011 were in Vancouver Coastal and Fraser Health Authorities.
- Males continue to have higher rates and an older age distribution of new TB diagnoses than females.
- TB rates by origin have remained consistent in the past decade. In 2011, 72.1% of cases were foreign born, 11.5% were Aboriginal, and 12.6% were Canadian-born non-Aboriginal.
- TB rates show disparities between WHO country groupings, with the Western Pacific Region consistently comprising the greatest proportion of cases (43.1% in 2011).
- In 2011, 78.4% of TB cases had known HIV status, of which 4.3% were coinfected with HIV.
- Drug resistant TB is a concern world-wide, and rates of Isoniazid-resistant TB in BC has increased over the past decade, reaching 9.7% of all cases in 2011. Only a single case of multi-drug resistant TB (MDRTB) was seen in 2011.
- The percentage of TB cases undergoing directly observed therapy (DOT) has remained consistent at near 17% since 2003. Of patients starting treatment in 2010, 91.1% completed treatment, with 75.0% doing so within 1 year.

Latent TB

- LTBI infection was most common in foreign-born, who accounted for 67.8% of estimated LTBI in BC in 2011.
- A total of 720 individuals were placed on LTBI therapy in 2011, of which 72.3% successfully completing treatment. The most common reason for LTBI therapy failure was negative drug reaction.

Contact Tracing

- In 2011, an average of 17.6 contacts (median=8.00) were documented per respiratory TB case. Of contacts documented in the Integrated Public Health Information System (iPHIS) in 2011, 47.1% were Type 1, 20.4% were Type 2, and 20.6% were Type 3.

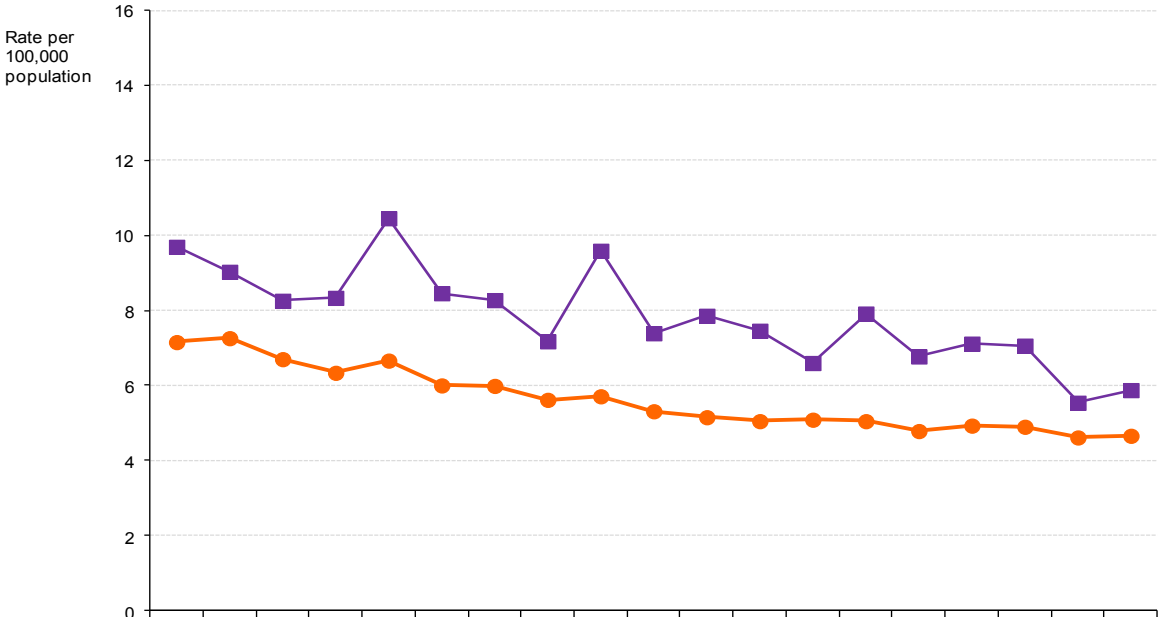
Active Tuberculosis

A. Incidence and Case Totals

Active TB Historical Trends

The rate of active TB in British Columbia was 5.9/100,000 in 2011 compared to 5.5/100,000 in 2010. The provincial rate of TB has decreased over the previous 2 decades, and this decreasing rate mirrors that seen for Canada as a whole (Figure 1). Active TB incidence in BC has historically been higher than the overall Canadian rate, and this trend continues in 2011 with a Canadian TB rate of 4.7/100,000 population. The higher active TB rate observed in BC relative to the Canadian average likely stems from the large number of foreign-born individuals entering the province from high-incidence countries.[1] It must be noted that BC has a more inclusive case definition than does the Public Health Agency of Canada (PHAC), which may elevate our rates slightly compared to the Canadian rate. Also, the *Integrated Public Health Information System* (iPHIS), a provincial clinical management system, was implemented in 2003 (see Appendix for further discussion).

Figure 1. Active TB Disease rates in BC and Canada, 1993 to 2011



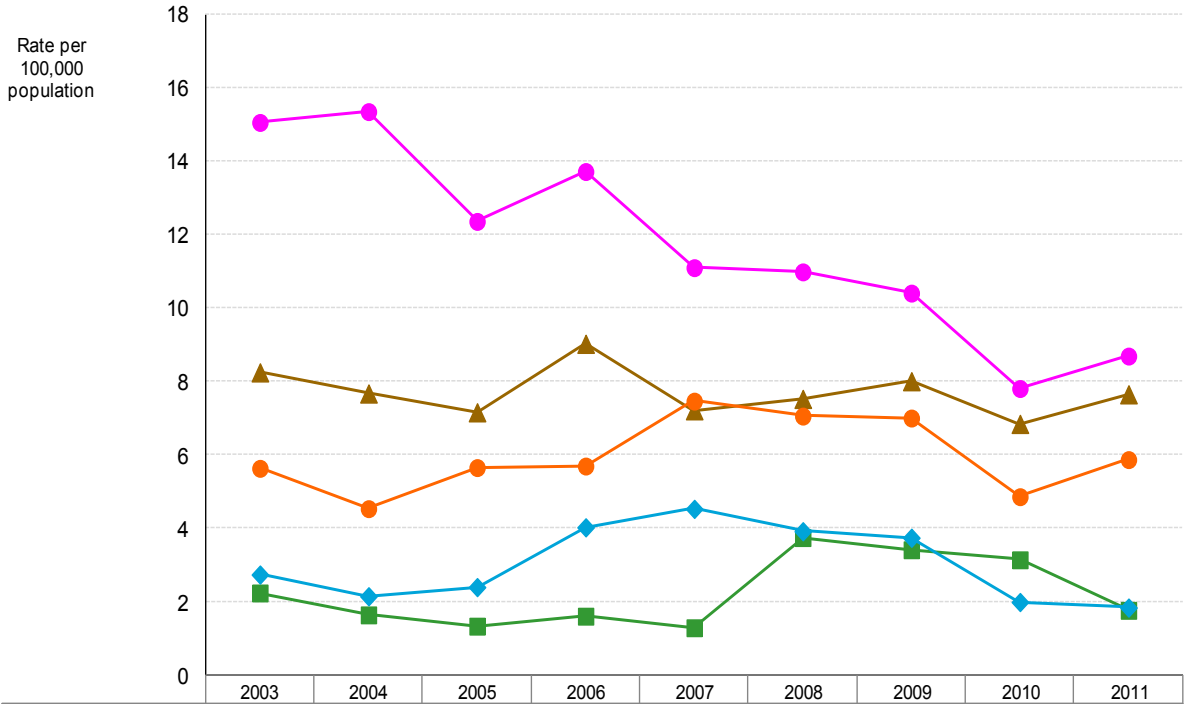
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BC Diagnoses	346	332	312	323	413	337	332	290	391	303	324	310	277	336	292	312	315	251	269
BC Rate	9.7	9.0	8.3	8.3	10.5	8.5	8.3	7.2	9.6	7.4	7.9	7.5	6.6	7.9	6.8	7.1	7.1	5.5	5.9
Canadian Rate	7.2	7.3	6.7	6.3	6.7	6.0	6.0	5.6	5.7	5.3	5.2	5.0	5.1	5.0	4.8	4.9	4.9	4.6	4.7

* Canadian rates come from the Public Health Agency of Canada

Active TB Rates by Health Authority of Residence

In 2011, the rate of active TB was highest in Vancouver Coastal (8.7/100,000 population), followed by Fraser (7.6/100,000 population), Northern (5.9/100,000 population), and Interior and Vancouver Island, both of which had a rate of 1.8/100,000 population (Figure 2). Vancouver Coastal had the highest rates in 2011, but also had the greatest decrease in active TB rates over the last 9-years. The subtle peaks in active TB rates for Vancouver Island (2006-2009) and the Interior (2008-2010) likely resulted from TB outbreaks documented during these periods.

Figure 2. Active TB Disease rates by Health Authority* in BC, 2003 to 2011



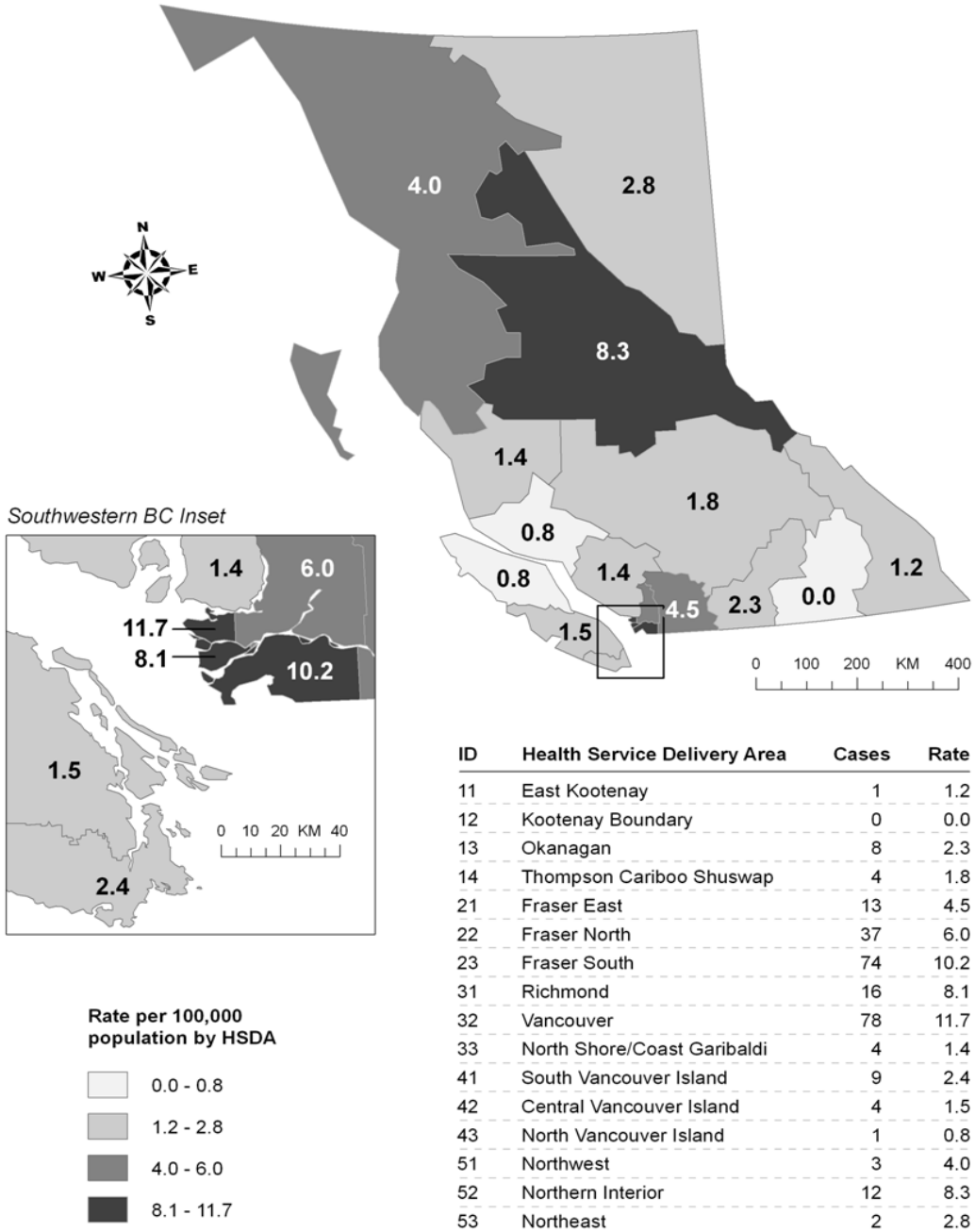
	2003	2004	2005	2006	2007	2008	2009	2010	2011
Interior	2.2	1.6	1.3	1.6	1.3	3.7	3.4	3.1	1.8
Fraser	8.2	7.7	7.2	9.0	7.2	7.5	8.0	6.8	7.6
Vancouver Coastal	15.1	15.4	12.4	13.7	11.1	11.0	10.4	7.8	8.7
Vancouver Island	2.7	2.1	2.4	4.0	4.5	3.9	3.7	2.0	1.8
Northern	5.6	4.5	5.6	5.7	7.5	7.0	7.0	4.9	5.9

* Residence classified at time of case

Active TB Rates by Health Service Delivery Area

Figure 3. Active TB Disease rates by Health Service Delivery Area* in BC, 2011

Vancouver had the highest rate of active TB in 2011 at 11.7/100,000 population, followed by Fraser South (10.2/100,000 population), the Northern Interior (8.3/100,000 population), and Richmond (8.1/100,000 population) (Figure 3). The lowest active TB rates occurred on the East Kootenay (1.2/100,000 population) and the Kootenay Boundary (0.0/100,000 population) HSDA.



ID	Health Service Delivery Area	Cases	Rate
11	East Kootenay	1	1.2
12	Kootenay Boundary	0	0.0
13	Okanagan	8	2.3
14	Thompson Cariboo Shuswap	4	1.8
21	Fraser East	13	4.5
22	Fraser North	37	6.0
23	Fraser South	74	10.2
31	Richmond	16	8.1
32	Vancouver	78	11.7
33	North Shore/Coast Garibaldi	4	1.4
41	South Vancouver Island	9	2.4
42	Central Vancouver Island	4	1.5
43	North Vancouver Island	1	0.8
51	Northwest	3	4.0
52	Northern Interior	12	8.3
53	Northeast	2	2.8
	Unknown	3	

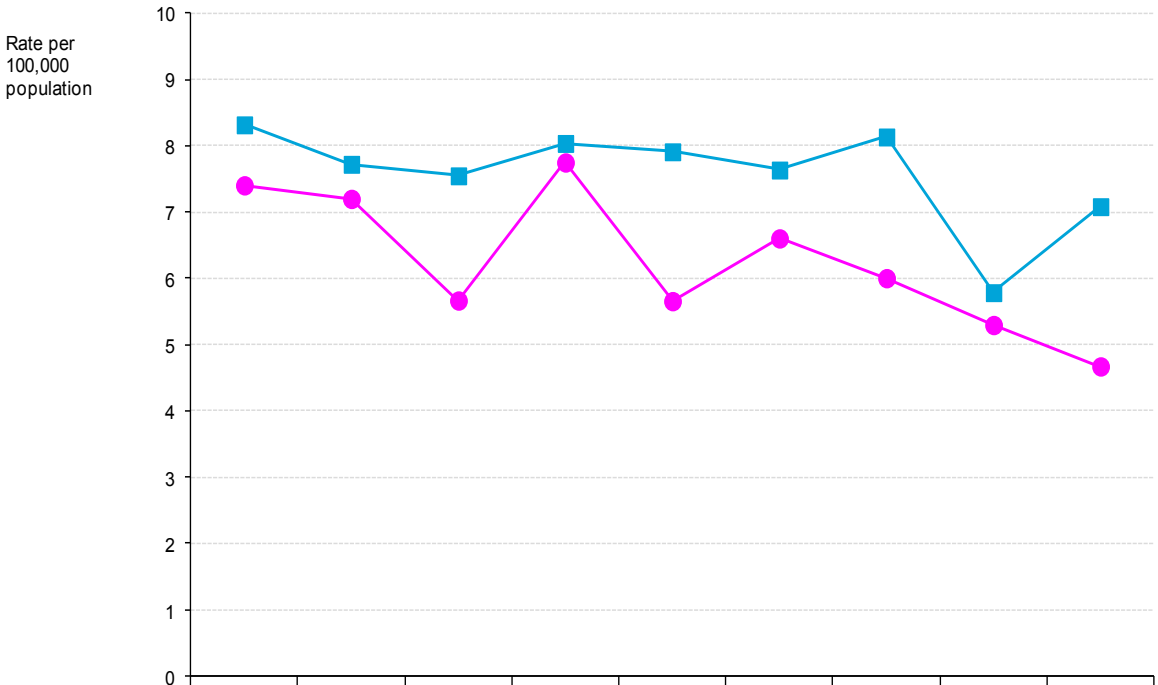
Rates calculated with population estimates released by BC Stats
* Health Service Delivery Area determined at time of case

Active TB by Age and Gender

The rate of active TB in men is consistently higher than in women (Figure 4). The rate of active TB in men in 2011 was 7.1/100,000 population, up from 5.8/100,000 in 2010. The rate of active TB in females in 2011 was 4.7/100,000, down from 5.3/100,000 in 2010.

In 2011, the greatest percentage of active TB cases in BC occurred in those 40-59 (30.1%) and 60 or older (39.0%) (Fig. 5). This older age distribution of cases is more pronounced in males than in females (Figure 6 and Figure 7). In 2011, the highest rate of active TB in men was in those >60 years of age (15.1/100,000 population) (Figure 8). In contrast, the highest rate of active TB in females occurred in those 30-39 years of age (7.9/100,000 population) followed by those >60 years of age (6.7/100,000 population) (Figure 8). Active disease in those <5 years of age indicates recent transmission because of the reduced probability of historic exposure and reactivation. Only a single case of active TB was diagnosed in those <5 years of age in 2011, compared to 2 cases in 2010.

Figure 4. Active TB disease rates by gender in BC, 2003 to 2011



	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rate - Female	7.4	7.2	5.7	7.8	5.7	6.6	6.0	5.3	4.7
Rate - Male	8.3	7.7	7.6	8.0	7.9	7.6	8.1	5.8	7.1
Cases - Female	154	151	120	166	123	146	135	121	108
Cases - Male	170	159	157	169	169	166	180	130	161
Cases - Other *	0	0	0	1	0	0	0	0	0

* Other - transgender and gender unknown

Figure 5. Percentage of active TB cases by age, 2003 to 2011

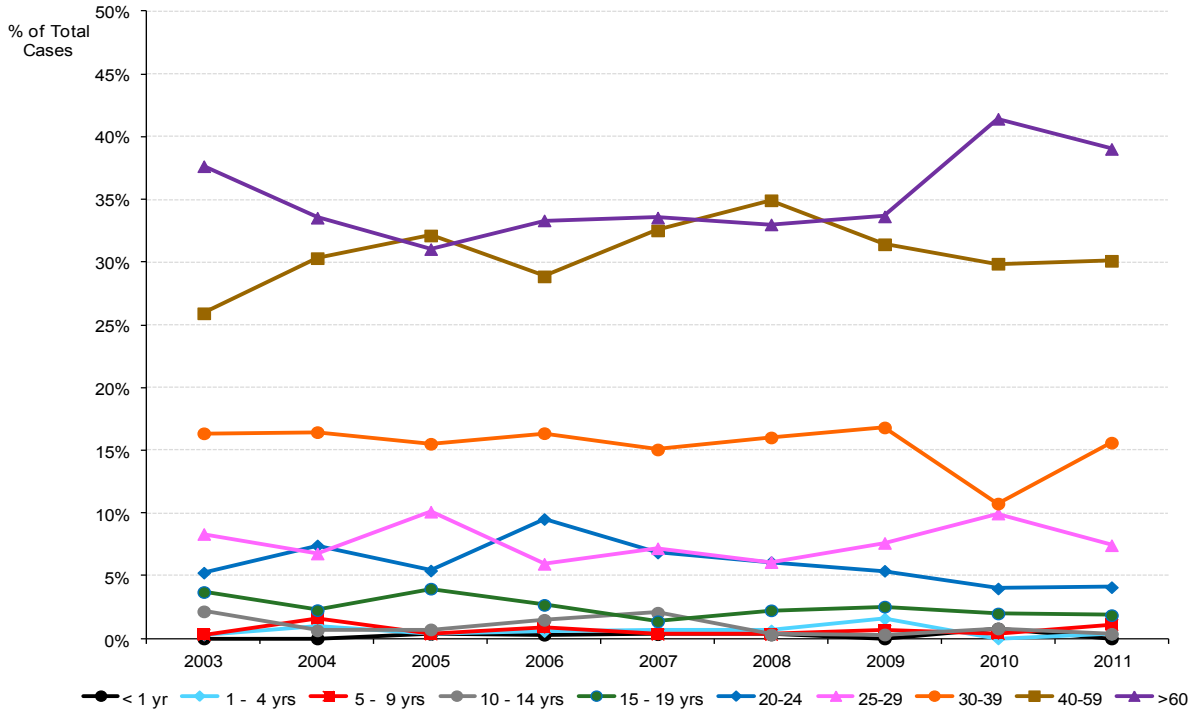


Figure 6. Percentage of active TB cases by age for females, 2003 to 2011

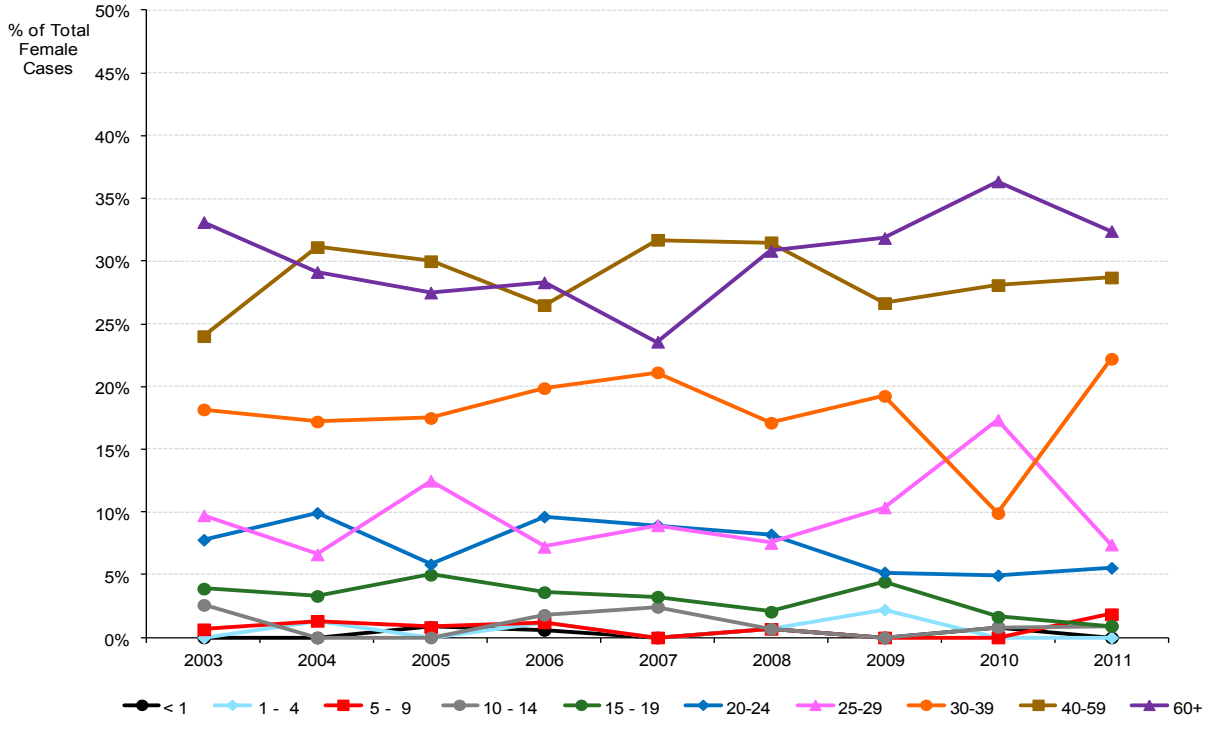


Figure 7. Percentage of active TB cases by age group for males, 2003 to 2011

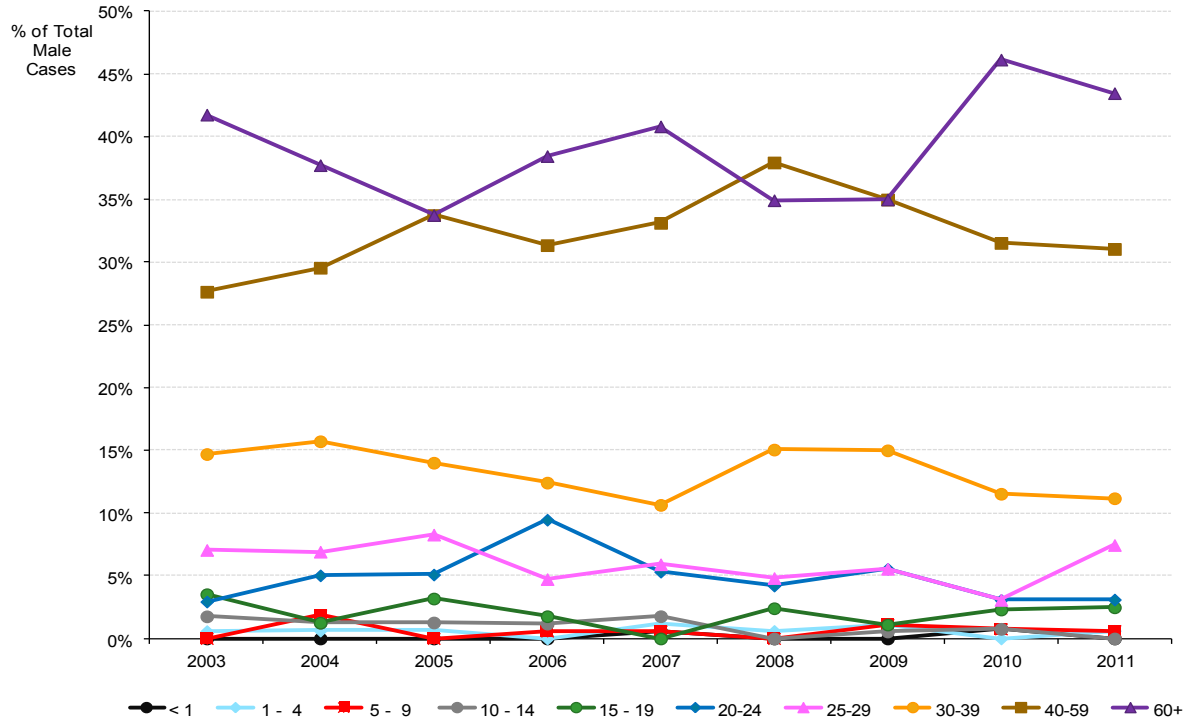
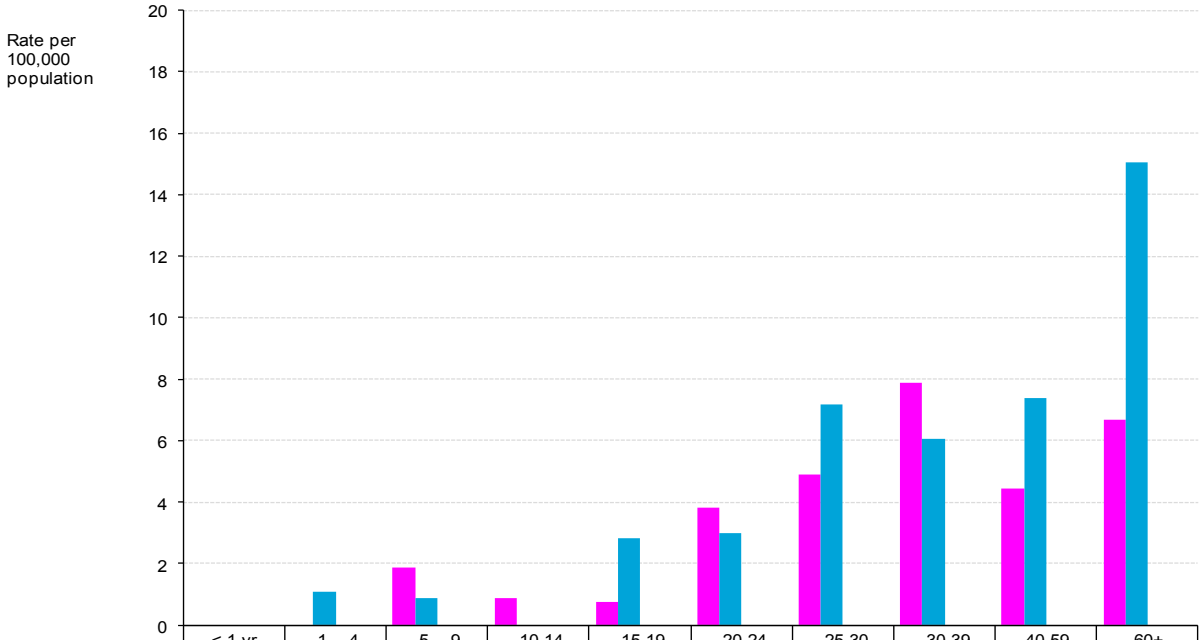


Figure 8. Active TB disease rates by gender and age in BC for 2011

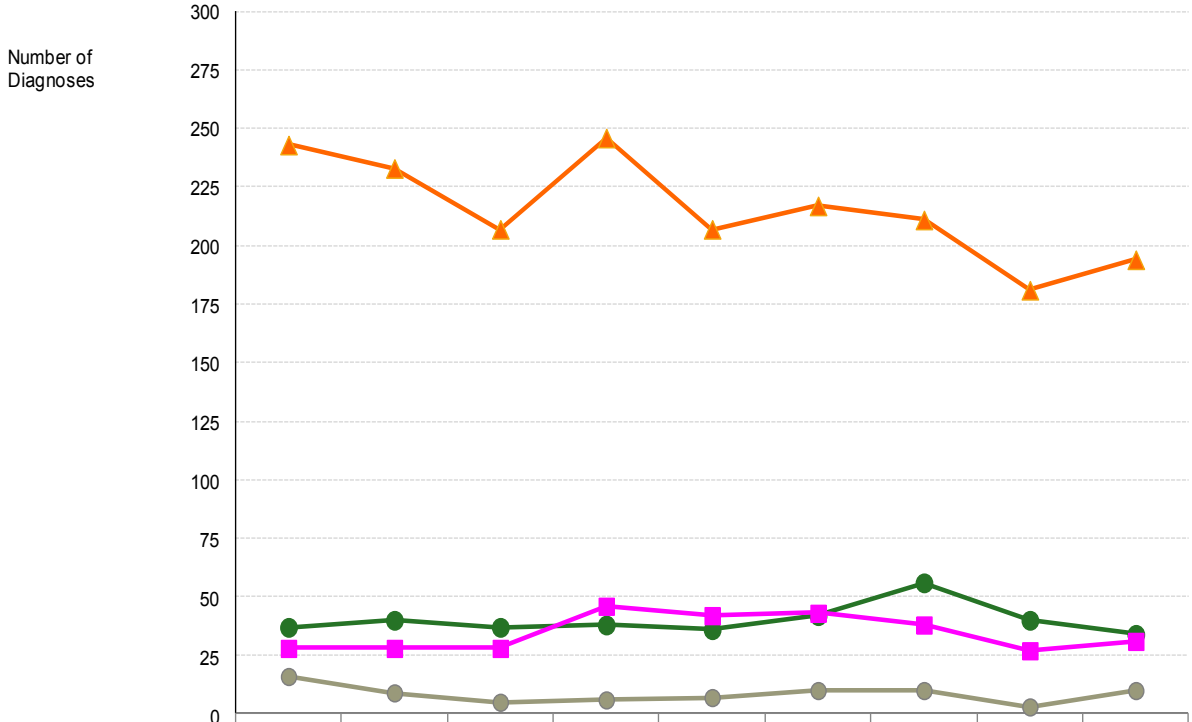


	< 1 yr	1 - 4	5 - 9	10-14	15-19	20-24	25-30	30-39	40-59	60+
Rates - Female	0.0	0.0	1.9	0.9	0.7	3.8	4.9	7.9	4.5	6.7
Rates - Male	0.0	1.1	0.9	0.0	2.8	3.0	7.2	6.1	7.4	15.1
Cases - Female	0	0	2	1	1	6	8	24	31	35
Cases - Male	0	1	1	0	4	5	12	18	50	70

Active TB by Origin

Between 2003 and 2011, 72.2% of active TB cases in BC occurred in the foreign-born population (n=1938), 13.4% in Canadian Born non-Aboriginals (n=360) and 11.6% in self-identified Aboriginal Peoples (First Nations, Métis, and Inuit) (n=311) (Figure 9). The number of foreign-born cases in BC has decreased over the last decade, but increased in 2011 compared to 2010. In 2011, 194 (72.1%) foreign-born cases were reported, with 181 (72.1%) reported in 2010 (Figure. 9). In contrast, the case totals for other groups have remained stable with only minor fluctuations. In 2011, there were 31 Aboriginal cases, compared to 27 in 2010. A total of 34 active TB cases in Canadian-born non-Aboriginals were diagnosed in 2011, compared to 40 in 2010. At the time of this report, 10 (3.7%) of active cases in 2011 have an unknown origin.

Figure 9. Active TB disease total by origin in BC, 2003 to 2011



	2003	2004	2005	2006	2007	2008	2009	2010	2011
Foreign Born	243	233	207	246	207	217	211	181	194
Can. Born-Non Abor.	37	40	37	38	36	42	56	40	34
Aboriginal Peoples	28	28	28	46	42	43	38	27	31
Unknown	16	9	5	6	7	10	10	3	10
TOTAL	324	310	277	336	292	312	315	251	269

Active TB among Aboriginal Peoples

The disproportionate burden of TB in Aboriginal Peoples in Canada stems from social and structural cases affecting Aboriginal communities such as social inequity, discrimination, and a history of residential schooling.[2] These root causes contribute to factors affecting disease transmission and progression including overcrowding, poverty, malnutrition, difficulty in accessing healthcare in remote communities, and a distrust of TB treatment owing to the family disintegration that resulted from the historic use of TB treatment facilities or sanitaria.[3] Despite these challenges, it is critically important to realize that the majority of Aboriginal communities are not at risk for TB, and that Aboriginal Peoples have strong networks that can provide resources with which to prevent and control the disease.

TB cases in Aboriginal Peoples in this report include only those who self-identified as Aboriginal at the time of diagnosis. Among the nearly 200,000 Aboriginal persons living in BC in 2006, approximately 66% are First Nations, 30% are Métis, and fewer than 5% are Inuit or other Aboriginal identity.[4] The remainder of this report will only present data for those Aboriginal Peoples who identified as First Nations because of the small number Métis and Inuit with TB (five or fewer TB cases were reported per year among Métis and Inuit people between 2003 and 2011), and the absence of population estimates for Métis and Inuit populations.

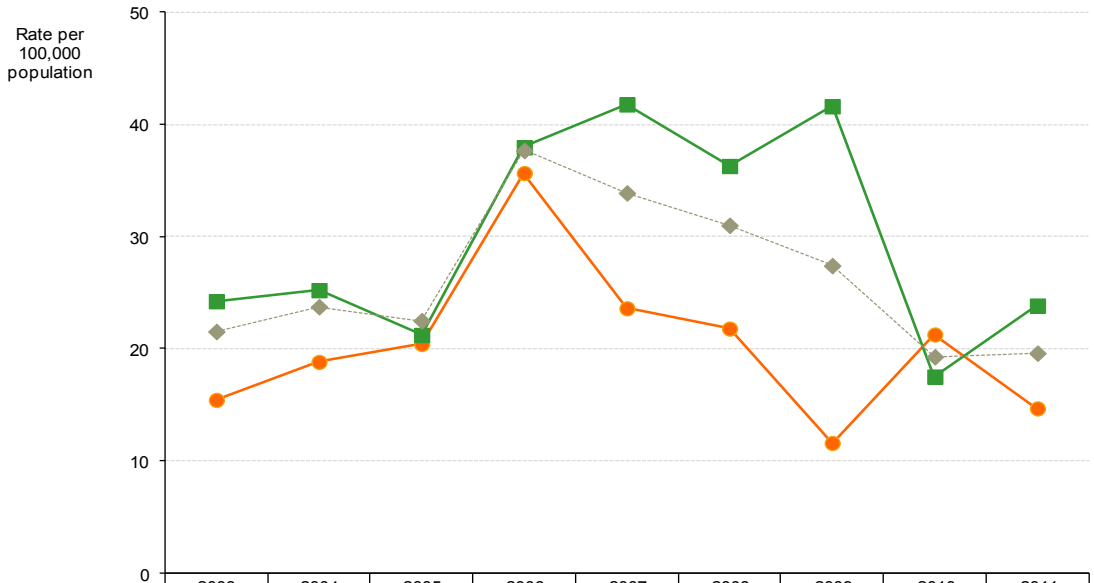
The rate of TB in First Nations people in 2011 was 19.6/100,000 population. The rate of TB in First Nations people was steady between 2003 and 2005, but increased to 37.7/100,000 population in 2006, taking nearly four years to return to pre-2006 levels (Figure 10). While the overall TB rate in First Nations people increased slightly in 2011 compared to 2010 (19.3/100,000 population), it remains lower than any year between 2003 and 2009.

The use of aggregate rates masks meaningful differences in TB rates among those living On-and-Off Reserve. In 2011, the TB rate among On-reserve groups (14.7/100,000 population) decreased from 2010 (21.3/100,000 population) and is consistent with historic trends, with the exception of an increase in TB rates in 2006 (Figure 10). The TB rates is typically higher among Off-reserve groups, with an increase in 2011 (23.8/100,000 population) from 2010 (17.5/100,000 population). The rate of TB among Off-reserve groups also increased in 2006, and remained elevated until 2010 due to an unusually high number of Off-Reserve cases in Vancouver Coastal and Vancouver Island during this period. In 2011, the rate of TB among First Nations living Off-Reserve increased from 2010 levels yet remains lower than any year since 2003. It should be noted that fluctuations in the TB rate for First Nations people is expected given the small number of yearly cases.

In 2011, as in the previous 2 years, the highest number of TB cases among First Nations people were in the Northern Health Authority (10 cases, 38.5%), followed by Vancouver Coastal (6 cases, 23.1%) and Fraser (5 cases, 19.2%). Three cases were detected on Vancouver Island (11.5%), and two were diagnosed in the Interior Health Authority in 2011 (7.7%).

The overall rate of TB in First Nations males and females in 2011 was 24.5/100,000 and 14.9/100,000 population, respectively. The large fluctuation in gender specific rates across years is likely due primarily to the small number of cases (Figure 11). No TB cases were diagnosed in First Nations people less than 20 years of age in BC in 2011, the first time this has occurred since 2003 (Figure 12). The highest rate for both males and females in 2011 occurred in those 60 years of age or older, with rates of 62.5/100,000 population for males and 35.8/100,000 population for females in this age group.

Figure 10. Active TB disease rates for First Nations peoples on and off reserve in BC, 2003 to 2011.



	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rate - On Reserve	15.4	18.8	20.4	35.7	23.6	21.8	11.6	21.3	14.7
Rate - Off Reserve	24.2	25.2	21.2	38.0	41.8	36.3	41.6	17.5	23.8
Rate - Total (incl. unkn.)	21.5	23.7	22.5	37.7	33.9	31.0	27.4	19.3	19.6
Cases - On Reserve	9	11	12	21	14	13	7	13	9
Cases - Off Reserve	14	15	13	24	27	24	28	12	17
Cases - Unkw. Residence	2	2	2	1	1	2	0	0	0

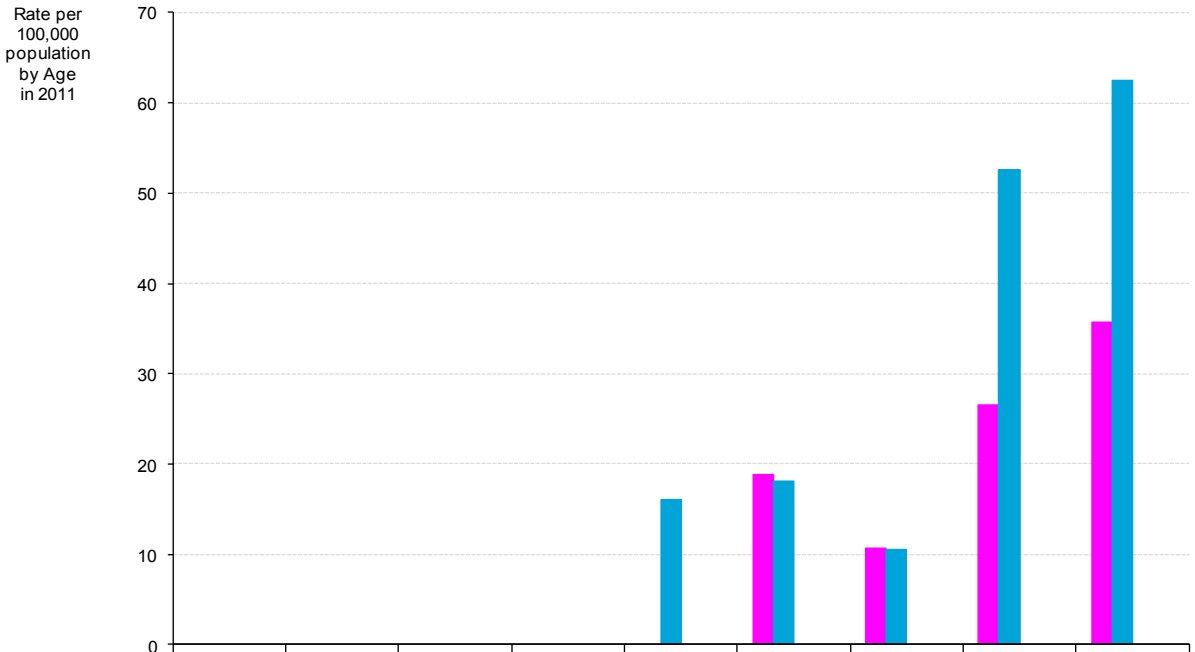
* Unknown Residence - has no on reserve status listed
Rates based on First Nations population estimates from Aboriginal Affairs and Northern Development Canada (AANDC)

Figure 11. Active TB disease rates for First Nations peoples by gender in BC, 2003 to 2011

	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rate - Male	28.1	27.6	25.4	25.0	47.6	27.5	36.6	14.1	24.5
Rate - Female	15.2	20.0	19.7	49.9	20.6	34.4	18.5	24.3	14.9
Rate - Total	21.5	23.7	22.5	37.7	33.9	31.0	27.4	19.3	19.6
Cases - Male	16	16	15	15	29	17	23	9	16
Cases - Female	9	12	12	31	13	22	12	16	10

Rates based on First Nations population estimates from Aboriginal Affairs and Northern Development Canada (AANDC)

Figure 12. Active TB Disease rates for First Nations peoples by gender and age in BC for 2011.



	0 - 4 yrs	5 - 9 yrs	10 - 14 yrs	15 - 19 yrs	20 - 24 yrs	25-29 yrs	30-39	40-59	60+
Rate - Female	0.0	0.0	0.0	0.0	0.0	18.8	10.7	26.5	35.8
Rate - Male	0.0	0.0	0.0	0.0	16.0	18.2	10.5	52.7	62.5
Cases - Female	0	0	0	0	0	1	1	5	3
Cases - Male	0	0	0	0	1	1	1	9	4

Rates based on First Nations population estimates from Aboriginal Affairs and Northern Development Canada (AANDC)

Active TB among Foreign-born Populations

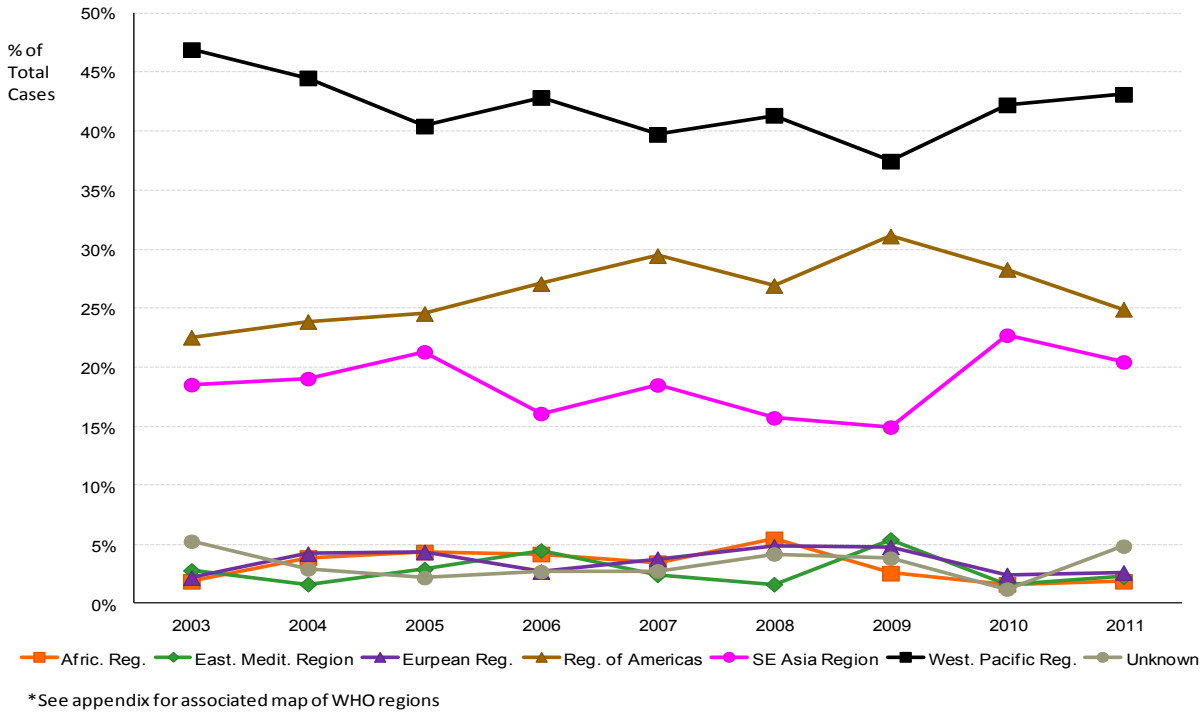
Between 2003 and 2011, 72.2% of active TB cases in BC occurred in the foreign-born population (n=1938) (Figure 9). This is not unique to BC as the foreign-born population in Canada has a rate of active TB that is 13 times that of Canadian-born non-Aboriginal Peoples.[5] Many of BC's recent immigrants come from regions with high rates of active TB such as the World Health Organization (WHO) South-east Asia and Western Pacific region[1,6] resulting in a large number of individuals with latent TB infection (LTBI). Citizenship and Immigration Canada (CIC) currently screen immigrants applying for permanent residency for active TB, as well as all students, visitors or workers staying for more than 6 months.[7] Visitors, students or workers staying less than 6 months do not undergo CIC screening.

Individuals with historic signs of active TB are allowed entry into Canada and are referred for post-landing medical surveillance. As part of this process, these individuals are required to contact public health authorities within 30 days of landing. Post landing surveillance is passive and up to half of those identified at pre-immigration screening are lost to follow-up. The rate of active TB in foreign-born people is highest in the first 5 years after landing[7], however, the greatest number of cases occur in older individuals in whom disease activates years after arrival as after the development of co-morbidities like diabetes.

The highest numbers of yearly active TB cases in BC consistently occur in groups from the Western Pacific region followed by the Region of the Americas and the South East Asian Region (Figure 13, see Additional Map, pg. 51); in 2011, there were 116, 67, and 55 cases of active TB from these regions, respectively. Fewer than 20 cases of active TB were diagnosed each year in individuals from each of the other WHO regions. Recent work at the BCCDC shows that the rate of disease in groups defined by birth country is partially predicted by the rate of active TB in the country of origin, further supporting the notion that much of the TB diagnosed in foreign-born after landing results from activation of historic exposure, and not novel transmission.

In 2011, foreign-born cases of active TB were slightly younger (median: 51.5 years) then were non-foreign-born cases (median: 55.0 years). In 2011, 57% of foreign-born cases were male. The age breakdown of foreign-born active TB cases is similar to that of provincial totals, with 38.7% of foreign-born cases occurring in those over 60 years of age and with 27.8% between 40-59 years of age (Figure 14). The age breakdown for foreign-born males shows a higher percentage of older cases of active TB than for females, with the 2011 age breakdown for men being group consistent with historic fluctuations (Figure 15 and Figure 16). There is a noticeable increase from 2010 to 2011 in the percent of foreign-born female cases aged 30-39 years of age, however the 2011 value is within the range of historic trends.

Figure 13. Percentage of total active TB disease cases for foreign-born peoples by WHO region in BC, 2003 to 2011



*See appendix for associated map of WHO regions

Figure 14. Percentage of total active TB disease cases for foreign-born peoples in BC by age groupings, 2003 to 2011

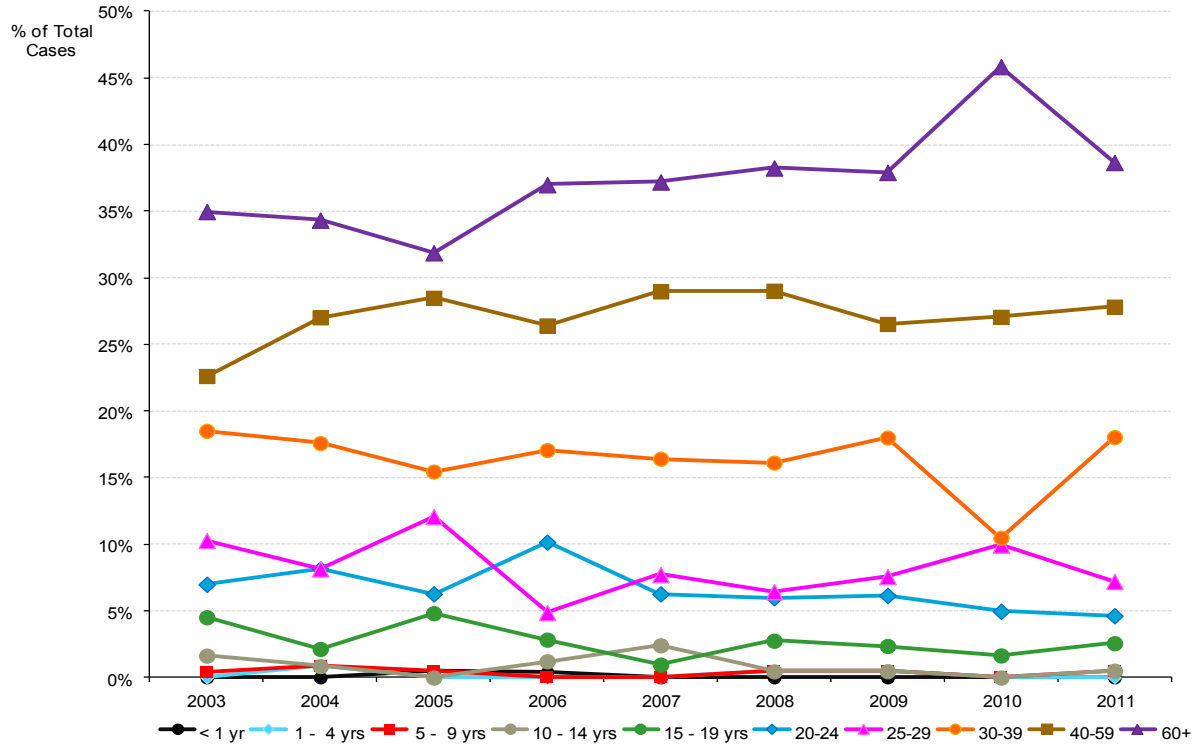


Figure 15. Percentage of total male active TB cases for foreign-born peoples in BC by age groupings, 2003 to 2011

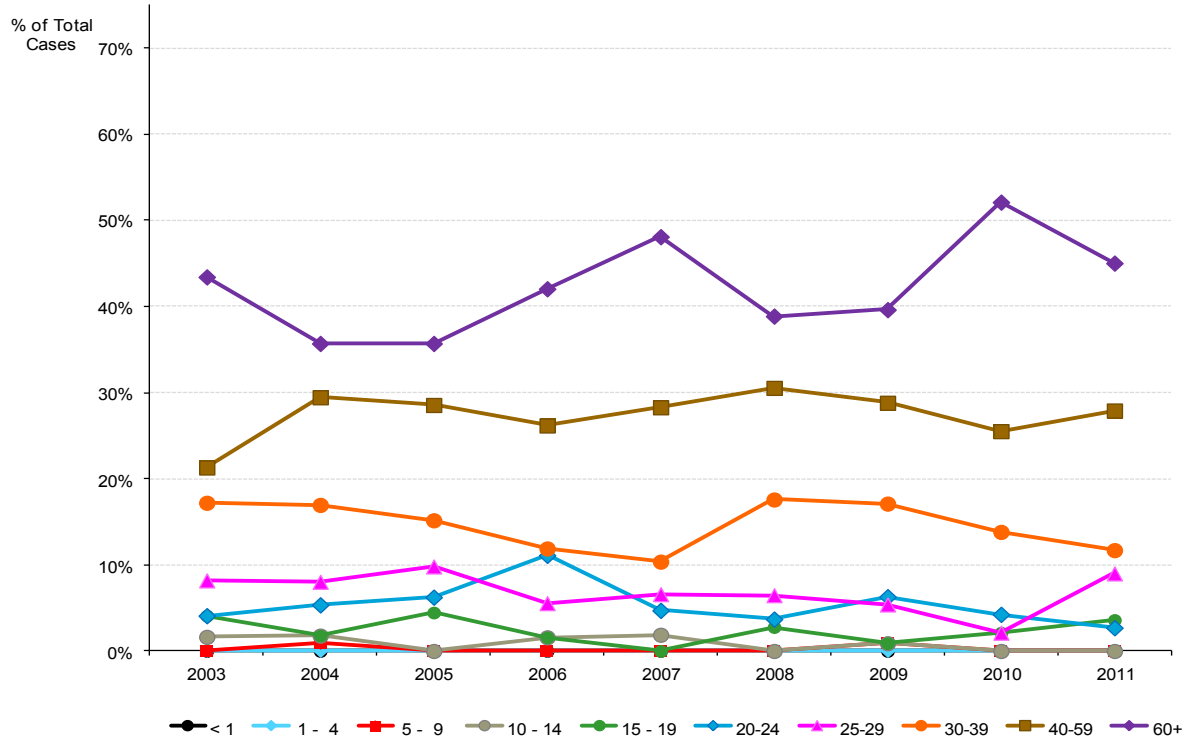
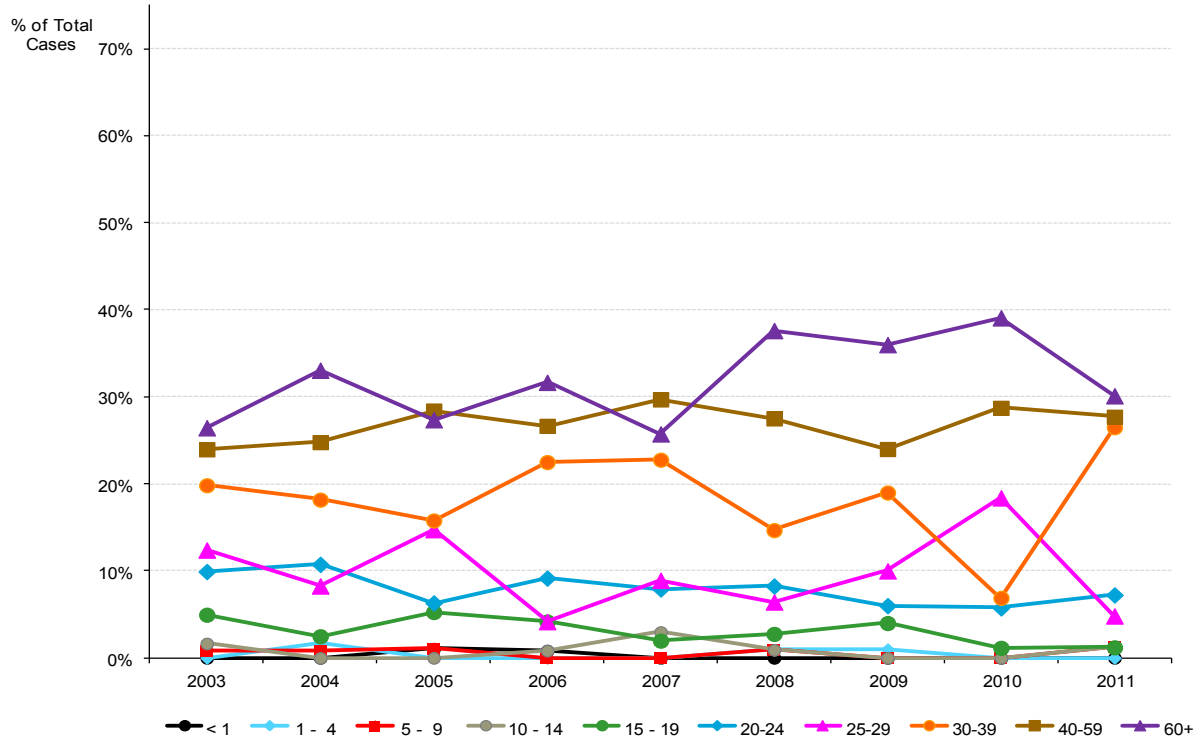


Figure 16. Percentage of total female active TB cases for foreign-born peoples in BC by age groupings, 2003 to 2011



Reason for Diagnosis

The majority of active TB cases in BC between 2003 and 2011 were diagnosed as a result of patients having symptoms compatible with the site of TB; in 2011, 69.9% of patients were diagnosed for this reason, up from 68.9% in 2010 (Table 1). In 2010 and 2011, 5.6% of active TB cases were documented as detected through contact tracing. In 2011, 6.7% of cases were identified through immigration screening and 7.4% were diagnosed through incidental findings.

Table 1. Percentage of total cases of active TB in BC, 2003 to 2011

	% of Total Cases								
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Symptoms Comp. With Site	79.3	80.6	81.2	76.8	71.6	72.8	74.0	68.9	69.9
Contact Investigation	3.4	2.9	2.5	4.2	6.5	7.1	7.6	5.6	5.6
Screening: Immigration	4.0	5.5	4.7	6	5.8	5.1	3.8	6	6.7
Screening: Occupation	0	0.3	0.7	0.9	0.3	0.3	0.0	0.8	0.7
Incidental Findings [1]	2.5	1.9	0.7	1.8	5.1	3.5	4.4	8.8	7.4
Post Mortem	3.4	2.6	2.2	2.1	3.1	3.2	1.9	0.8	1.1
Other	7.4	6.1	7.9	8.3	7.5	8.0	8.3	9.2	8.6
Total Cases	**324**	**310**	**277**	**336**	**292**	**312**	**315**	**251**	**269**

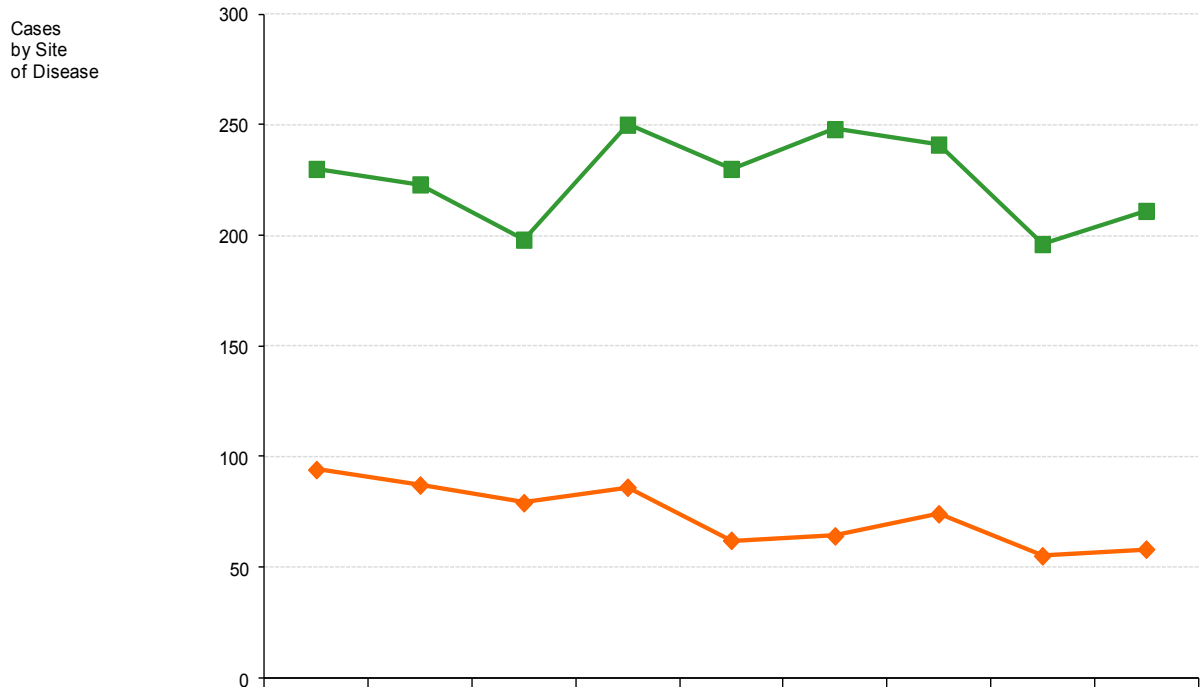
[1] Detection through Incidental findings indicates that the individual sought medical attention for another cause, and TB was detected incidentally.

Site of Disease

The site of active TB describes the location of bacterial infection, and respiratory infection is more transmissible than non-respiratory infection[8]. In 2011, 78.4% (n=211) of active TB cases were respiratory, up from 78.1% (n=196) in 2010 (Figure 17). Of respiratory cases in 2011, 91.9% were pulmonary, 4.3% were classified as other respiratory, 3.3% were miliary, and 0.5% were diagnosed as primary infections (Figure 17). Primary infections are perhaps the most severe form of TB and often affect children.[8] The percentage of miliary TB cases in 2011 (3.3% of all respiratory cases) is the highest seen in the last 9 years, although it should be noted yearly fluctuations are likely driven by small numbers (Table 2).

In 2011, 21.6% (n=58) of cases were non-respiratory, compared to 21.9% (n=55) of cases in 2010. That pattern observed in 2011 is consistent with the historic trend. Of the non-respiratory cases in 2011, 58.6% (n=n=34) occurred in the Peripheral Lymph Nodes, 3.4% (n=2) occurred in the meninges and CNS, and 37.9% (n=22) were classified as other (Table 2).

Figure 17. Cases of respiratory and non-respiratory TB, 2003 to 2011



	2003	2004	2005	2006	2007	2008	2009	2010	2011
Cases - Total Resp.*	230	223	198	250	230	248	241	196	211
Cases - Total Non-Resp.	94	87	79	86	62	64	74	55	58
% - Total Resp.	71.0	71.9	71.5	74.4	78.8	79.5	76.5	78.1	78.4
% - Total Non-Resp.	29.0	28.1	28.5	25.6	21.2	20.5	23.5	21.9	21.6

* Respiratory includes all cases classified as pulmonary, primary, miliary, and other pulmonary.

Table 2. Percentage of total active TB cases by site classification in BC, 2003 to 2011

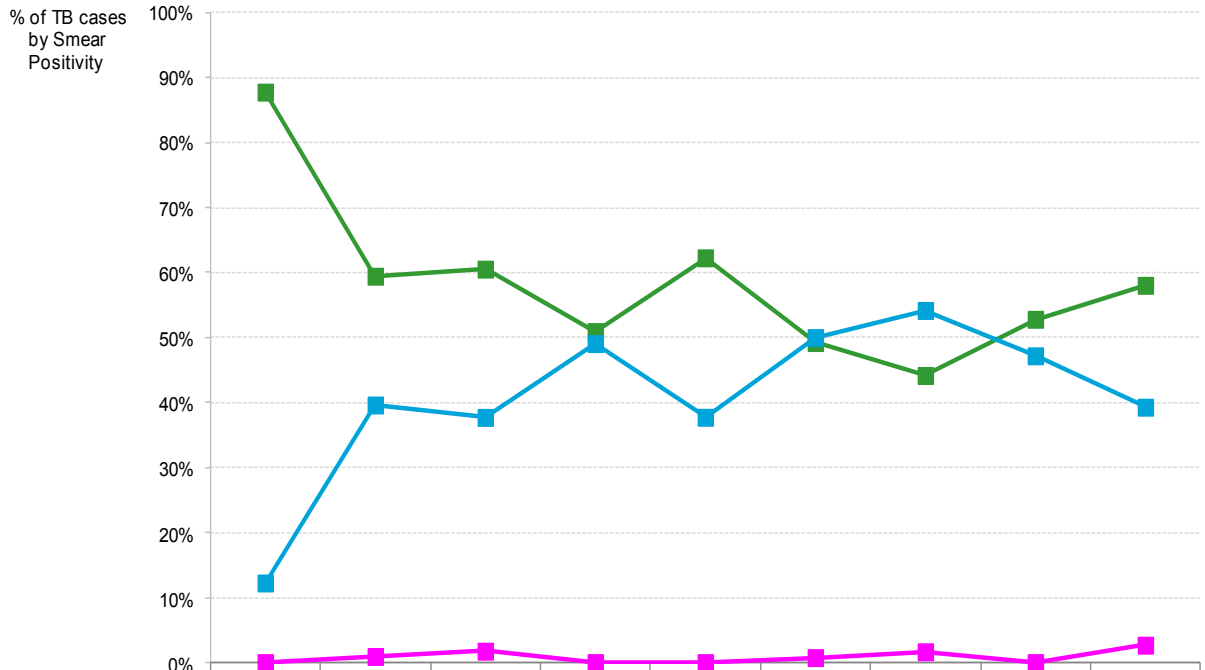
% of Total Cases	2003	2004	2005	2006	2007	2008	2009	2010	2011
Respiratory									
% Primary	2.2	4.0	2.0	2.8	0.4	1.2	2.1	2.0	0.5
% Pulmonary	89.1	85.7	88.4	86.8	89.1	93.1	90.5	89.8	91.9
% Miliary	1.7	1.3	0.0	0.0	0.0	0.0	0.8	1.0	3.3
% Other	7.0	9.0	9.6	10.4	10.4	5.6	6.6	7.1	4.3
% - Total Resp.	***71.0***	***71.9***	***71.5***	***74.4***	***78.8***	***79.5***	***76.5***	***78.1***	***78.4***
Non-Respiratory									
% Meninges and CNS	5.3	5.7	6.3	4.7	8.1	1.6	6.8	7.3	3.4
% Peripheral Lymph Node	58.5	49.4	46.8	61.6	53.2	43.8	51.4	61.8	58.6
% Other	36.2	44.8	46.8	33.7	38.7	54.7	41.9	30.9	37.9
% - Total Non-Resp.	***29.0***	***28.1***	***28.5***	***25.6***	***21.2***	***20.5***	***23.5***	***21.9***	***21.6***
Unknown Cases	0	0	0	0	0	0	0	0	1
Total Cases	**324**	**310**	**277**	**336**	**292**	**312**	**315**	**251**	**269**

Degree of Smear Positivity

The BCCDC receives documentation of positive sputum smear results only. Smear positivity characterizes the infectiousness of a given patient with the Acid Fast Bacteria (AFB) classification signifying the quantity of bacteria contained in a sample; hence AFB 3/4+ patients are more infectious than AFB 1/2+ patients.[8]

In 2011, 54.6% (n=112) of active respiratory cases had a smear result documented in iPHIS, compared to 35.4% (n=89) in 2010 (Figure 18). Of these cases with known smear positivity in 2011, 39.3% had smear positivity 3+ or greater, down from a peak of 54.2% in 2009. The percentage of total pulmonary cases having a documented smear that was AFB 3/4+ generally increased from 2003-2009, but has decreased in recent years. Note that the values observed in 2003 are not consistent with overall trends and may represent coding artifacts resulting from the transition to iPHIS.

Figure 18. Percentage of total smears submitted to BCCDC by severity in BC, 2003 to 2011



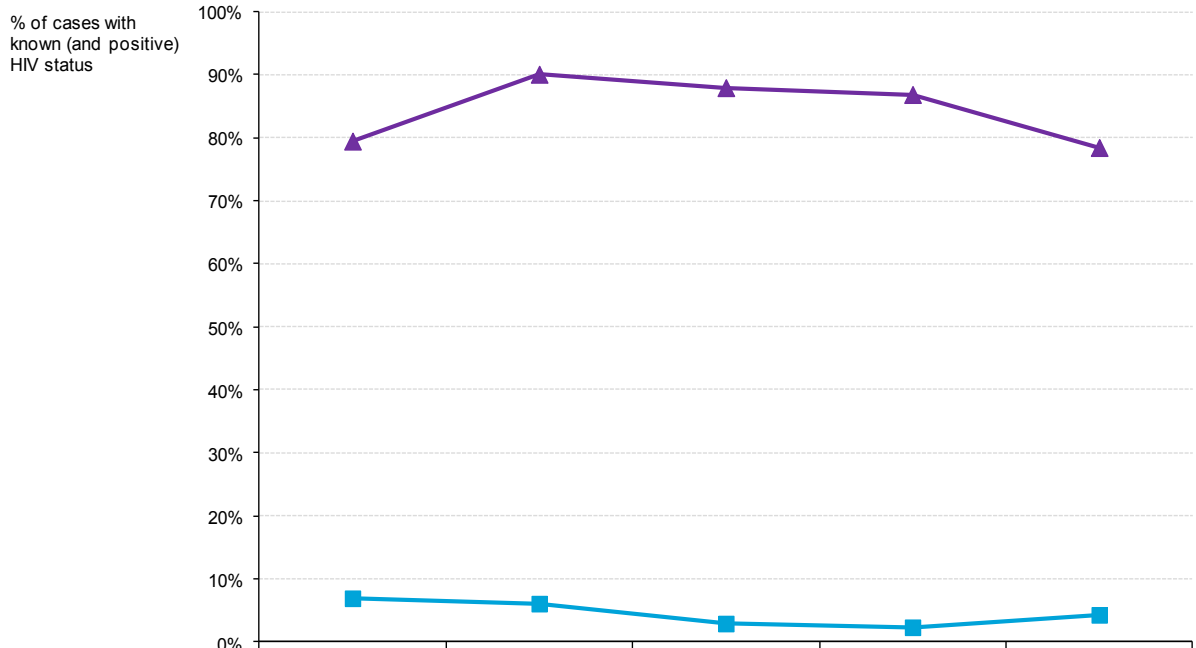
	2003	2004	2005	2006	2007	2008	2009	2010	2011
% - AFB1/2+*	87.8	59.4	60.5	50.9	62.3	49.2	44.2	52.8	58.0
% - AFB 3/4+	12.2	39.6	37.7	49.1	37.7	50.0	54.2	47.2	39.3
% - Other	0.0	0.9	1.8	0.0	0.0	0.8	1.7	0.0	2.7
Cases - AFB1/2+*	86	63	69	55	66	64	53	47	65
Cases - AFB 3/4+	12	42	43	53	40	65	65	42	44
Cases - Other	0	1	2	0	0	1	2	0	3

* This category also contains a small number of cases with "positive" or "seen".

HIV Screening and Co-infection

Only data collected 2007 or later is presented here because HIV data was previously incompletely documented. In 2011, 78.4% of active TB cases had a known HIV status (including self-reported status), down from 86.9% in 2010. Of those with known status, 4.3% had HIV infection in 2011 as indicated by self report or lab report, up from 2.3% in 2010 (Figure 19). The decreasing percentage of HIV positive active TB cases since 2007 may partially result from increases in the availability and use of anti-retroviral medications in the province, resulting in an elevated CD4 count and a decreased probability of TB activation in HIV infected patients.

Figure 19. Percentage of active TB Cases with known HIV status in BC, 2007 to 2011



	2007	2008	2009	2010	2011
% - Positive*	6.9	6.0	2.9	2.3	4.3
% - Known Status#	79.5	90.1	87.9	86.9	78.4
Total - Positive	16	17	8	5	9
Cases - Status Known	232	281	277	218	211

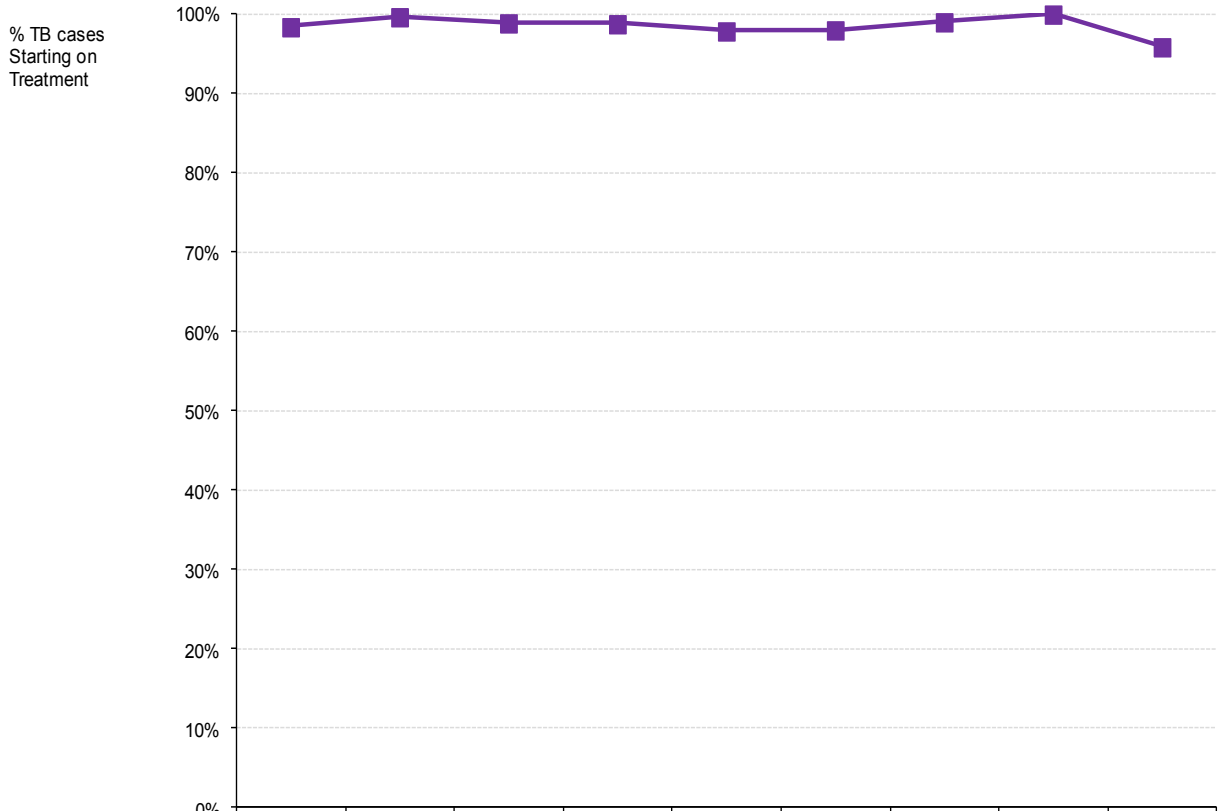
Known status includes results from testing, as well as self-reported status
* % positive of those with known status

B. Treatment of Active Cases

Number of Active Cases Starting Treatment

Here we present data on the percentage of cases starting treatment in a subgroup of all active cases, excluding those diagnosed post-mortem. In this group, the percentage of active cases starting treatment in BC has remained near, or above 95%, since 2003. In 2011, 95.9% of all active cases started treatment, down from 100.0% in 2010 (Figure 20). In 2011, a total of 13 cases (4.8%) have no documented treatment start date, with 2 of these individuals identified post-mortem.

Figure 20. Percentage of total TB Cases treated in BC, 2003 to 2011



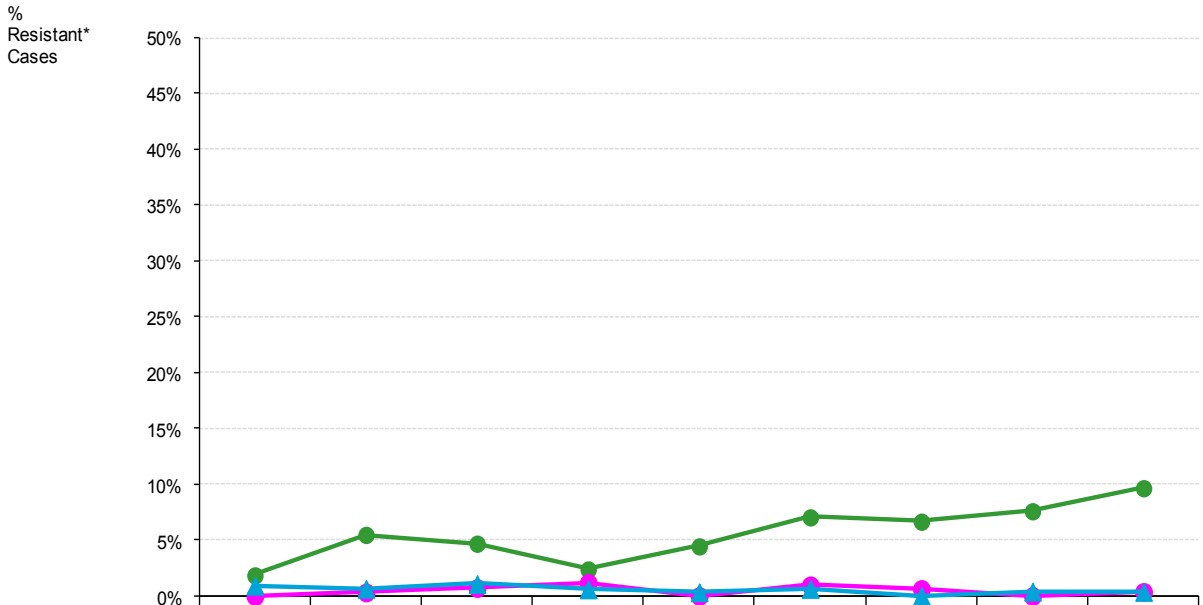
	2003	2004	2005	2006	2007	2008	2009	2010	2011
% - Starting Treatment	98.4	99.7	98.9	98.8	97.9	98.0	99.0	100.0	95.9

Drug Resistance

The percentage of cases with iINH resistance has increased from 7.6% in 2010 to 9.7% in 2011 (Figure 21). This increase is consistent with historic provincial trends, and is expected given increases in both the worldwide rates of drug resistance[9] and the number of immigrants from countries with high-rates of endemic TB. Such patterns further emphasize the importance of post-landing follow-up of recent immigrants in 2-years after arrival. The percentage of total active TB cases with Rifampin resistance remains low at 0.4% (n=1) of cases in 2011.

Multi-Drug Resistant TB (MDRTB, combined INH and RIF resistance) is also rare, with only a single case of MDRTB seen in both 2010 and 2011. No extensively drug resistant TB (XTRTB) has been diagnosed in BC.

Figure 21. Percentage of total cases with drug resistance in BC, 2003 to 2011



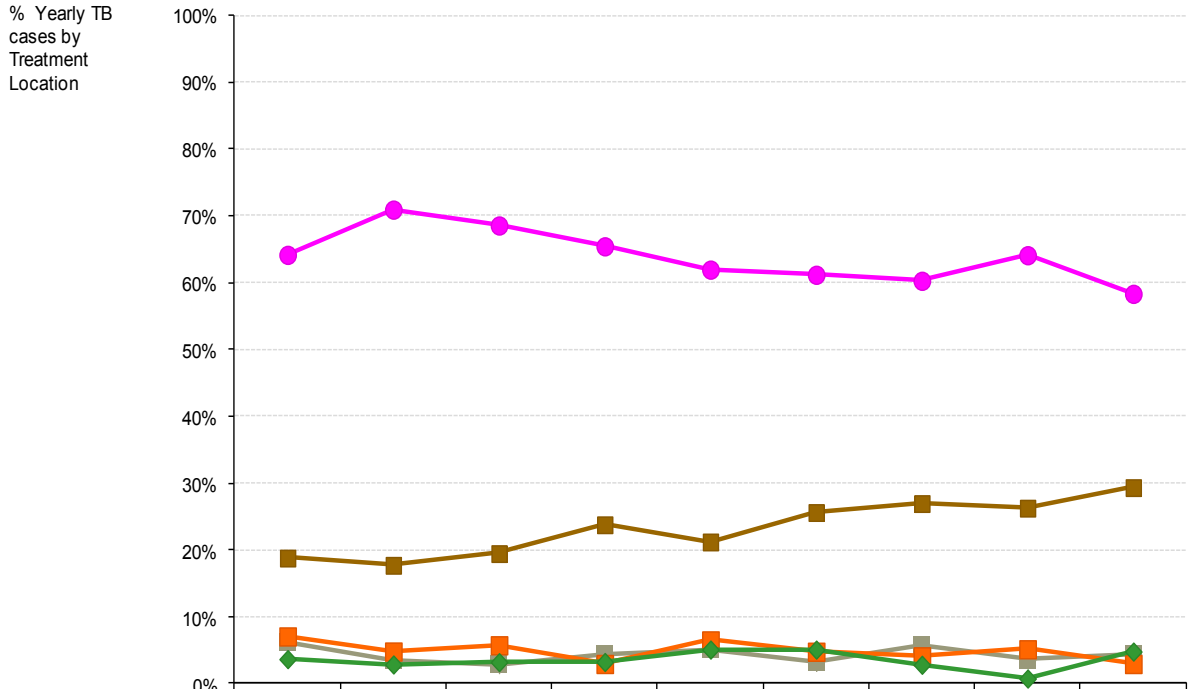
	2003	2004	2005	2006	2007	2008	2009	2010	2011
% - Isoniazid	1.9	5.5	4.7	2.4	4.5	7.1	6.7	7.6	9.7
% - Rifampi	0.0	0.3	0.7	1.2	0.0	1.0	0.6	0.0	0.4
% - Both	0.9	0.6	1.1	0.6	0.3	0.6	0.0	0.4	0.4
Cases - Isoniazid	6	17	13	8	13	22	21	19	26
Cases - Rifampin	0	1	2	4	0	3	2	0	1
Cases - Both	3	2	3	2	1	2	0	1	1
Total	324	310	277	336	292	312	315	250	269

*Resistance to drugs other than Isoniazid or Rifampin is not represented here.

Setting Where Treatment Started

Of patients starting treatment in 2011, 29.4% received their first documented treatment in a hospital, 58.4% in an outpatient setting, 3.0% in the TB Ward at Vancouver General Hospital, and 4.5% outside of BC; 4.8% did not have documented treatment (Figure 22). The number of patients starting treatment in a general hospital has increased from 26.3% in 2010 to 29.4% in 2011, while the number starting treatment in out-patient facilities decreased from 64.1% in 2010 to 58.4% in 2011. Both the decrease in those starting treatment as outpatients and the increase in those starting treatment at Vancouver General Hospital are consistent with historic trends. The percentage of patients starting treatment in the TB ward also decreased from 5.2% in 2010 to 3.0% in 2011.

Figure 22. Percentage of total active TB cases by treatment location in BC, 2003 to 2011

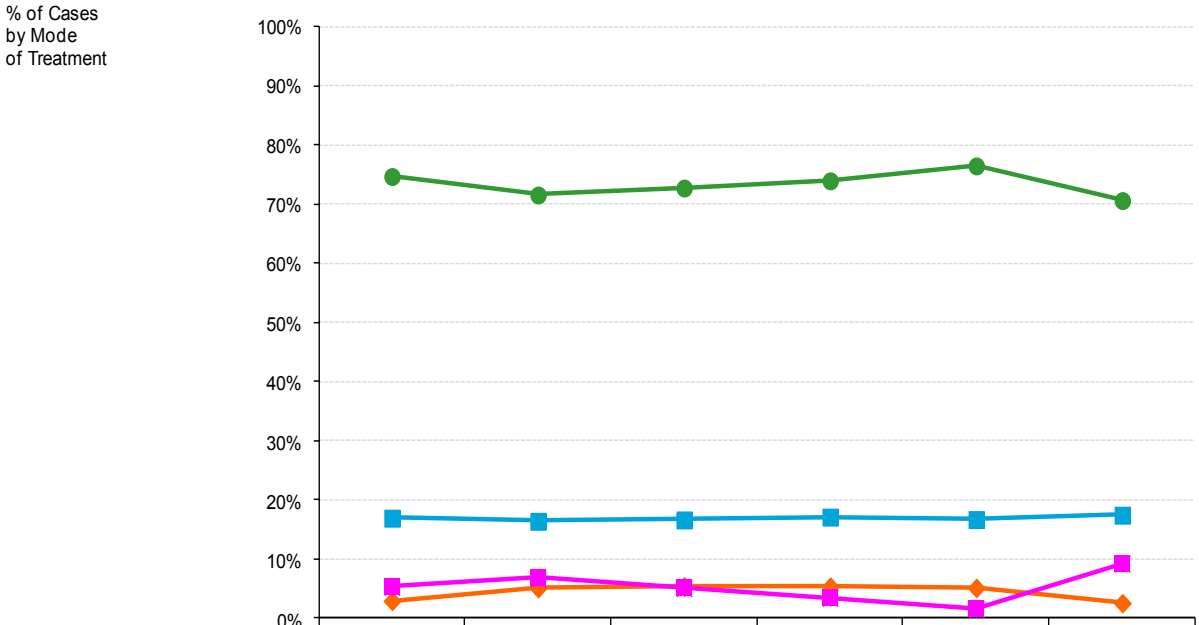


	2003	2004	2005	2006	2007	2008	2009	2010	2011
% - General Hospital	18.8	17.7	19.5	23.8	21.2	25.6	27.0	26.3	29.4
% - Out-Patient	64.2	71.0	68.6	65.5	62.0	61.2	60.3	64.1	58.4
% - Outside BC	6.2	3.5	2.9	4.5	5.1	3.2	5.7	3.6	4.5
% - TB Ward	7.1	4.8	5.8	3.0	6.5	4.8	4.1	5.2	3.0
% - No Treatment	3.7	2.9	3.2	3.3	5.1	5.1	2.9	0.8	4.8

Major Mode of Treatment

The primary mode of treatment has only been documented in iPHIS since 2006, and trends have been stable since this time. Since 2006, at least 70% of active cases self-administered their treatment, with 70.6% of patients receiving care this way in 2011 (Figure 23). The percentage of patients receiving directly observed therapy (DOT) increased from 16.7% in 2010 to 17.5% in 2011. In contrast, the percentage of patients with self-administered treatment decreased from 76.5% in 2010 to 70.6% in 2011, although this occurred concurrently with an increase in the percentage of unknowns.

Figure 23. Percentage of total active case by mode of treatment in BC for 2011



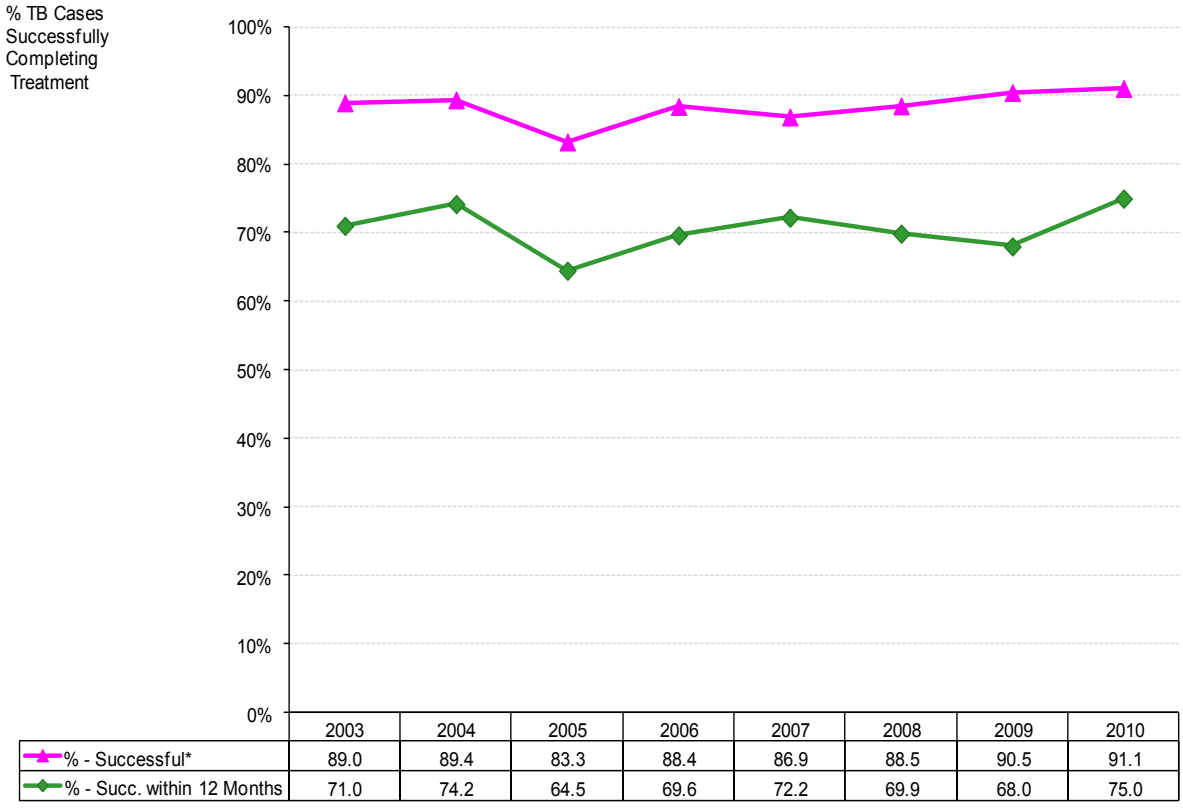
	2006	2007	2008	2009	2010	2011
% - Daily Self-Administered	74.7	71.6	72.8	74.0	76.5	70.6
% - DOT	17.0	16.4	16.7	17.1	16.7	17.5
% - Other	3.0	5.1	5.4	5.4	5.2	2.6
% - Unknown	5.4	6.8	5.1	3.5	1.6	9.3
Cases - Daily Self-Administered	251	209	227	233	192	190
Cases - DOT	57	48	52	54	42	47
Cases - Other	10	15	17	17	13	7
Cases - Unknown	18	20	16	11	4	25

Treatment Completion

Active TB treatment completion is clinically defined and evaluated only for 2003-2010 due to expected delays in documenting treatment completion for those starting treatment at the end of 2011. The percentage of patients completing treatment for active TB disease remained stable over the last 9 years. In 2010, 91.1% percent of patients starting treatment successfully completed treatment, with 75.0% doing so within 12 months (Figure 24).

Of those patients who did not complete active TB treatment in 2010 (not including those who died), a total of 20.8% were lost to follow-up, 12.5 % were non-adherent, and 8.3% had negative drug reactions (Table 3). The percentage of active TB cases that were lost to follow-up or had a negative drug reaction was at a 9-year high in 2010.

Figure 24. Percentage of active TB Cases# by treatment success in BC, 2003 to 2010



	2003	2004	2005	2006	2007	2008	2009	2010
% - Successful*	89.0	89.4	83.3	88.4	86.9	88.5	90.5	91.1
% - Succ. within 12 Months	71.0	74.2	64.5	69.6	72.2	69.9	68.0	75.0

Data does not include those individuals dying during the course of treatment, or those having left the province during treatment.
* Successful treatment indicated solely by iPHIS indicator witn no associated time frame

Table 3. Percentage of documented treatment failures in BC by reason for failure, 2003 to 2010

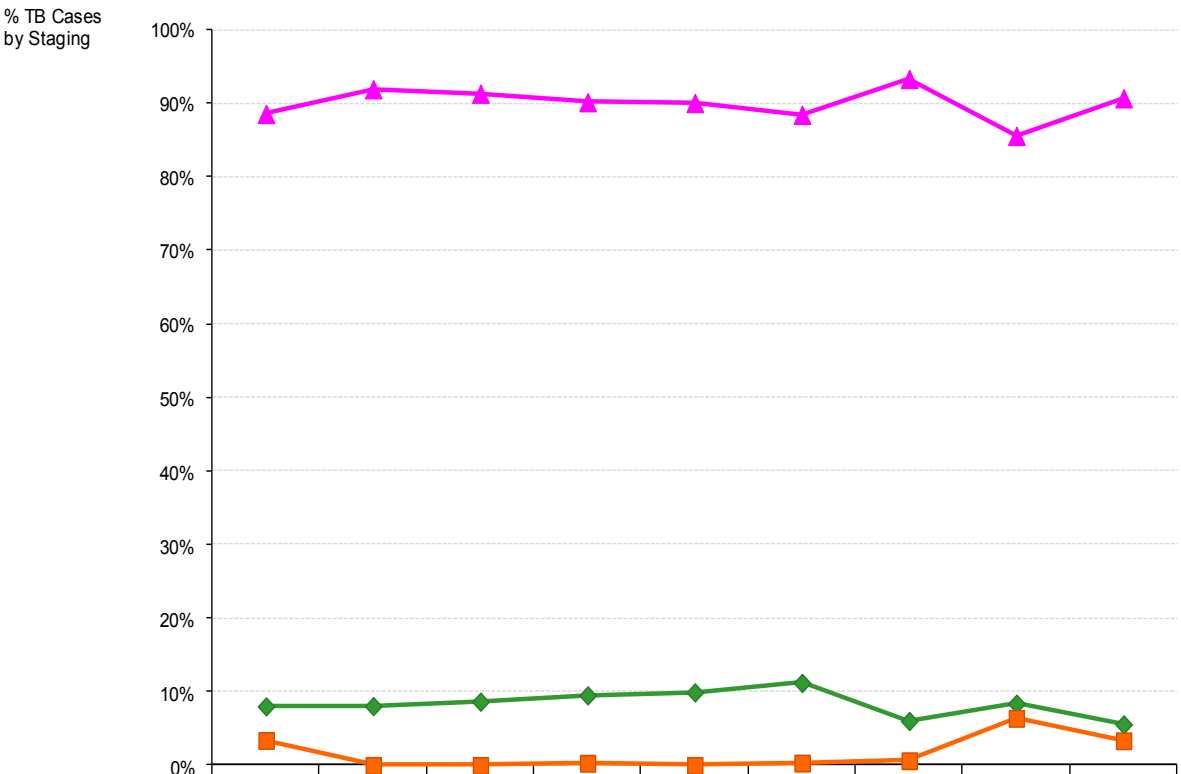
Reason for Non-Completion	2003	2004	2005	2006	2007	2008	2009	2010
Drug Reaction	4.3	10.8	3.6	2.0	2.0	2.3	6.5	8.3
Left Province	31.9	18.9	25.5	28.6	37.3	34.1	16.1	25.0
Lost to Followup	12.8	13.5	18.2	24.5	17.6	11.4	16.1	20.8
Non-Adherence	17.0	29.7	30.9	16.3	9.8	11.4	25.8	12.5
No Data	31.9	24.3	16.4	26.5	29.4	36.4	29.0	16.7
Other	2.1	2.7	5.5	2.0	3.9	4.5	6.5	16.7
# Unsatisfactory Compl.	**47**	**37**	**55**	**49**	**51**	**44**	**31**	**24**

This data includes only information on those individuals who did not complete treatment, and does not include those who died during treatment.

Retreatment

Retreatment cases are clients who have active disease with documented evidence of previous active disease (where documentation is available to BC). The majority of active TB cases in BC between 2003 and 2011 represent initial reactivation of latent TB or novel infection. In 2011, 90.7% of active cases were documented as new cases of active disease, up from 85.6% in 2010 (Figure 25). Only 5.6% of cases were determined to be retreatment of previous disease (3.3% missing staging information), down from 8.4% in 2010. In 2011, 93.3% (n=14) of retreatment occurred in the foreign-born population, up from 66.6% (n=16) in this group in 2010. In 2011, 53.3% of cases occurred in those 40-59 years of age, with 26.7% of cases occurring in those >60 years of age. In 2011, 53.3% of retreatment occurred in males, down from 90.5% in 2010.

Figure 25. Percentage of total TB cases diagnosed as retreatment in BC for 2011



	2003	2004	2005	2006	2007	2008	2009	2010	2011
% - New Cases	88.6	91.9	91.3	90.2	90.1	88.5	93.3	85.6	90.7
% - Retreatment	8.0	8.1	8.7	9.5	9.9	11.2	6.0	8.4	5.6
% - Unknown	3.4	0.0	0.0	0.3	0.0	0.3	0.6	6.4	3.3

C. Mortality in Active TB Cases

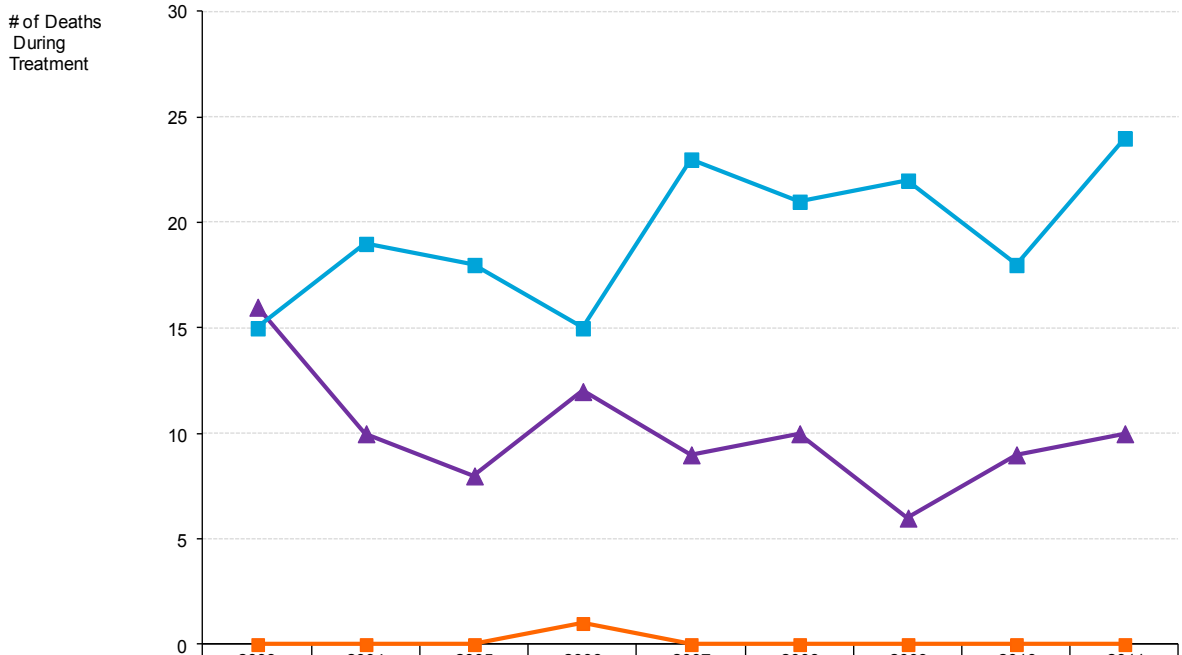
Mortality

In 2011, 34 deaths occurred in active TB cases during or prior to treatment; of these, 23 occurred *during* treatment, 10 *prior to* treatment, and 1 *within 30 days* of treatment completion. The total number of deaths during or prior to active TB treatment increased in 2011 from the 27 deaths observed in 2010, but is within the range of historic trends (27-34) (Figure 26).

Of the 34 deaths occurring in active TB cases in 2011, 70.6% (n=24) were male and 29.4% (n=10) were female (Figure 26). The higher mortality in men is consistent with provincial totals since 2004. No deaths occurred in those under 25 for either gender, while 75% and 73% of cases occurring in the over 60-age group for males and females, respectively.

Of the 34 deaths documented in 2011, active TB was a factor in 67.6% of cases; of these, TB was the underlying cause in 26.5% and contributed to, but was not the underlying cause, of 41.2% of cases (Figure 27). In 2011, 32.4% of the 34 deaths were unrelated to active TB disease. Note that the variability in the percentage of deaths with active TB as an unrelated or contributing cause is likely indicative of a combination of small numbers and coding issues, and may not be reflective of true mortality patterns (Figure 27).

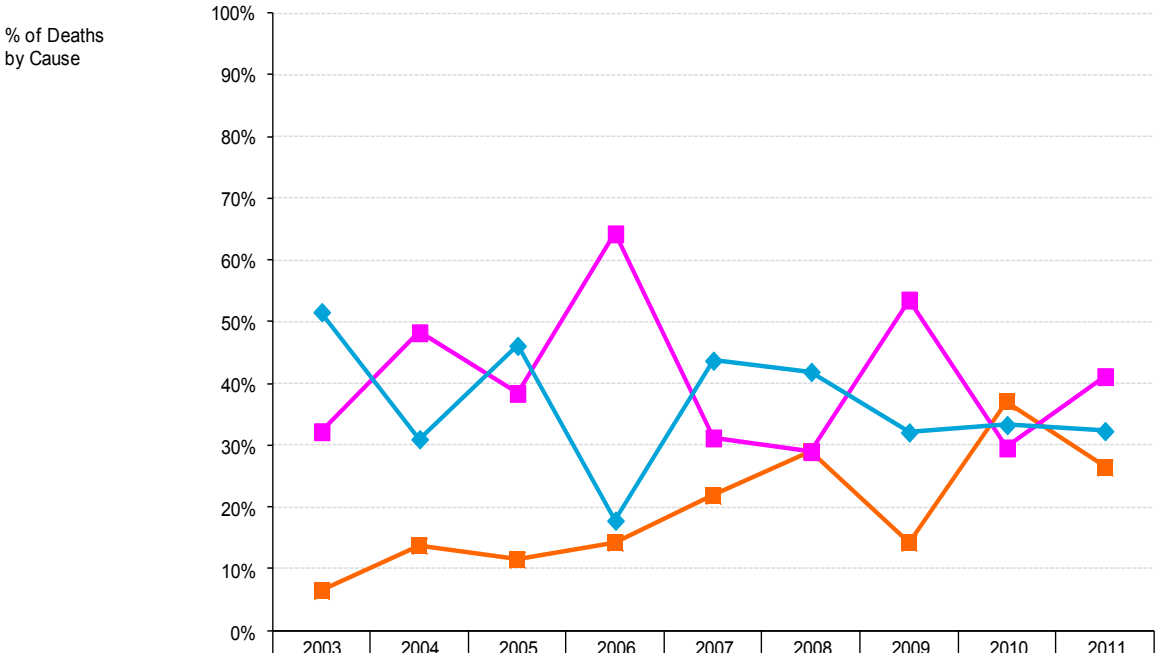
Figure 26. Total mortality* in active TB cases undergoing treatment by gender in BC, 2003 to 2011



	2003	2004	2005	2006	2007	2008	2009	2010	2011
Deaths - Female	16	10	8	12	9	10	6	9	10
Deaths - Male	15	19	18	15	23	21	22	18	24
Deaths - Unknown	0	0	0	1	0	0	0	0	0
Total Deaths	31	29	26	28	32	31	28	27	34

*Only mortality occuring during the course of active TB treatment, or within 30 days after, is included here.

Figure 27. Percent of total mortality by cause in BC, 2003 to 2011



	2003	2004	2005	2006	2007	2008	2009	2010	2011
% - TB Underlying Cause	6.5	13.8	11.5	14.3	21.9	29.0	14.3	37.0	26.5
% - Contr. not underlying	32.3	48.3	38.5	64.3	31.3	29.0	53.6	29.6	41.2
% - TB Unrelated	51.6	31.0	46.2	17.9	43.8	41.9	32.1	33.3	32.4
Cases - Contr. not underlying	10	14	10	18	10	9	15	8	14
Cases - TB Underlying Cause	2	4	3	4	7	9	4	10	9
Cases - TB Unrelated	16	9	12	5	14	13	9	9	11
Cases - Unknown	3	2	1	1	1	0	0	0	0

Latent TB Infection

Notes Regarding the Interpretation of TB Data

LTBI surveillance in BC is still under development, and this section of the report will continue to grow in future years as we validate additional historic data.

- Latent TB Infection (LTBI) is the asymptomatic form of the disease and those with LTBI represent an important group for preventative treatment.[8] LTBI is detected through the presence of an elevated immune response to *M. tuberculosis* (MTB) antigen using Tuberculin Skin Tests (TST) or Interferon-Gamma Release Assay (IGRA).[10] IGRA is the newer test, and is typically used for confirmatory testing of TST positive individuals , especially in those with previous BCG vaccination. A tuberculin response can be difficult to detect in certain subgroups of the population like those with immune-compromising conditions, and IGRA is often used to supplement standard testing.

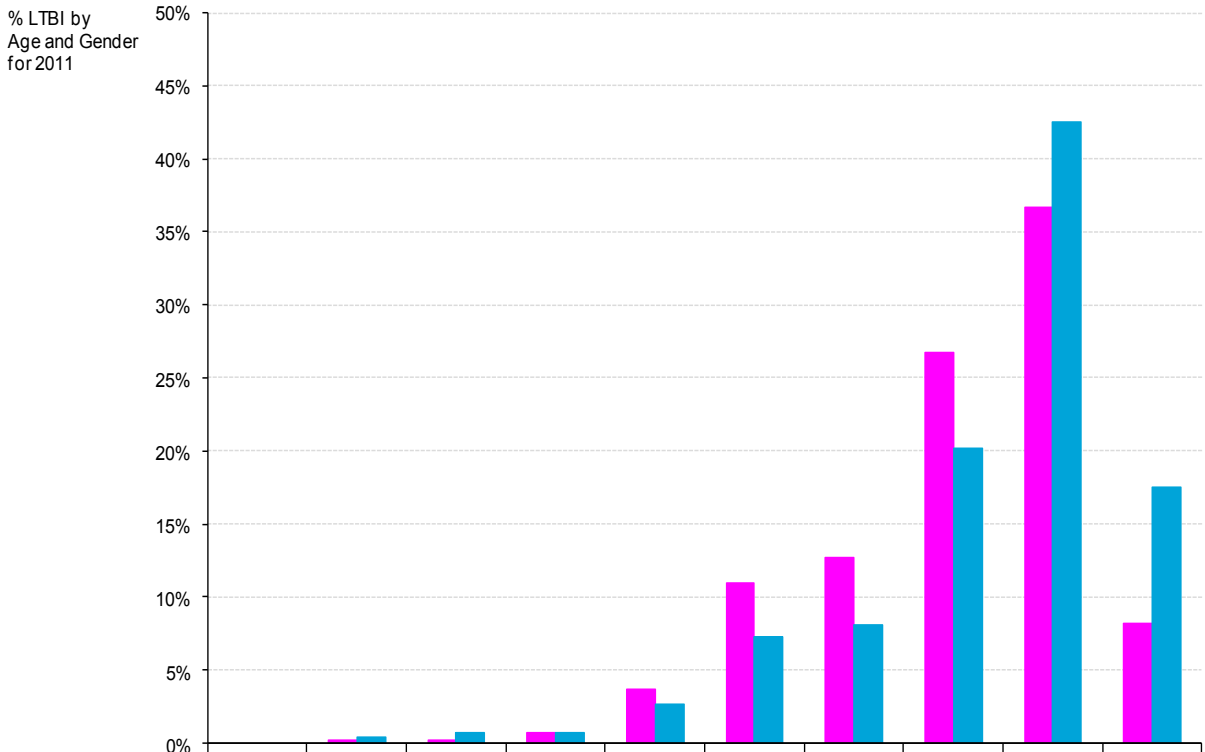
- Our surveillance definition of LTBI combines both TST>9mm and/or IGRA reactive results to broadly estimate the number of persons tested in 2010 or 2011 in BC, and whose results indicate infection with MTB. Specifically, LTBI is estimated as the total of: 1) TST>9mm without subsequent IGRA, 2) TST>9mm with confirmatory follow-up IGRA reactive, and 3) those documented as IGRA reactive with no associated TST within a given year (See Appendix for figure of LTBI case definition). Radiograph results were not specifically reviewed for findings consistent with prior or inactive TB. This estimate will not accurately reflect the provincial prevalence of LTBI since it accounts for those tested in 2010 or 2011 only as we currently lack quality data for previous years. This definition also fails to capture individuals with a clinical diagnosis of LTBI and will likely underrepresent those with immunocompromising conditions.

- LTBI patterns presented here are heavily affected by provincial and regional screening and documentation practices. LTBI screening occurs through contact tracing, immigration screening, employment screening, or student screening. The breakdowns of LTBI patterns in the province must be viewed in relation to current screening practices.

LTBI by Gender and Age

LTBI was identified more frequently in females than males in 2011, with 41.4% of LTBI occurring in men and 58.6% in women. This gender distribution may be driven by health care worker screening. The age distribution of LTBI was similar in both 2010 and 2011. In 2011, 36.6% of LTBI was detected in those 40-59 years of age, followed by 26.7% in those 30-39 years of age. No clinically relevant difference in the age distribution of LTBI was seen between males and females, although the age distribution does skew younger for women and older for men (Fig. 28).

Figure 28. Percent of total LTBI by sex and age in BC, 2011



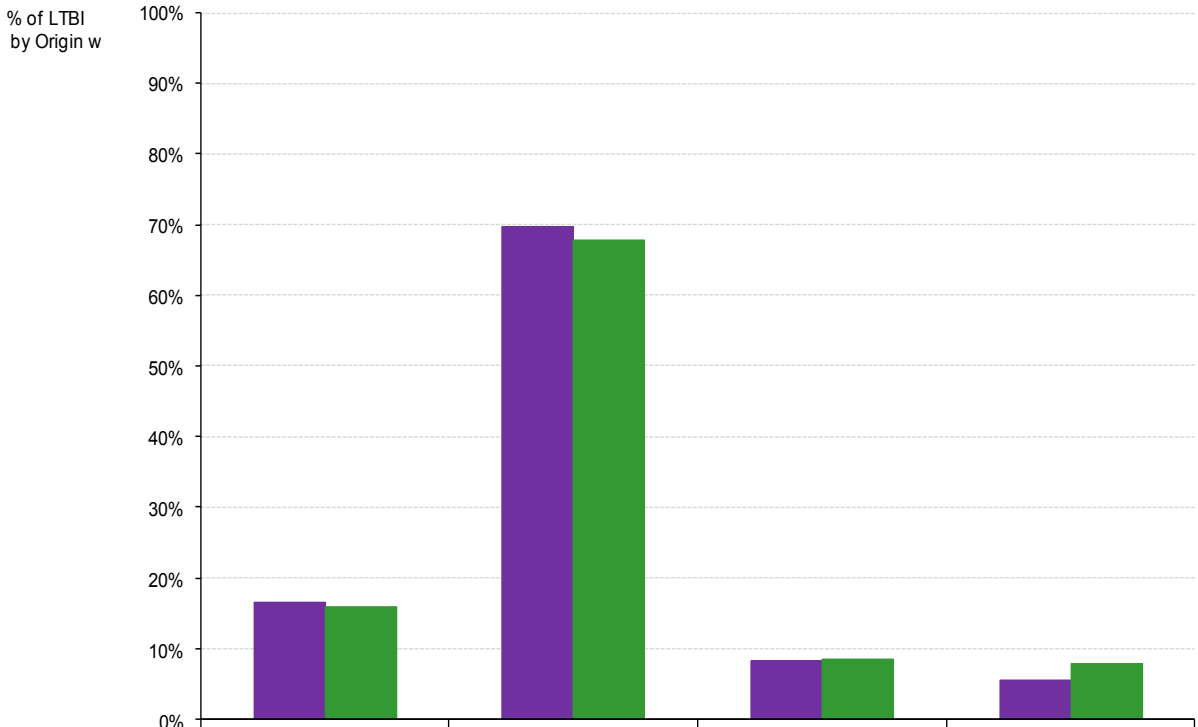
	<1	1-5	5-9	10-14	15-19	20-24	25-29	30-39	40-59	>60
Females	0.0	0.2	0.1	0.7	3.6	11.0	12.7	26.7	36.6	8.2
Males	0.0	0.4	0.7	0.7	2.7	7.2	8.1	20.2	42.5	17.5

*The results presented here are heavily affected by provincial and regional screening and documentation practices.

LTBI by Origin

In 2011, 3515 individuals were identified as having LTBI, compared to 3753 in 2010. In 2011, 67.8% of LTBI occurred in the foreign-born, 15.9% in Canadian born non-Aboriginal Peoples , and 8.4% in Aboriginal Peoples (Figure 29). The high proportion of LTBI in foreign-born populations is expected given the high TB rates observed in many countries, and the fact that this group experiences higher LTBI screening rates then do other demographic groups because of provincial post-landing screening of recent immigrants.

Figure 29. Percent of total LTBI by origin in BC, 2010 and 2011



	Canadian Born Non-Aboriginal	Foreign Born	Aboriginal Peoples	Unknown
2010	16.4	69.8	8.3	5.5
2011	15.9	67.8	8.4	7.9

*The results presented here are heavily affected by provincial and regional screening and documentation practices.

LTBI Treatment

LTBI treatment is recommended only for those at increased risk of developing active disease given latent infection, or those with a higher risk of exposure; not all individuals with TST>9mm or positive IGRA will therefore be offered treatment. In 2011, 718 total patients started LTBI therapy, representing 20.4% of those identified with LTBI in BC. The percentage of LTBI patients starting therapy has decreased from 2010 when 1059 (28.2%) of patients were treated.

A total of 71.5% and 72.3% of those starting treatment completed treatment satisfactorily in 2010 and 2011 (Table 4). Of those starting treatment in 2011, 41.2% were aged 40-59, 21.3% were 30-39, and 18.4% were greater than 60 (Fig. 30). In 2011, 64.1% of those starting LTBI treatment were foreign-born, 22.8% were Canadian-born non-Aboriginals, and 9.1% were Aboriginal; 4.0% were of unknown origin or had missing data. The proportion of Canadian born non-Aboriginal cases starting LTBI treatment remains consistent from 2010, while the proportion of Aboriginal Peoples starting treatment increased slightly from 2010 (2010: 5.8 %), while treatment in foreign-born decreased (2010: 64.1%).

Of those failing to satisfactorily complete treatment in 2011, 13.0% did so for reasons that are not amenable to intervention (drug reaction, death all causes, and leaving province), while 13.8% did so for reasons that can potentially be improved with additional public health intervention (non-adherence, lost to follow up), down from 17.2% in 2010 (Table 4). Of those failing to complete treatment in 2011, the most common reasons were: 11.6% had negative drug reactions, 8.2% were lost to follow-up, and 2.9% were non-adherent. The percentage of cases with negative drug reactions increased slightly from 2010, while the percentage of cases lost to follow-up decreased (Table 4). Of those starting treatment in 2011, 90.0% received self-administered treatment and 7.7% had directly observed preventative therapy, up from 3.4% in 2010.

Figure 30. Proportion of total LTBI starting treatment by age in BC for 2011

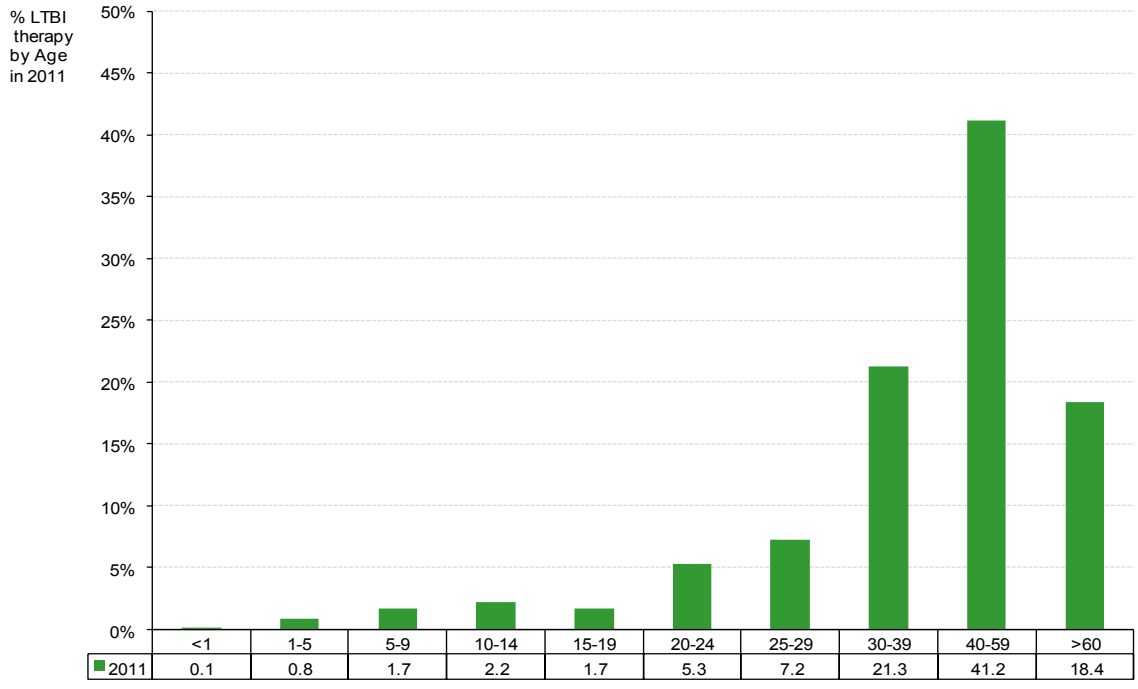


Table 4. Proportion of cases by treatment outcomes for 2010 and 2011

Treatment	2010		2011	
Satisfactory	71.5		72.3	
Not Complete - Non Amenable	9.8		13.0	
Drug Reaction		8.8		11.6
Left Province		0.8		0.8
Death		0.3		0.6
Not Completed - Amenable	17.2		13.8	
Non Adherent		4.3		2.9
Lost to Follow-up		9.8		8.2
Incomplete - Other		3.1		2.6
Other	1.2		0.6	
Not Finished	0.0		0.3	
No Data	0.2		0.1	
Total LTBI Treatment	1060		718	

TB Contact Tracing

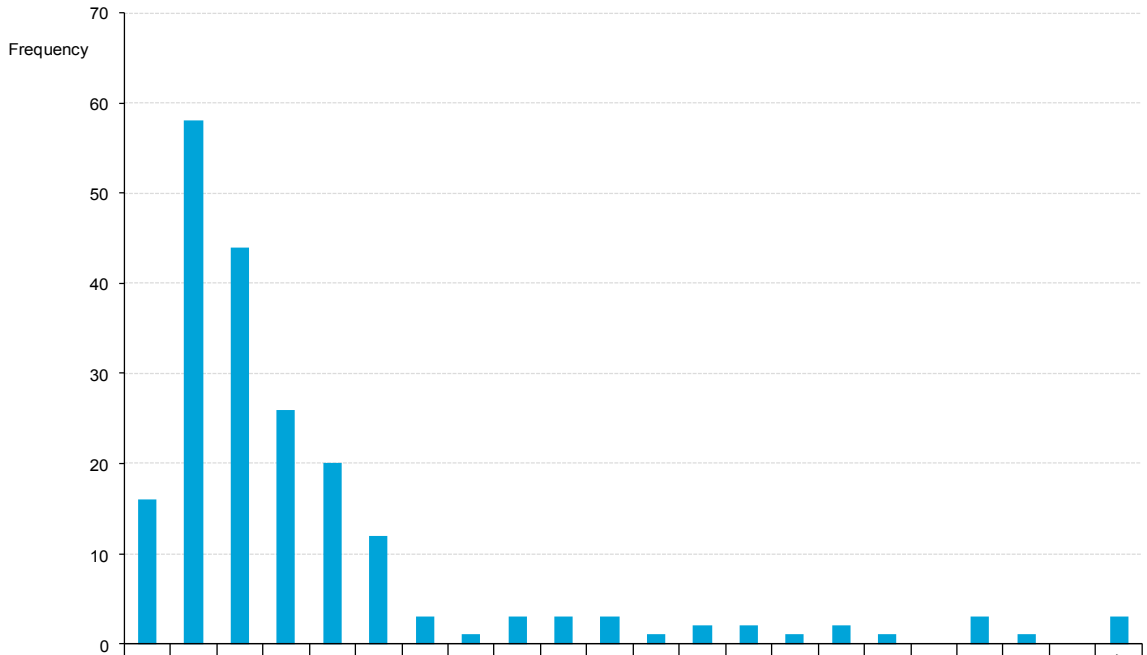
Notes Regarding the Interpretation of Contact Data

Contact tracing is an important public health intervention that involves identifying individuals who may be at risk of having TB infection or active TB disease as a result of having shared air space with an active TB case. Not all person-to-person contact is equivalent, however, and contacts are classified and prioritized based according to the type and duration of contact. This data may not be complete, as regions may have separate databases for contact investigation to facilitate contact management during routine public health follow-up and in the investigation of clusters/outbreaks, the specific details of which may not always be included in provincial iPHIS data. This section of the report provides data on contacts of known source cases diagnosed in BC (i.e., contacts identified as part of federally managed airplane screening or contacts of non-resident cases are not included). Finally, patterns in the number of contacts are affected by case clustering and TB outbreaks, as well as patterns of data collection and entry .

Contacts Per Case

In 2011, 4041 unique contacts were documented in iPHIS, of which 1.9% (n=79) were listed as contacts of more than a single case (74 linked to 2 source cases, 5 linked to 3 source cases). The total number of unique contacts in 2011 had increased from the 2968 unique contacts reported in 2010. The mean number of contacts per respiratory TB case (primary, pulmonary, miliary, and other respiratory) in 2011 was 19.8 (median=9.00), up from 16.8 in 2010 (median=8.00). In 2011, 16 cases had no contacts documented in iPHIS, and these individuals were not included in the calculations of average number of contacts. The maximum number of contacts associated with a single respiratory case was 295 and 421 in 2010 and 2011, respectively. The majority of cases in 2011 have 10 or less contacts, with only a few individuals having >100 contacts (Fig. 31).

Figure 31. Histogram of number of contacts per respiratory source case in 2011



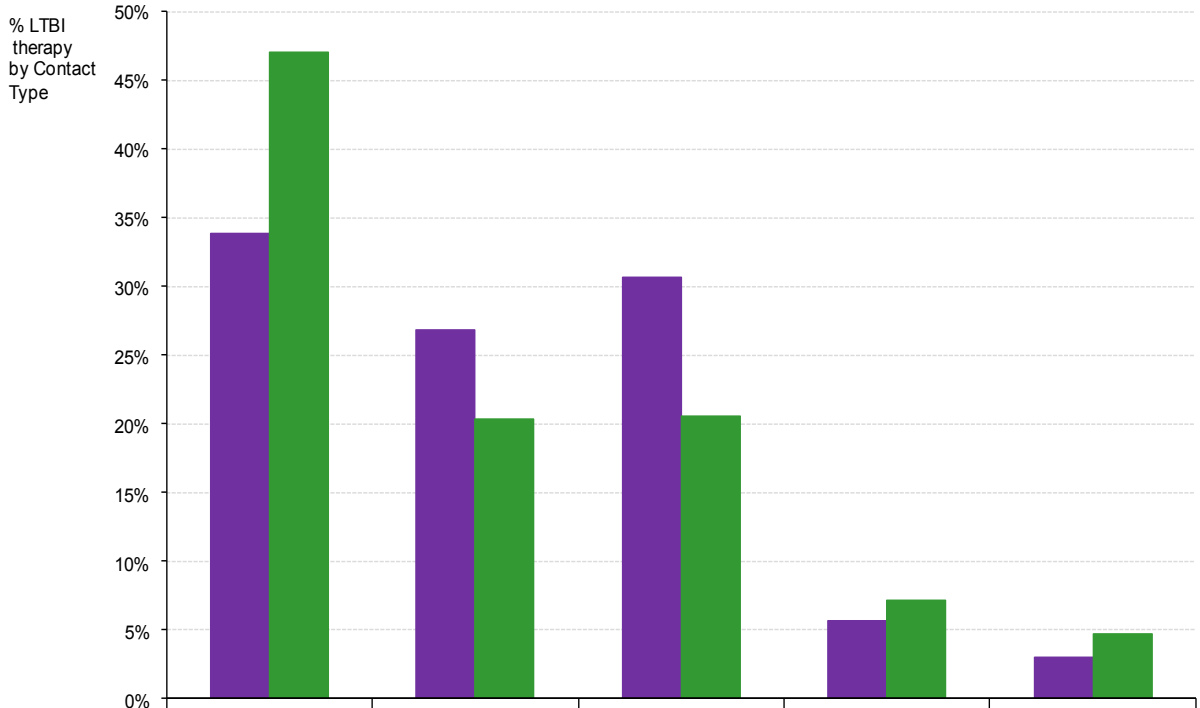
# cont./case	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	> 100
Frequency	16	58	44	26	20	12	3	1	3	3	3	1	2	2	1	2	1	0	3	1	0	3

Contact by Type

Contacts are grouped according to the intensity of the exposure; Type 1 are household contacts or those sharing airspace for 4 hours per week, Type 2 contacts are non-household contacts or those sharing air space for 2-4 hours per week, and Type 3 are casual contacts or those sharing airspace for less than 2 hrs per week.[11]

In 2011, 47.1% of all contacts listed (including individuals listed more than once) were classified as Type 1 contacts, 20.4% being Type 2 and 20.6% being Type 3 (Fig. 32). In contrast, a more even distribution of contacts types occurs in 2010, with 33.9% Type 1 contacts, 26.8% Type 2 and 30.6% Type 3 contacts occurring in this year.

Figure 32. Percentage of contacts by contact type for BC in 2010 and 2011



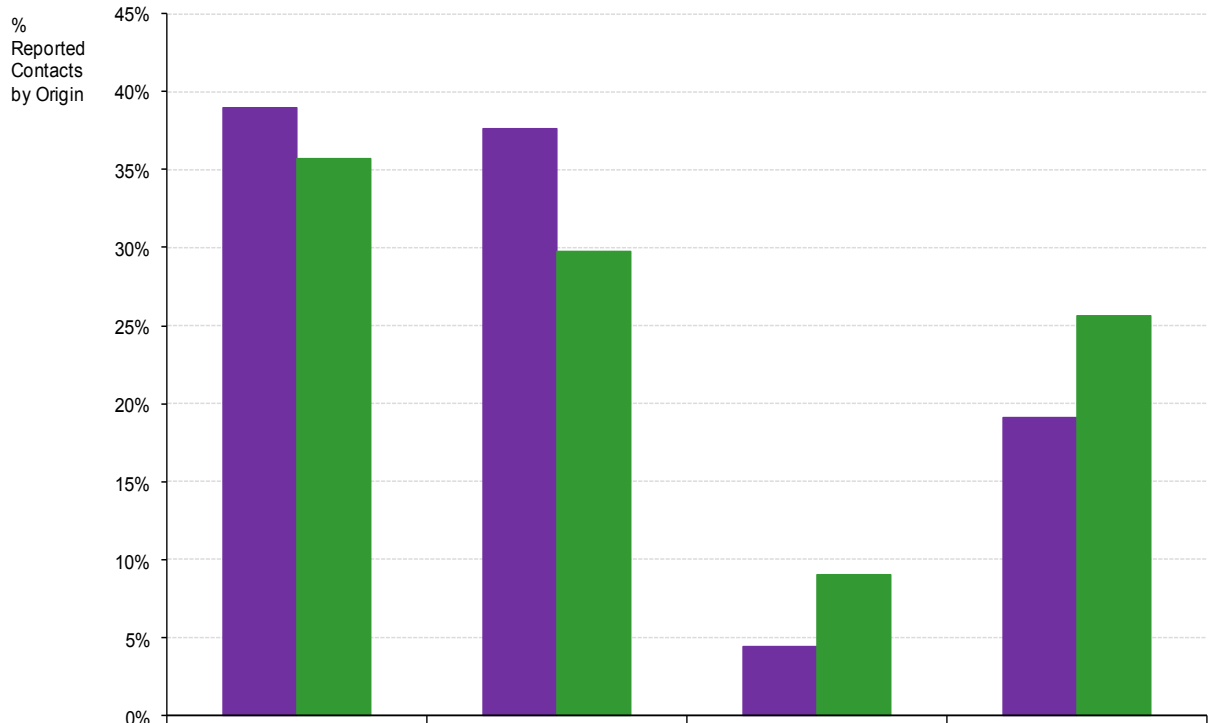
	% - Type 1	% - Type 2	% - Type 3	% - Health Care Setting	% - Other
2010	33.9	26.8	30.6	5.7	3.0
2011	47.1	20.4	20.6	7.2	4.8

*The results presented here are heavily affected by provincial and regional contact management practices.

Contact by Origin

Canadian Born Non-Aboriginals accounted for over 38.9% of contacts identified in 2010, and 35.7% in 2011, despite accounting for only 16% and 13% of total cases in these years (Fig. 33). Foreign-born contacts comprised 37.6% and 29.7 % of all contacts in 2010 and 2011, with Aboriginal contacts accounting for 4.4% and 9.0% of contacts in these years. Note that differential reporting practices from targeted screening and control programs may bias the results presented here.

Figure 33. Percentage of total contacts by origin for BC in 2010 and 2011



	Canadian Born Non-Aboriginal	Foreign Born	Aboriginal Peoples	Unknown
2010	38.9	37.6	4.4	19.1
2011	35.7	29.7	9.0	25.6

*The results presented here are heavily affected by provincial and regional contact management practices.

Endnotes

[1] For identification of high risk countries, see the "Designated Country/Territory List. Ottawa: Citizenship and Immigration Canada, 2011." Retrieved from: http://www.cic.gc.ca/english/information/medical/dcl.asp

[2] For further discussion of the historic factors that contribute to inequities in the social determinants of health among Aboriginal people see: BC Provincial Health Officer. (2009). Pathways to Health and Healing: 2nd Report on the Health and Well-being of Aboriginal People in British Columbia. Provincial Health Officer's Annual Report 2007. Retrieved from http://www.health.gov.bc.ca/pho/reports/annual.html

[3] Additional information on the multiple historic factors contributing to the inequities in the social determinants of health among Aboriginal people see: Orr PH, Case C, Mersereau T, Lem M. Tuberculosis control in First Nations and Inuit Populations. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 298-308.

[4] BC Stats. Census Statistical Profiles of Aboriginal Peoples, 2006. retrieved from http://www.bcstats.gov.bc.ca/statisticbysubject/AboritinalPeoples/CensusProfiles.aspx

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[10] Menzies D, Khan K. Diagnosis of Tuberculosis Infection and Disease. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 53-91.

[11] TB Manual for Professionals to Help Manage TB. BCCDC; 2011. pg. 43. Retrieved from: http://www.bccdc.ca/NR/rdonlyres/7CDEAF08-D7F0-41A1-ABED-98BC3CEB6B96/0/BCCDC_TB_ManualRevisedFebruary_2012.pdf

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- Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada for providing the national TB rates.

Technical Appendix

Data Limitations

There are several key limitations to surveillance data which are important to understand in order to interpret surveillance data appropriately.

- All TB surveillance data comes from the Integrated Public Health Information System (iPHIS). This system was implemented in 2003. This report only includes data from 2003-2011 to minimize data quality issues stemming from the transition from the previous TB Clinical Data system to iPHIS.
- All geographic breakdowns reflect place of residence at time of diagnosis or time of treatment. Subsequent movement is not reflected in this report.
- Active TB case data, including data on treatment and drug resistance, was extracted from iPHIS on October 31st, 2012. TST, IGRA, and LTBI data was extracted March 15th, 2013. In rare instances, iPHIS data may be modified after diagnosis as additional laboratory or clinical findings become available; such changes will not be reflected in this report.
- Active TB case totals may differ from those reported by the Public Health Agency of Canada (PHAC). PHAC excludes cases diagnosed in temporary BC residents (visitors, students, and people granted work permits), while the BCCDC includes these cases in provincial totals.
- Active TB is rare in BC. This means that the fluctuations over time observed for some indicators may reflect minor differences in small numbers, and not meaningful changes in the underlying disease process.
- TST data is entered in both the TB module by TB-Services and into the Public Health module by our Health Authority partners. This may result geographic differences in patterns of data entry. Furthermore, negative TST results are not routinely documented in iPHIS; we are therefore unable to provide information on the proportion of TST>9mm and the total number of TST performed.
- A small number of individuals have TST tests occurring in multiple years over the 2009 to 2011 period. These individuals are counted in each year that a test occurs. A similar approach is used when analyzing LTBI treatment.
- Disease rates are not provided for Foreign-born individuals by WHO region groupings because we lack accurate denominator data for country groups in BC.
- The contact information presented here includes only contacts of source cases identified in BC; the data presented does not include contacts identified as part of federal airplane screening, or contacts of sources cases not located in BC. As a result, the data presented does not reflect the full workload of contact tracing teams.

Case Definitions

A. Active TB

Detection and confirmation of *Mycobacterium tuberculosis* complex or clinical presentation compatible with tuberculosis.

Laboratory confirmed case

- Cases with *Mycobacterium tuberculosis* complex isolated by culture from a clinical specimen, specifically *M. tuberculosis*, *M. africanum*, *M. canetti*, *M. caprae*, *M. microti*, *M. pinnipedii* or *M. bovis* (excluding *M. bovis* BCG strain).

Clinically confirmed case

- In the absence of culture proof, cases clinically compatible with active tuberculosis that have, for example:
- chest x-ray changes compatible with active tuberculosis;
- Clinical symptoms and/or signs of nonrespiratory tuberculosis (meningeal, bone, kidney, peripheral lymph nodes etc.);
- Histopathologic or post-mortem evidence of active tuberculosis
- Favorable response to therapeutic trial of antituberculosis drugs.

New active case

Incident case of active TB with no documented evidence or adequate history of previously active tuberculosis.

Reactivation case

The development of active disease after a period of latent tuberculosis infection.

Retreatment case

A re-treatment case of tuberculosis has current active disease and historic documentation of previous active disease. Note that: (1) the client does not currently need to be on treatment, (2) the client did not have to receive previous treatment, and (3) previous treatment did not have to occur in BC.

Drug Resistance

Active cases are classified as resistant to rifampin, isoniazid, or both. Resistance to other TB medication is not reported here.

B. Site of Disease

The main diagnostic site is determined by the following hierarchy: primary, pulmonary, other respiratory and extrapulmonary TB [miliary/disseminated, meninges/central nervous system (CNS), peripheral lymph node and other sites].

Respiratory TB

Primary

This includes primary respiratory tuberculosis and tuberculous pleurisy in primary progressive tuberculosis due to infection within the last 24 months (ICD-9 codes 010.0, 010.1, 010.8, 010.9; ICD-10 codes 015.7, 016.7).

Case Definitions (cont.)

Pulmonary
Includes tuberculosis of the lungs and conducting airways, which includes tuberculous fibrosis of the lung, tuberculous bronchiectasis, tuberculous pneumonia, tuberculous pneumothorax, isolated tracheal or bronchial tuberculosis and tuberculous laryngitis (ICD-9 codes 011-011.9, 012.2, 012.3; ICD-10 codes A15.0-A15.3, A15.5, A15.9, A16.0-A16.4, A16.9).

Other respiratory
Includes tuberculous pleurisy (nonprimary) and TB of intrathoracic lymph nodes (hilar, mediastinal, tracheobronchial), nasopharynx, nose (sputum) and sinus (any nasal) (ICD-9 codes 012.0, 012.1, 012.8; ICD-10 codes 015.4, 015.6, 015.8, 016.3, 016.5, 016.8).

Miliary/disseminated
Includes blood-borne disseminated or generalized tuberculosis whether of a single specified site, multiple sites or unspecified site (ICD-9 codes 018.0- 018.9; ICD-10 codes 019.0-019.9).

Non-Respiratory TB

Any extrapulmonary site may be involved, but the most common site is peripheral lymph nodes (as defined below).

Meninges/Central Nervous System (CNS)
Includes tuberculosis of meninges (cerebral or spinal), tuberculoma of meninges, tuberculoma or abscess or tuberculosis of brain, CNS unspecified (ICD-9 codes 013.0-013.9, ICD-10 codes 017.0-017.9).

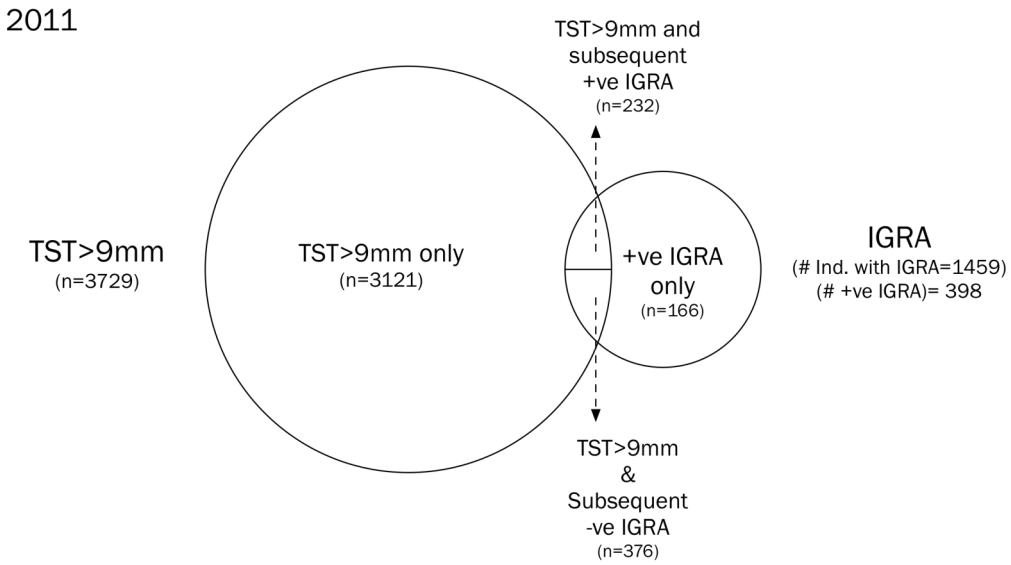
Peripheral Lymph Node
Includes tuberculosis of peripheral lymph nodes but excludes intrathoracic, mesenteric and retroperitoneal lymph nodes (ICD-9 code 017.2; ICD-10 code 018.2).

Other non-respiratory
Includes tuberculosis of all other sites: intestine, peritoneum, mesenteric glands; bones and joints (including vertebral column), genitourinary system; other organs such as skin, eye, ear, thyroid, adrenal gland, spleen, heart, other (ICD-9 all other ICD-9 codes; ICD-10 all other ICD-10 codes).

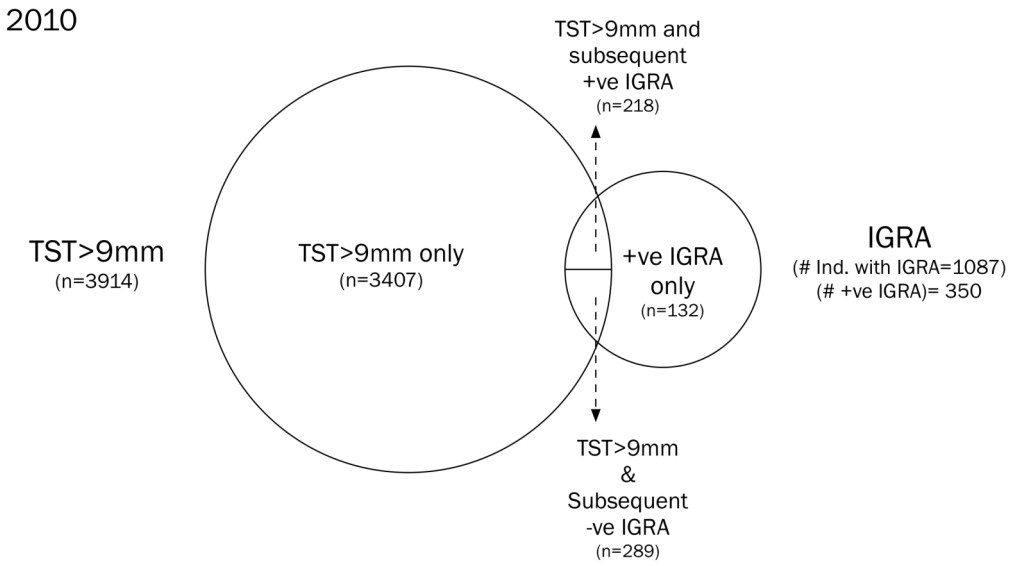
C. Latent Tuberculosis Infection (LTBI)

The clinical definition for LTBI is based on a complex mix of demographic characteristics and the presence of co-morbidities[11]. The clinical definition of LTBI is impractical for surveillance purposes because it cannot be determine based solely on current surveillance data. As a surrogate, we use a combination of TST result greater than 9mm and IGRA testing to provide an estimate of LTBI for the TB annual report. Specifically, LTBI is defined as: 1) Positive TST>9mm with no confirmatory IGRA follow-up, 2) TST>9mm with confirmatory IGRA if subsequent testing was completed, 3) IGRA positive with no documented TST (see Fig. 32).

Figure 32. Figure outlining calculations for the estimate of LTBI in BC in 2010 and 2011.



Total LTBI in BC in 2010 = 3121 + 232 + 166 = 3519



Total LTBI in BC in 2010 = 3407 + 218 + 132 = 3757

Data Sources

Integrated Public Health Information System (iPHIS)

All data presented in this report is extracted from the iPHIS. This is the only database used in the creation of this report. This system was implemented in BC in 2003.

Population Data

Population data for 1993-2011 is based on BC Stats population Estimates Database http://www.bcstats.gov.bc.ca/StatisticsBySubject/Demography/PopulationEstimates.aspx. Note that population estimates for foreign-born need be extrapolated between census years owing to a lack of quality population estimates for this group.

First Nations Population Estimates

Population rates for First Nations people are calculated using estimates from Aboriginal Affairs and Northern Development Canada (AANDC, formerly INAC: http://www.aadnc-aandc.gc.ca/).

These estimates are based on the Indian Register, which is subject to several limitations, including:

- Under-counting due to delayed reporting of infants entitled to be registered
- Over-counting due to individuals remaining on the Register after they are deceased
- Individuals are included in the BC population by whether they are a member of a BC band and not where they actually live
- Systematic biases from imbalance in the migration into and out of the British Columbia region (these are difficult to quantify)

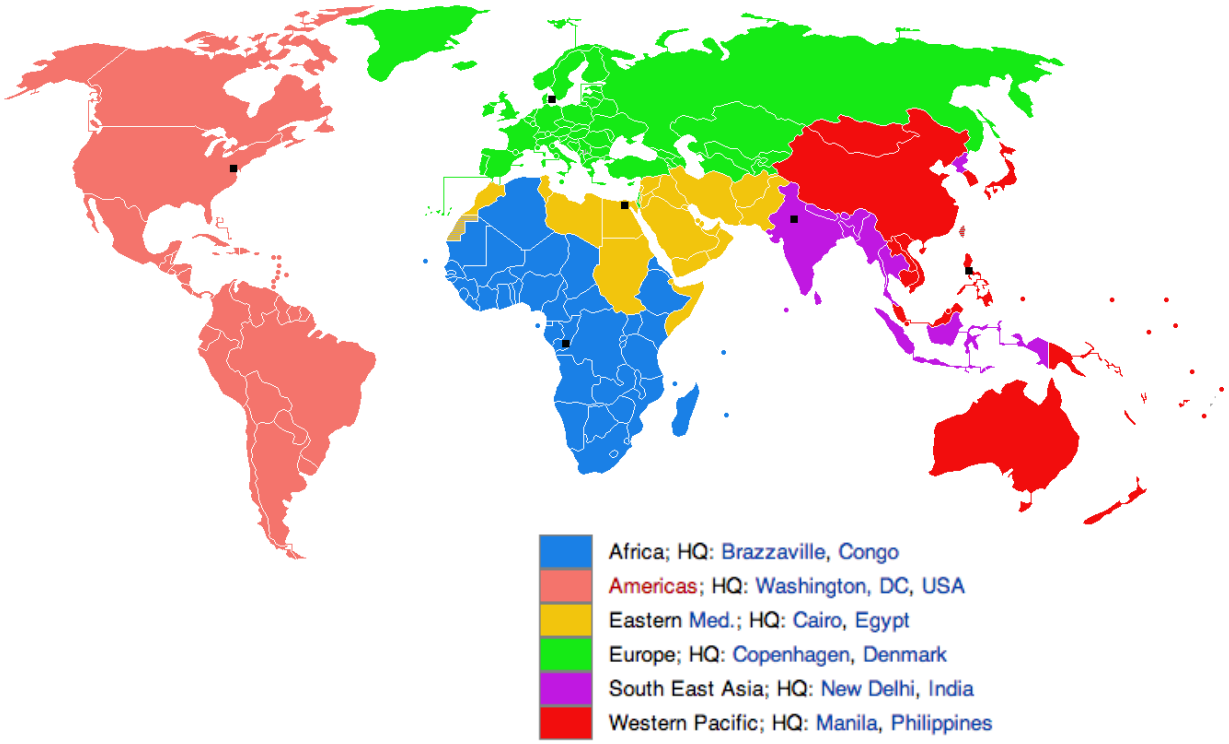
For further details about the data source and its limitations, see the report entitled *Registered Indian Population by Sex and Residence, 2011*. Aboriginal Affairs and Northern Development Canada.

Additional Notes

Classification of Health Region

Cases are assigned to health regions (i.e., Health Authority or Health Service Delivery Area (HSDA)) by residence. If residence is unknown, the case is assigned to the health region where the individual was diagnosed or screened.

Figure 33. World Health Organization Regions (FIGURE IS A PLACEHOLDER).



http://en.wikipedia.org/wiki/File:World_Health_Organisation_regional_offices.PNG