



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



TB

Annual Report

2012-2013

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Summary of Trends

Tuberculosis (TB)

Active TB

- In 2013, the rate of active TB in BC was 5.8 per 100,000 population (270 cases), down from 6.6/100,000 population in 2012.
- The highest rates of active TB in 2013 were in Fraser and Vancouver Coastal Health Authorities.
- Males continue to have higher active TB rates and an older age distribution of new TB diagnoses than females.
- In 2013, 78.5% of cases were among foreign born individuals, 4.4% were among Aboriginal peoples, and 15.6% were among Canadian-born non-Aboriginal people. The percentage of TB cases in Aboriginal peoples in 2013 is the lowest observed in over 10 years.
- Active TB rates show disparities between WHO country groupings, with the Western Pacific Region and South East Asian regions comprising 57.1% and 31.6% of cases, respectively, in 2013.
- In 2013, 81.5% of Active TB cases had known HIV status (up from 74.9% in 2012). Of cases with known status, 3.6% were co-infected with HIV in both 2012 and 2013.
- Drug resistant active TB is a concern world-wide, and rates of Isoniazid-resistant TB have generally increased in BC over the past decade. In 2013, 10.7% of all cases had Isoniazid resistance. No cases of multi-drug resistant TB (MDRTB) were seen in 2013, down from 2 in 2012.
- Of patients starting active TB treatment in 2013, 90.8% completed treatment, with 80.4% doing so within 1 year.

Latent TB Infection

- LTBI infection was most common in foreign-born, who accounted for 75.2% of estimated LTBI in BC in 2013.
- A total of 807 individuals were placed on LTBI therapy in 2013, of which 75.2% successfully completing treatment. The most common reason for LTBI therapy failure was adverse drug reaction.

Contact Tracing

- In 2013, an average of 19.7 contacts (median=11.0) were documented per respiratory TB case. Of contacts documented in the Integrated Public Health Information System (iPHIS) in 2013, 43.2% were Type 1, 21.6% were Type 2, and 19.2% were Type 3.

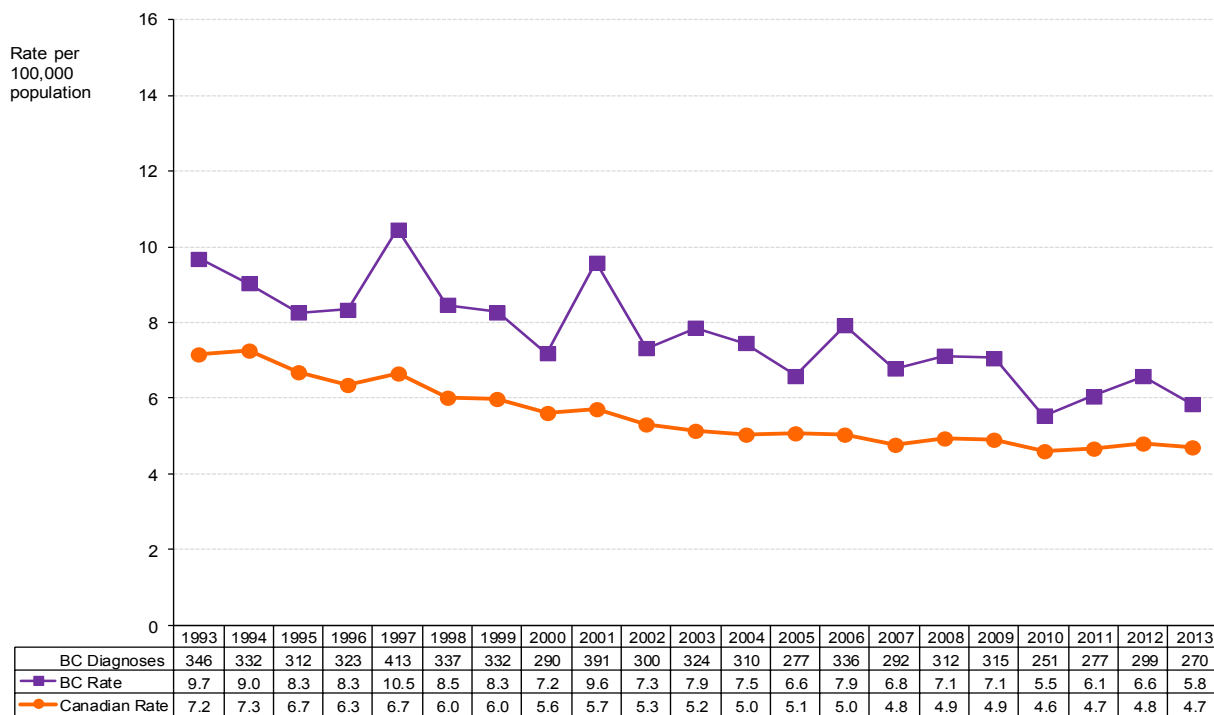
Active Tuberculosis

A. Incidence and Case Totals

Active TB Historical Trends

The rate of active TB in British Columbia was 5.8/100,000 in 2013, down from 6.6/100,000 in 2012. The provincial rate of TB has generally decreased over the previous 2 decades. This trend 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 2013 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 (see Technical Appendix).

Figure 1. Active TB Disease rates in BC and Canada, 1993 to 2013

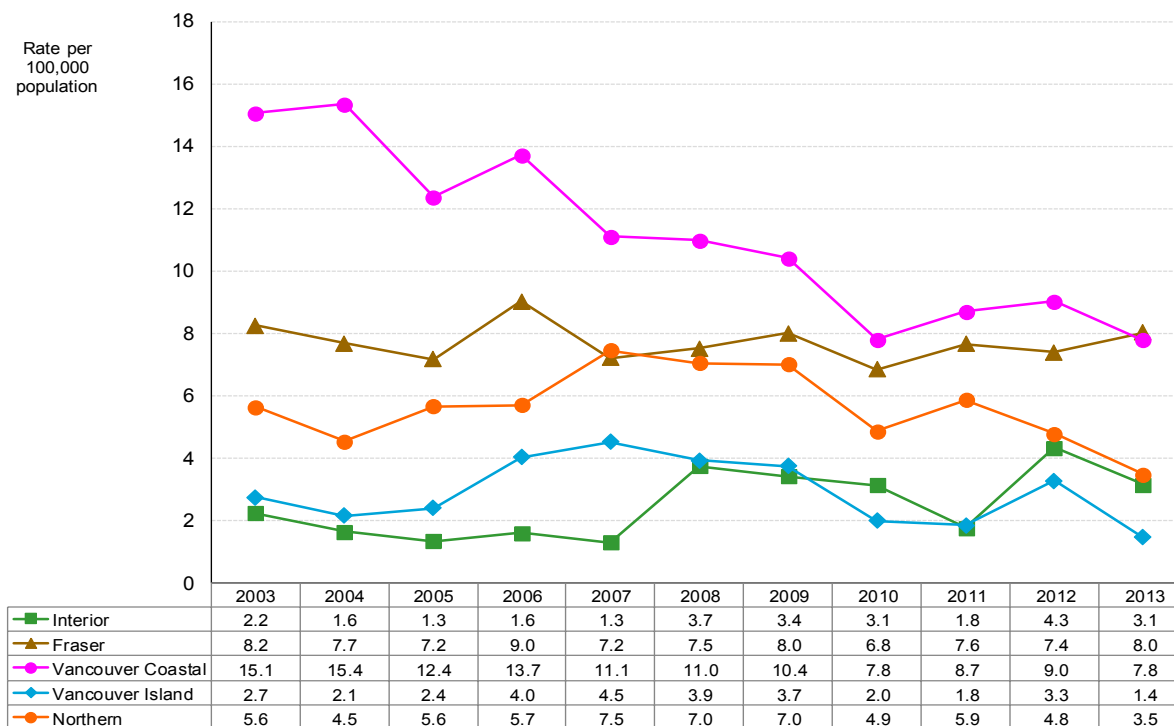


* Canadian rates come from the Public Health Agency of Canada

Active TB Rates by Health Authority of Residence

In 2013, the rate of active TB was highest in Fraser Health (8.0/100,000 population), followed by Vancouver Coastal (7.8/100,000 population), Northern (3.5/100,000 population), Interior (3.1/100,000 population) and Vancouver Island (1.4/100,000 population) (Figure 2). The subtle peaks in active TB rates for Vancouver Island (2006-2009) and the Interior (2008-2010) were due to TB outbreaks documented during these periods.

Figure 2. Active TB Disease rates by Health Authority* in BC, 2003 to 2013

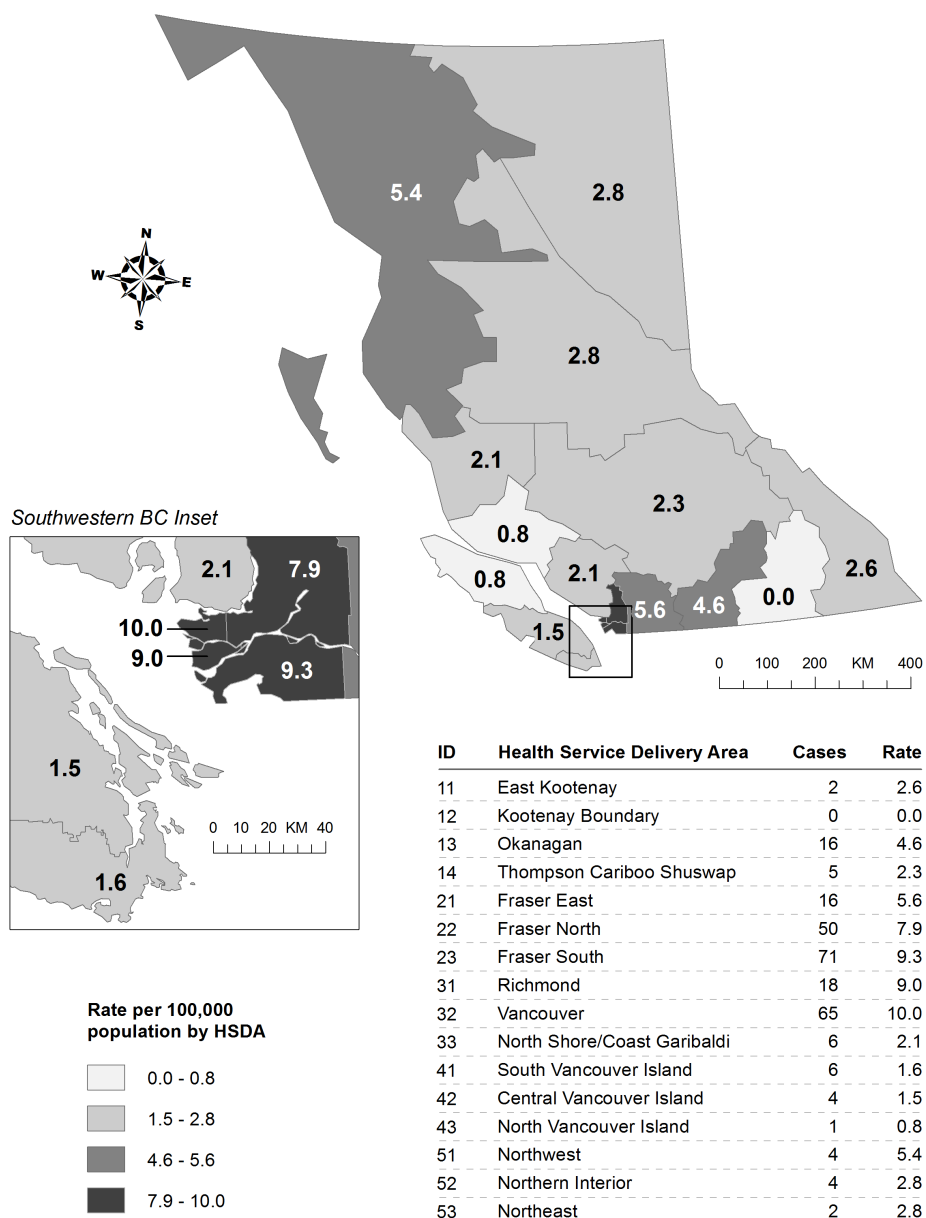


* Residence classified at time of case

Active TB Rates by Health Service Delivery Area

Vancouver had the highest rate of active TB in 2013 at 10.0/100,000 population, followed by Fraser South (9.3/100,000 population), Richmond (9.0/100,000 population), and Fraser North (7.9/100,000 population). The lowest active TB rates occurred on the Kootenay Boundary (0.0/100,000 population) and the North Vancouver Island (0.8/100,000 population) Health Service Delivery Areas (HSDAs). (Figure 3)

Figure 3. Active TB Disease rates by Health Service Delivery Area*+ in BC, 2013



Rates calculated with population estimates released by BC Stats

* Health Service Delivery Area determined at time of case

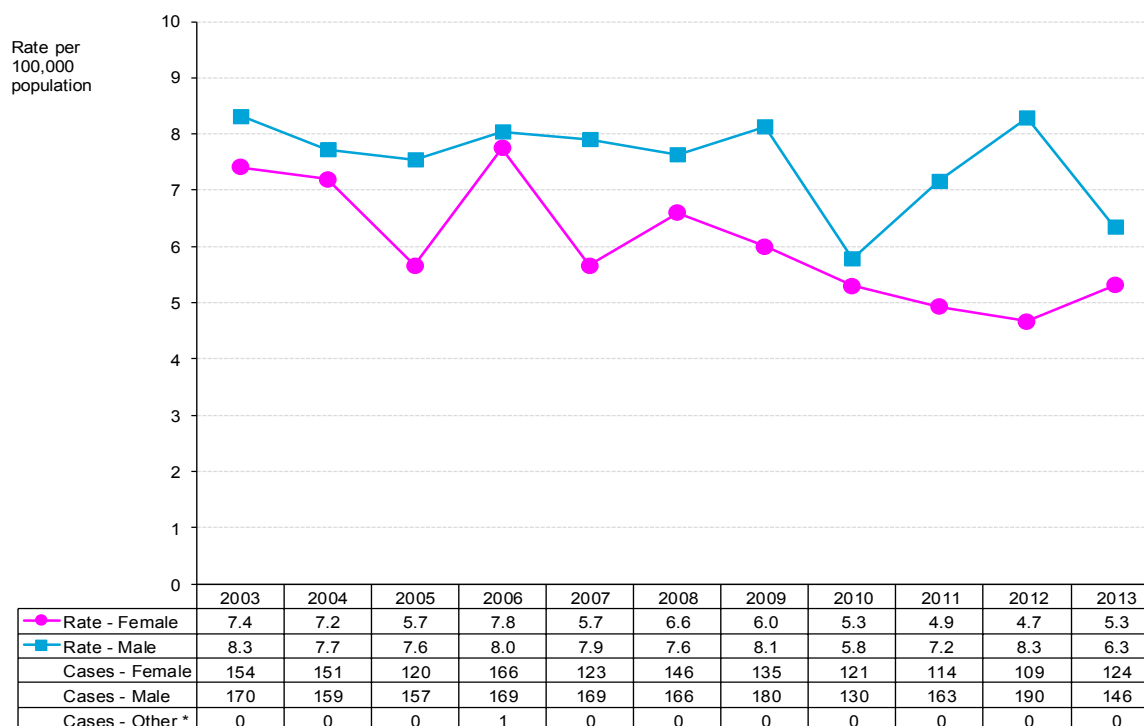
+ Population denominators come from 2014 Population Estimates from BC Statistics.

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 2013 was 6.3/100,000 population, down from 8.3/100,000 population in 2012. The rate of active TB in females in 2013 was 5.3/100,000 population, up from 4.7/100,000 in 2012.

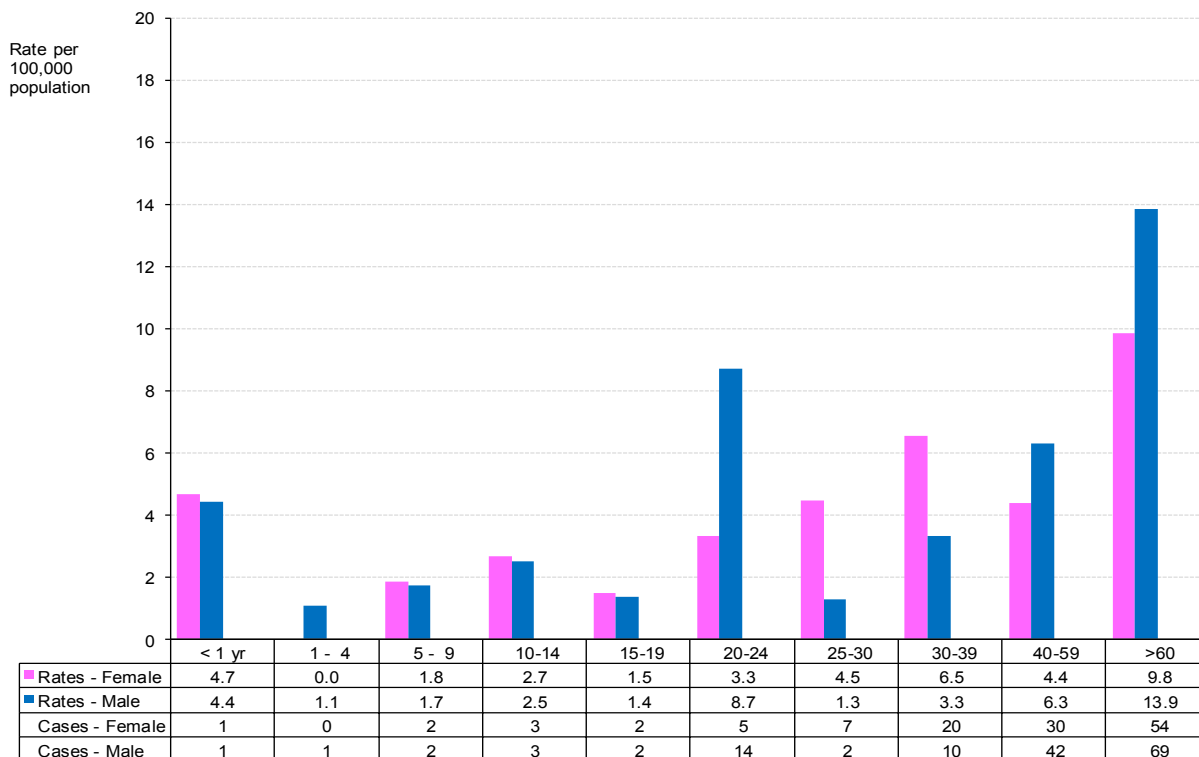
In 2013, the greatest percentage of active TB cases in BC occurred in those 40-59 years of age (26.7%) and 60 years or older (45.6%). This older age distribution of cases is more pronounced in males than in females. In 2013, the highest rate of active TB in men was in those ≥ 60 years of age (13.9/100,000 population), followed by those 20-24 (8.7/100,000 population) (Figure 5). Similar trends were seen in women, with the highest rate also occurring in those ≥ 60 years of age (9.8/100,000 population) followed by those 30-39 years of age (6.5/100,000 population) (Figure 5). Active disease in those < 5 years of age indicates recent transmission because of the reduced probability of historic exposure and reactivation. Three cases of active TB were diagnosed in those < 5 years of age in 2013, equal to what was seen in 2012 (n=3).

Figure 4. Active TB disease rates by gender in BC, 2003 to 2013



* Other - transgender and gender unknown

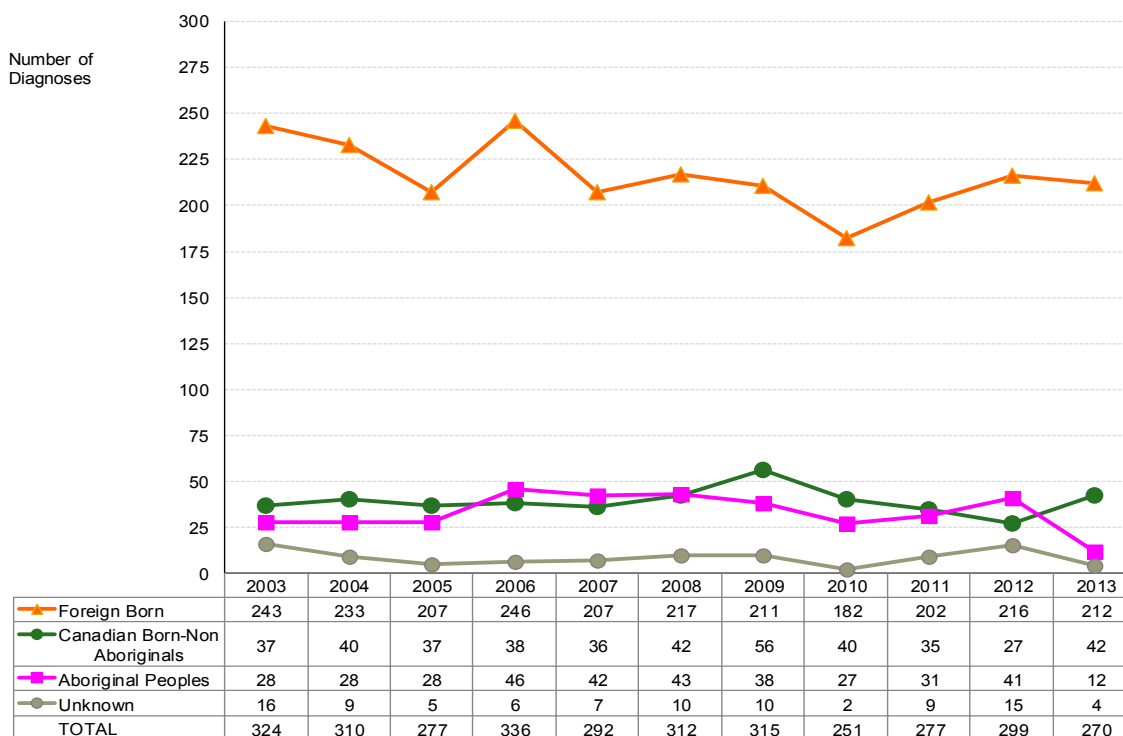
Figure 5. Active TB disease rates by gender and age in BC for 2013



Active TB by Origin

In 2013, 212 cases (78.5%) of provincial cases occurred in the foreign-born population, up from 72.2% (n=216) in 2012 (Figure. 9). In 2013, there were only 12 cases among Aboriginal peoples (4.4%), down from 41 in 2012. The number of active TB cases among people who identify as aboriginal in 2013 represent an 11 year low. A total of 42 (15.6%) active TB cases were diagnosed in Canadian-born non-Aboriginal people in 2013, up from 27 in 2012. At the time of this report, 4 (1.4%) of active cases in 2013 have an unknown origin.

Figure 6. Active TB disease total by origin in BC, 2003 to 2013



* Aboriginal Peoples include First Nations, Metis, and Inuit peoples.

Active TB among First Nations 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 sanitarium.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.

The term Aboriginal Peoples is used in this report to describe people self-identified as Aboriginal at the time of diagnosis. In this section we present data for the subset of Aboriginal Peoples who identified as First Nations. Métis and Inuit peoples are excluded due to the small numbers (five or fewer TB cases were reported per year among Métis and Inuit people between 2003 and 2013) and the absence of population estimates for Métis and Inuit populations.

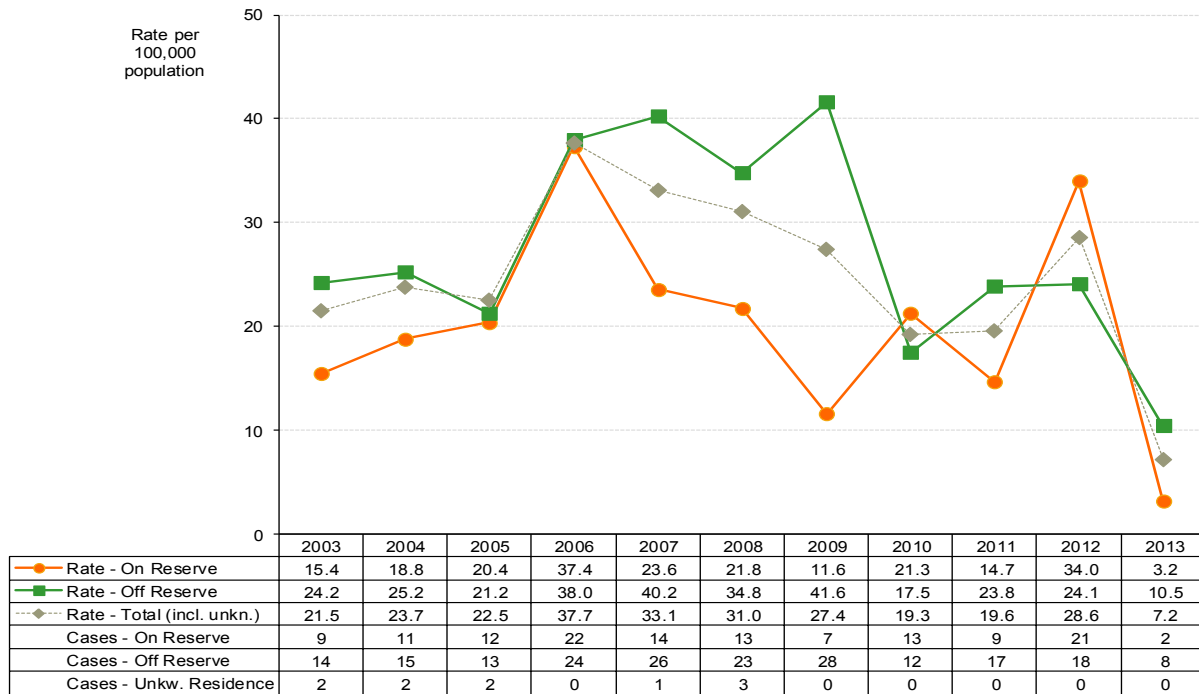
The rate of active TB in First Nations people in 2013 was 10.5/100,000 population, down from 24.1/100,000 population in 2012. The rate of active TB in First Nations people was steady between 2003 and 2005, but increased to 37.7/100,000 population in 2006, taking nearly four years to return to pre-2006 levels (Figure 10).

In 2013, the active TB rate among First Nations living on-reserve was (3.2/100,000 population), dropping significantly from 2012 (34.0/100,000 population), and was the lowest value since 2003 (Figure 10). The active TB rate is typically higher among First Nations living off-reserve, and this is seen in 2013 with an off-reserve rate of 10.5/100,000. In 2013, the rate of active TB among First Nations living off-Reserve also decreased to its lowest value in 11-years. It should be noted that fluctuations in the TB rate among First Nations people is expected given the small number of cases annually.

The overall rate of active TB in First Nations males and females in 2013 was 11.7/100,000 population and 2.8/100,000 population, respectively. This was a decrease from male and female active TB incidence in 2012, at 28.3/100,000 and 28.9/100,000 population, respectively.

There were no people under 20 years of age diagnosed with active TB in 2013, whereas 5 cases under 20 were reported in 2012. The rate for males in 2013 was 9.9/100,000 population in those 30-39 years of age, 27.7/100,000 population in those 40-59 year of age, and 27.1/100,000 population in those over 60 years of age. All other age groups for males had no cases in 2013. In females, the incidence was 5.4/100,000 population in those 40-59 years of age, and 10.4/100,000 population in those 60 years of age and older. No cases were diagnosed in the other age groups for females.

Figure 7. Active TB disease rates for First Nations peoples on and off reserve in BC, 2003 to 2013.



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

Active TB among Foreign-born Populations

Between 2003 and 2013, 72.8% of active TB cases in BC occurred in the foreign-born population (n=2150) (Figure 6). 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.⁴ Many of BC's recent immigrants come from regions with high rates of active TB such as the Public Health Agencies (PHAC) South-east Asia and Western Pacific regions^{1,5}. 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.⁶ Visitors, students or workers staying less than 6 months do not undergo screening.

The highest numbers of active TB cases in foreign-born population in BC consistently occur in groups from the Western Pacific region followed and the South East Asian Region¹ (Figure 8); in 2013, there were 121 and 67 cases from these regions, respectively, representing 88.7% of all foreign-born TB cases. Fewer than 50 cases of active TB were diagnosed each year in individuals from each of the other PHAC regions.

In 2013, foreign-born cases of active TB were older (median: 51.0 years) than were non-foreign-born cases (median: 48.0 years). In 2013, 48.6% of foreign-born cases were male. The age breakdown of foreign-born active TB cases is similar to that of provincial totals, with 48.6% of foreign-born cases occurring in those over 60 years of age and with 23.6% between 40-59 years of age (Figure 9).

Figure 8. Percentage of total active TB disease cases for foreign-born peoples by PHAC region in BC, 2003 to 2013

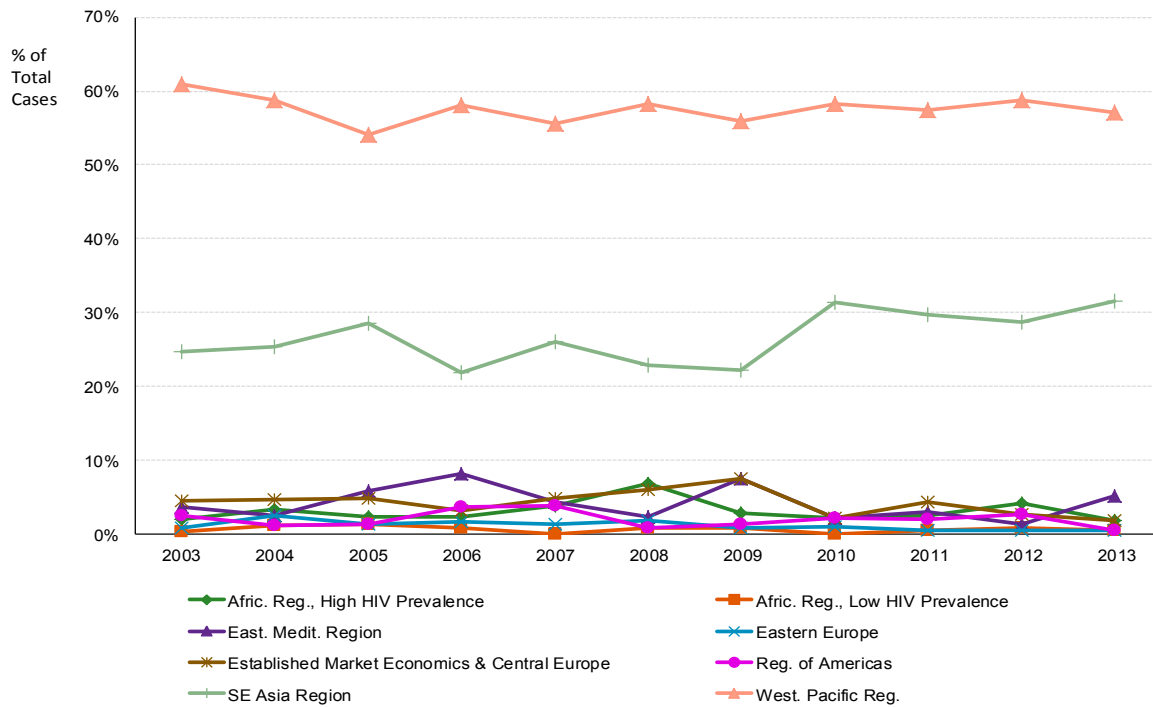
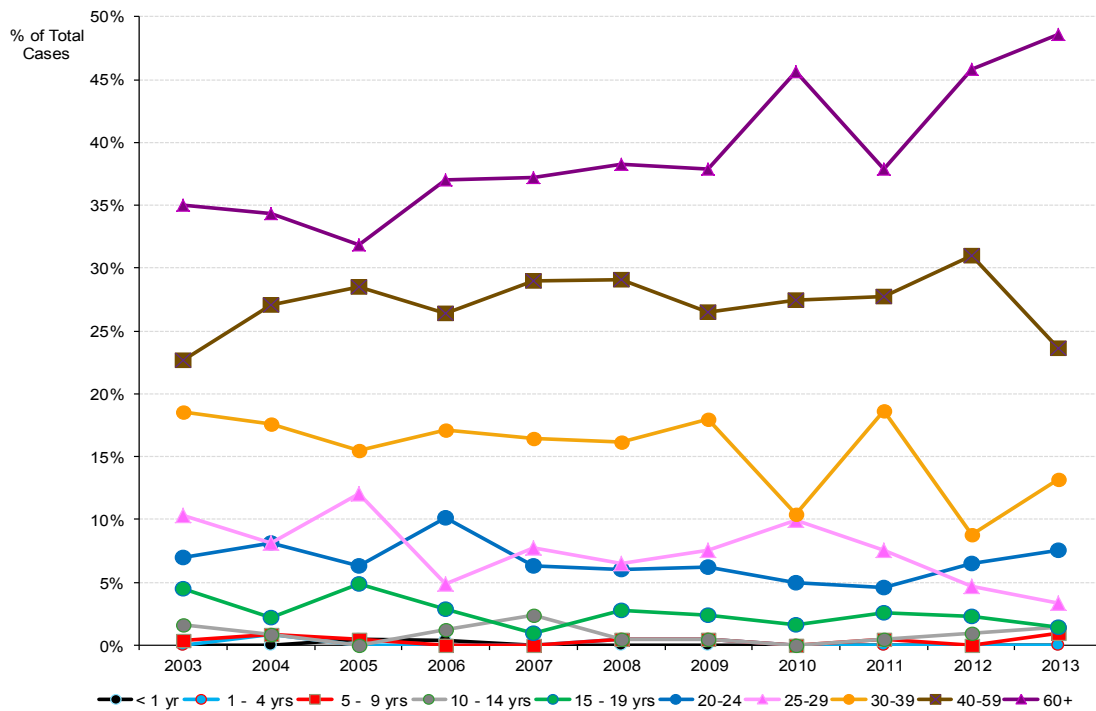


Figure 9. Percentage of total active TB disease cases for foreign-born peoples in BC by age groupings, 2003 to 2013



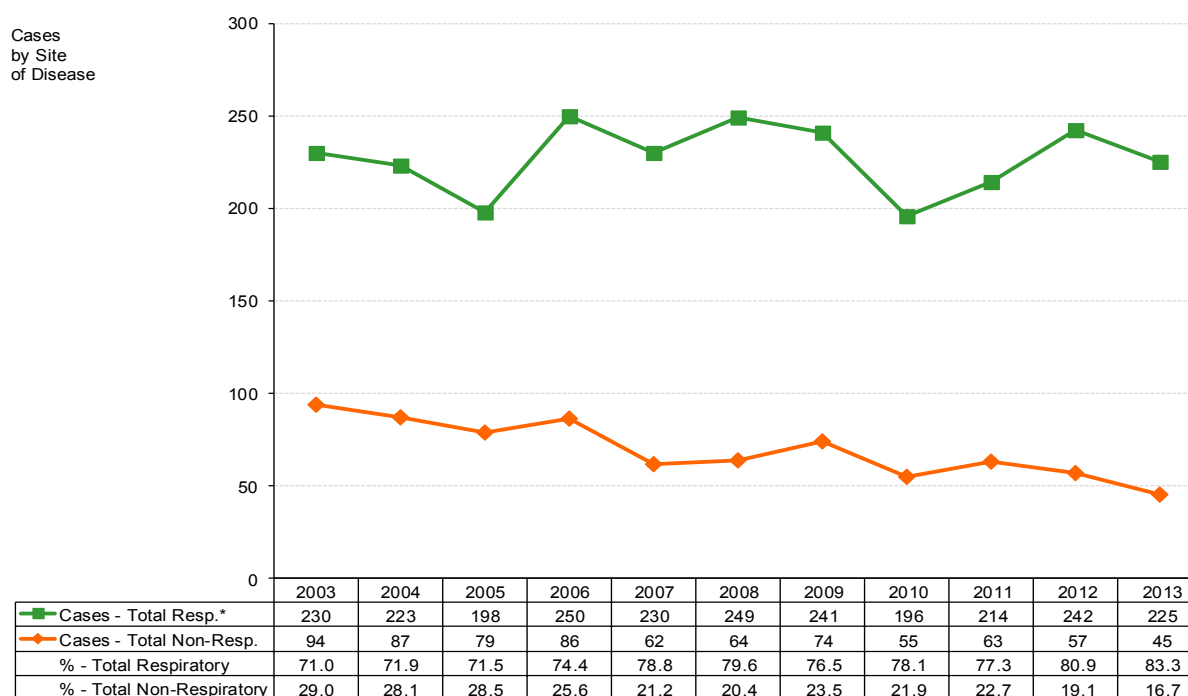
Site of Disease

The site of active TB describes the location of TB infection. Respiratory infection is more transmissible than non-respiratory infection⁷. In 2013, 83.3% (n=225) of active TB cases were respiratory, up from 80.9% (n=242) in 2012 (Figure 10). Of respiratory cases in 2013, 88.4% were pulmonary, 7.6% were classified as other respiratory, 2.7% were miliary, and 1.3% were diagnosed as primary infections (Table 1). Of the respiratory cases in 2013, 9.8% (n=22) were cavitary, down from 13.6% (n=33) in 2012.

Primary infections are perhaps the most severe form of TB and often affect children.⁷ The percentage of miliary TB cases in 2013 (2.7% of all respiratory cases) increased from 0.8% in 2012. Yearly fluctuations are likely driven by small numbers (Table 2).

In 2013, 16.7% (n=45) of cases were non-respiratory, compared to 19.1% (n=57) of cases in 2012. That pattern observed in 2013 is consistent with the historic trend. Of the non-respiratory cases in 2013, 37.8% (n=17) occurred in the Peripheral Lymph Nodes, 4.4% (n=2) occurred in the meninges and central nervous system (CNS), and 57.8% (n=26) were classified as other (Table 1).

Figure 10. Cases of respiratory and non-respiratory TB, 2003 to 2013



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

Table 1. Percentage of total active TB cases by site classification in BC, 2003 to 2013

% of Total Cases	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Respiratory												
% Primary	2.2	4.0	2.0	2.8	0.4	1.6	2.1	2.0	0.5	1.2	1.3	0.5
% Pulmonary	89.1	85.7	88.4	86.8	89.1	92.8	90.5	89.8	92.1	90.5	88.4	95.0
% Miliary	1.7	1.3	0.0	0.0	0.0	0.0	0.8	1.0	3.3	0.8	2.7	1.4
% Other	7.0	9.0	9.6	10.4	10.4	5.6	6.6	7.1	4.2	7.4	7.6	3.2
% - Total Respiratory	71.0	71.9	71.5	74.4	78.8	79.6	76.5	78.1	77.3	80.9	83.3	82.7
Non-Respiratory												
% Meninges and CNS*	5.3	5.7	6.3	4.7	8.1	1.6	6.8	7.3	3.2	1.8	4.4	2.2
% Peripheral Lymph Node	58.5	49.4	46.8	61.6	53.2	43.8	51.4	61.8	60.3	49.1	37.8	65.2
% Other	36.2	44.8	46.8	33.7	38.7	54.7	41.9	30.9	36.5	49.1	57.8	32.6
% - Total Non-Respiratory	29.0	28.1	28.5	25.6	21.2	20.4	23.5	21.9	22.7	19.1	16.7	17.3
Unknown Site	0	0	0	0	0	0	0	0	1	0	0	0
Total Cases	324	310	277	336	292	312	315	251	277	299	270	266

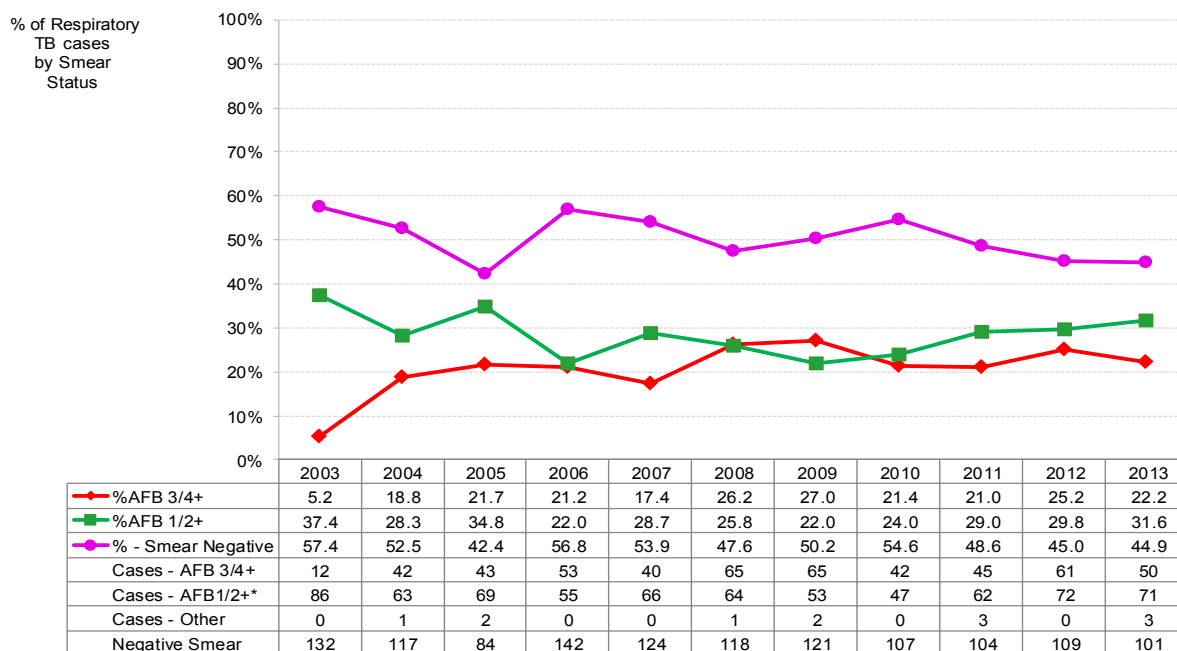
* CNS = central nervous system

Degree of Smear Positivity

All cases of respiratory active disease have a sample collected for rapid smear testing. 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+ or 4+ patients are more infectious than AFB 1+ or 2+ patients.⁷

In 2013, 22.2% (n=50) of active respiratory cases were smear 3 or 4+ positive, down from 25.2% (n=61) in 2012 (Figure 11). However, the percentage of total smear positive (AFB 1 or 2+, AFB 3 or 4+ and other) respiratory cases remained nearly identical 2012 and 2013.

Figure 11. Percentage smear results for respiratory cases in BC, 2003 to 2013

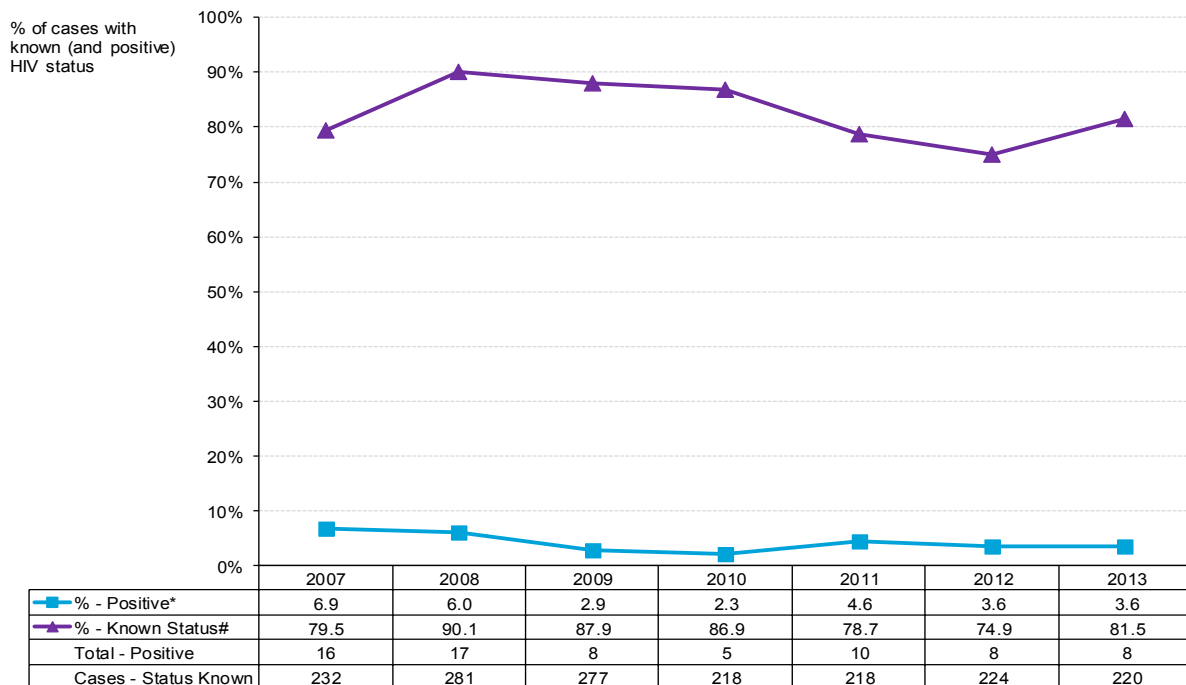


* This category also contains a small number of cases with "positive" or "seen".

HIV Screening and Co-infection

Only data collected 2007 or later is presented here because HIV data was previously not routinely collected for all TB cases. In 2013, 81.5% of TB cases had a known HIV status (including self-reported), up from 74.9% in 2012. Of those with known status, 3.6% had HIV infection in 2013 as indicated by self report or lab report, equal to the 3.6% observed for 2012 (Figure 12). 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 12. Percentage of active TB Cases with known HIV status in BC, 2007 to 2013



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 (excluding those diagnosed post-mortem (n=6)). In this group, the percentage of active cases starting treatment in BC has remained above 97% since 2003. In 2013, 98.8% of all active cases started treatment, up from 98.0% in 2012. Of those who started treatment, 61.5% did so as outpatients, with 78.2% of all treatment starts being self-administered.

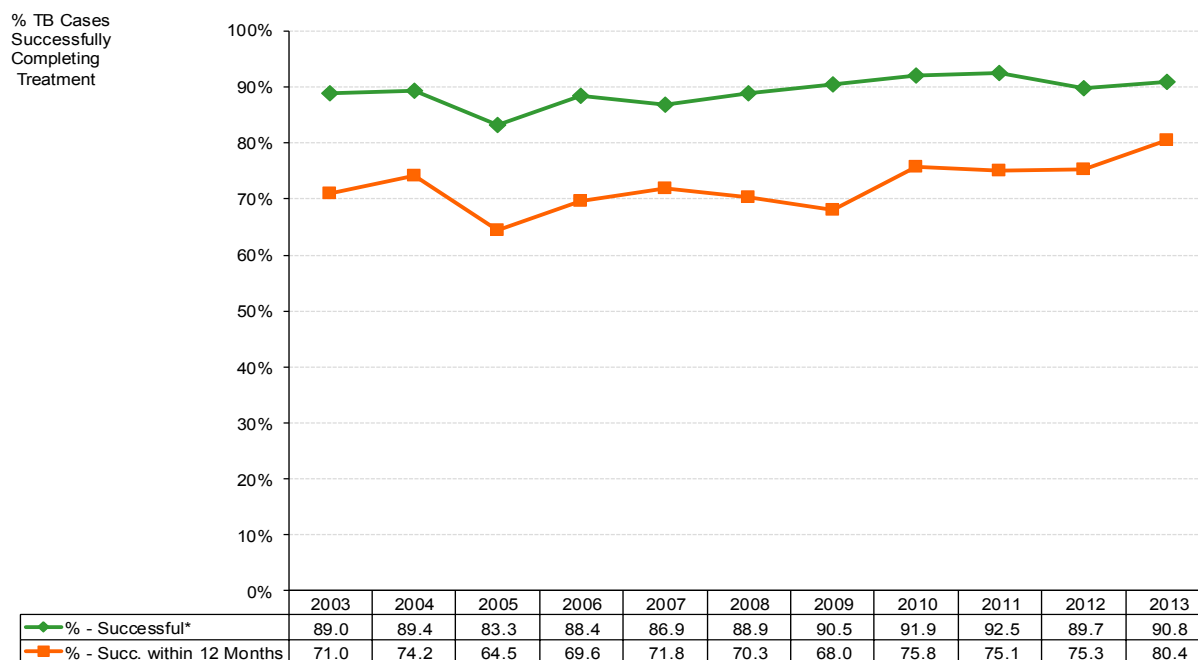
Of cases not diagnosed post-mortem in 2013, 3 cases (1.2%) were not documented as having started treatment. The 3 clients with no documented treatment were all temporary residents on student or work permits, and likely returned to their home country prior to the initiation of active TB treatment.

Treatment Completion

The percentage of patients completing treatment for active TB disease remained stable over the last 9 years. In 2013, 90.8% percent of patients starting treatment successfully completed treatment, with 80.4% doing so within 12 months (Figure 14). This was up from 89.7% successfully completing treatment in 2012 (75.3% in 12 months).

Of those patients who did not complete active TB treatment in 2013 (n=27, excluding those who died), 7.4 % were non-adherent, 7.4% had drug reactions, 14.8% left the province, and 70.4% had no information on reason for treatment completion (Table 2).

Figure 14. Percentage of active TB Cases# by treatment success in BC, 2003 to 2013



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 with no associated time frame

Table 2. Percentage of documented treatment failures in BC by reason for failure, 2003 to 2013

Reason for Non-Completion	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Drug Reaction	4.3	10.8	3.6	2.0	2.0	2.3	6.5	8.7	6.9	6.3	7.4
Left Province	31.9	18.9	25.5	28.6	37.3	34.1	16.1	34.8	41.4	18.8	14.8
Lost to Followup	12.8	13.5	18.2	24.5	17.6	11.4	16.1	21.7	3.4	6.3	0.0
Non-Adherence	17.0	29.7	30.9	16.3	9.8	11.4	25.8	13.0	6.9	25.0	7.4
No Data	31.9	24.3	16.4	26.5	29.4	36.4	29.0	8.7	41.4	40.6	70.4*
Other	2.1	2.7	5.5	2.0	3.9	4.5	6.5	13.0	0.0	3.1	0.0
# Unsatisfactory Compl.	47	37	55	49	51	44	31	23	29	32	27

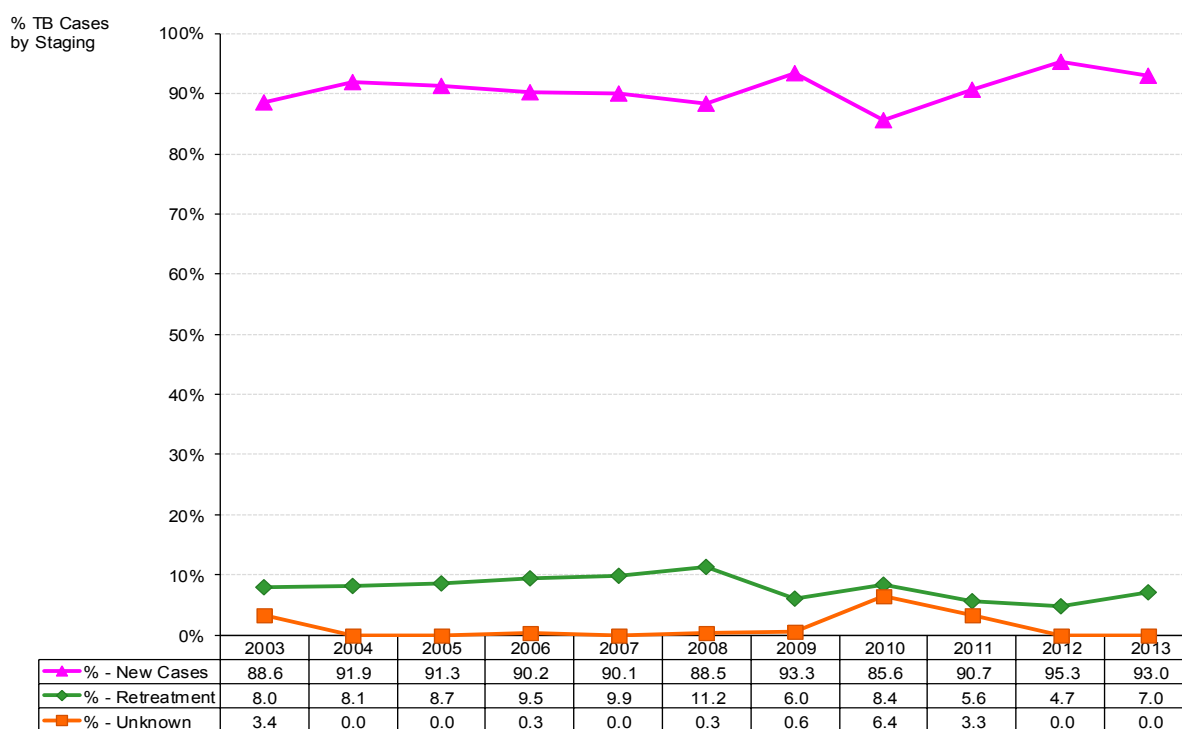
This data includes only information on those individuals who did not complete treatment, and does not include those who died during treatment.

* Lags in the recording of treatment completion information may inflate the % of unknown outcomes in most recent year

Retreatment

Retreatment cases are clients who have active disease with documented evidence of previous active disease in BC or elsewhere. The majority of active TB cases in BC between 2003 and 2013 represent initial reactivation of latent TB or novel infection. In 2013, 93.0% of active cases were documented as new cases of active disease, down from 95.3% in 2012 (Figure 15). Only 7.0% (n=19) of cases were determined to be retreatment of previous disease, up from 4.7% in 2012. In 2013, 94.7% (n=18) of retreatment occurred in the foreign-born population, up from 71.4% in 2012. In 2013, 84.1% of retreatment cases occurred in those ≥60 years of age, and 10.5% of cases occurring in those 40-59 years of age. In 2013, 89.7% of retreatment occurred in males, down from 92.9% in 2012.

Figure 15. Percentage of total TB cases diagnosed as retreatment in BC for 2013

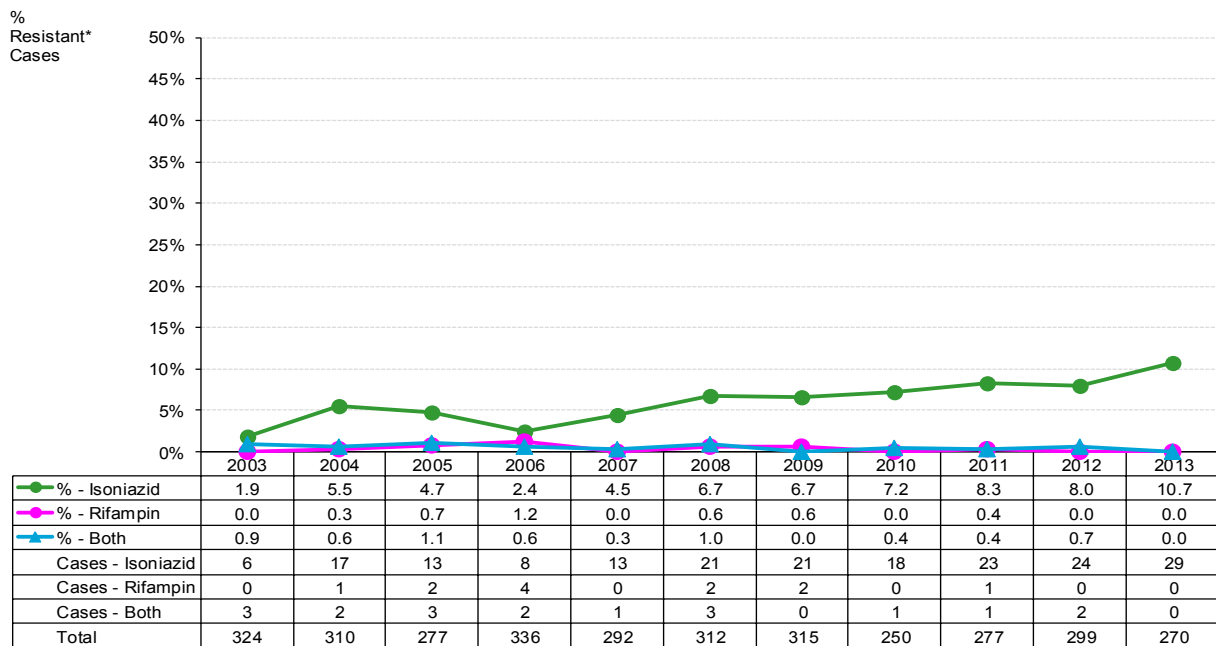


Drug Resistance

The percentage of cases with only Isoniazid resistance increased from 8.0% in 2012 to 10.7% in 2013 (Figure 16). There was no Rifampin resistance detected in BC for the second year in a row. Despite this, drug resistance remains an important issue given increases in both the worldwide rates of drug resistance⁸ and the number of immigrants from countries with high-rates of endemic TB.

Multi-Drug Resistant TB (MDRTB, which is identified as combined Isoniazid and Rifampin resistance) is also rare, with 0 cases seen in 2013, down from 2 cases detected in 2012. No extensively drug resistant TB (XDRTB) has been diagnosed in BC.

Figure 16. Percentage of total cases with drug resistance in BC, 2003 to 2013



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

C. Mortality in Active TB Cases

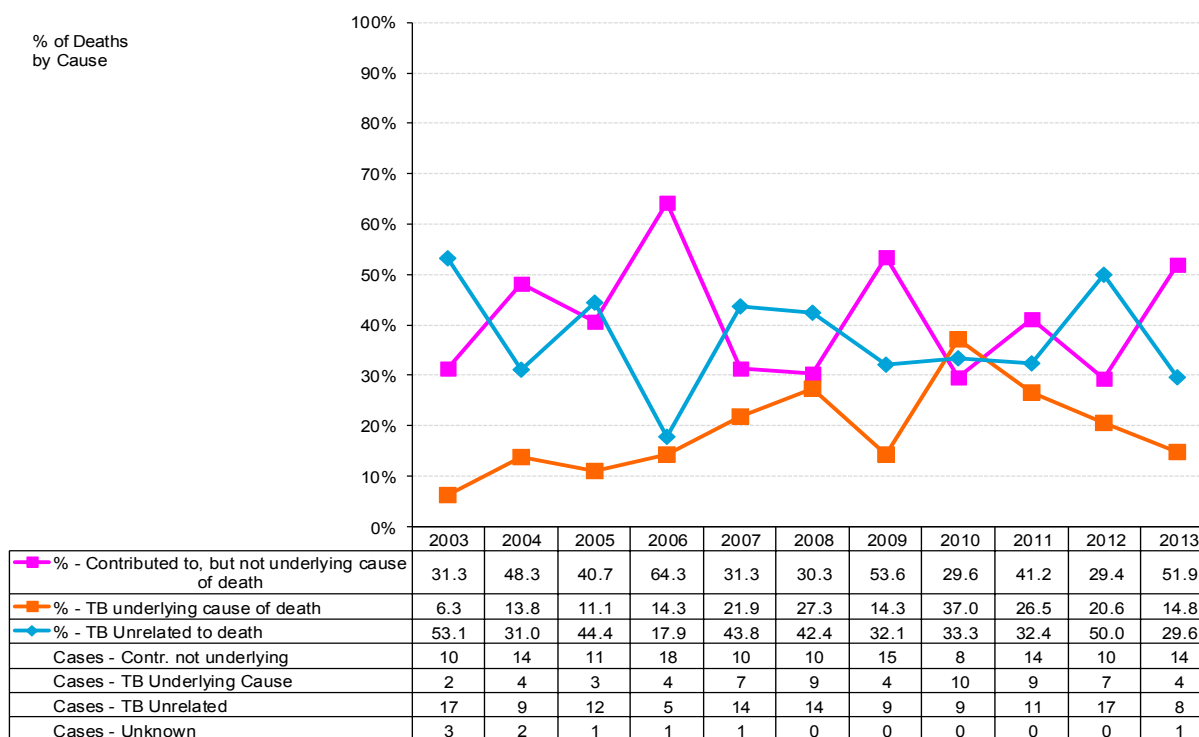
Mortality

In 2013, there were 27 deaths amongst active TB cases documented in iPHIS (see Appendix). Of these, 10 were diagnosed post-mortem, 16 cases died during active TB treatment, and 1 died within 30 days of treatment completion. The total number of deaths in TB cases in iPHIS decreased in 2013 compared to 2012 (n=35).

Of the 27 deaths occurring in active TB cases in 2013, 59.2% (n=16) were male and 40.7% (n=11) were female. The higher mortality in men is consistent with provincial totals since 2004. No deaths occurred in those under 25 for either gender, while 73% and 75% of cases occurred in the over 60-age group for males and females, respectively.

Of the 27 deaths documented in 2013, 29.6% (n=8) were unrelated to active TB disease. TB was the underlying cause of death in 14.8% (n=4) of documented deaths, and contributed to, but was not the underlying cause, in 51.9% (n=14) of cases (Figure 17). Note that variability in the percentage of deaths for which active TB was an unrelated or contributing cause is likely indicative of a combination of small numbers and coding issues, and may not reflect true mortality patterns (Figure 17).

Figure 17. Percent of total mortality by cause in BC, 2003 to 2013



Latent TB Screening & Treatment

Latent TB

Latent TB infection is not a reportable condition, and estimates are derived from clinical screening data. LTBI surveillance in BC remains in 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.⁷ 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).⁹ 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 is based on TST>9mm and/or IGRA reactive results to broadly estimate the number of persons tested in 2010-2013 in BC, and whose results indicate infection with TB. Specifically, LTBI is estimated as the total of: 1) TST>9mm without subsequent IGRA, 2) TST>9mm with subsequent confirmatory reactive IGRA results, 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 only accounts for those tested in the period 2010-2013 since 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 often focuses on specific high risk groups, and 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 Screening Results

In 2013, 3599 clients had a documented TST greater than 9mm in diameter in either the Public Health Module or TB Module of iPHIS. Of these, 2860 had no documented follow-up IGRA screening in the same year (Table 3). Of those with initial positive TST screening results, 20.5% (n=739) had subsequent IGRA testing, of which 43.0% (n=318) were confirmed reactive and 57.0% (n=421) were IGRA negative. The latter group represents those in whom LTBI therapy has potentially been avoided. In 2013, 303 clients were documented as IGRA positive with no initial TST documented in iPHIS in the period 2010-2013. Note that only 2012-2013 data is shown in Table 3 to ensure at least a 2-year retrospective window in which to identify previous TST testing results.

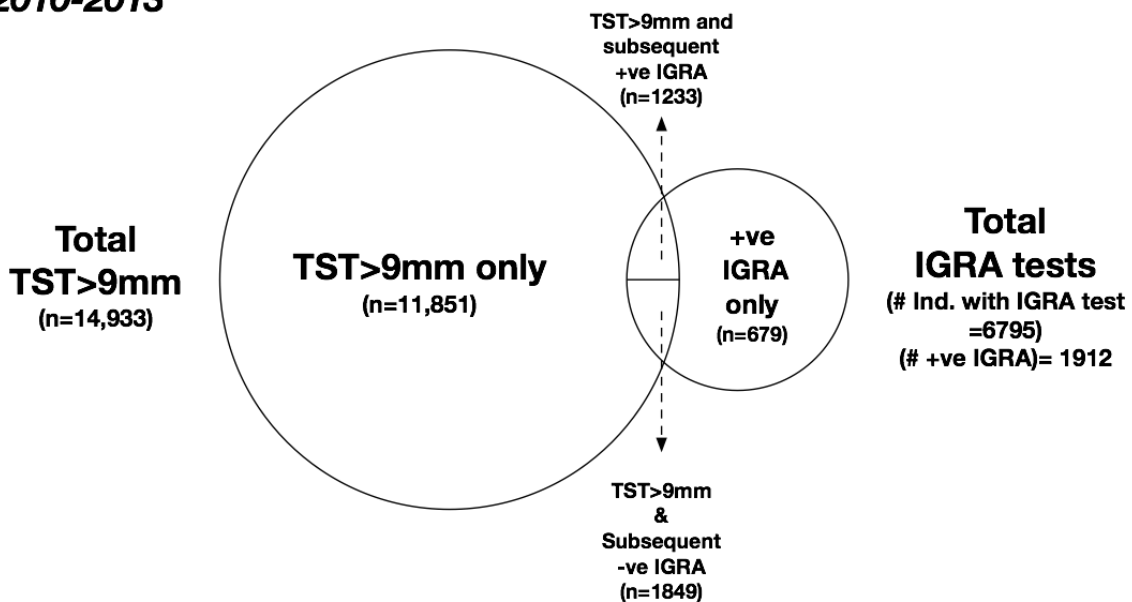
IGRA testing can occur months after initial TST testing in some instances which can affect year by year results. To address this issue, TST and IGRA testing data from 2010-2013 was grouped and evaluated together. From 2010-2013, 11851 individuals had TST >9mm with no follow-up IGRA, 679 had IGRA without an initial TST documented in iPHIS, and 3082 clients had a follow-up IGRA after showing an initial TST result of greater than 9mm. Of these 3082 clients, 40% had a positive follow-up IGRA (n=1233), while 60% had a negative follow-up IGRA.

Table 3. Total LTBI screening clients by result category BC, 2012-2013

Category	2012	2013
<i>TST>9mm only</i>	3150	2860
<i>TST>9mm & reactive IGRA</i>	272	318
<i>TST>9mm & non-reactive IGRA</i>	360	421
<i>Reactive IGRA only</i>	281	303

Figure 18. LTBI screening result summary for 2010-2013

2010-2013

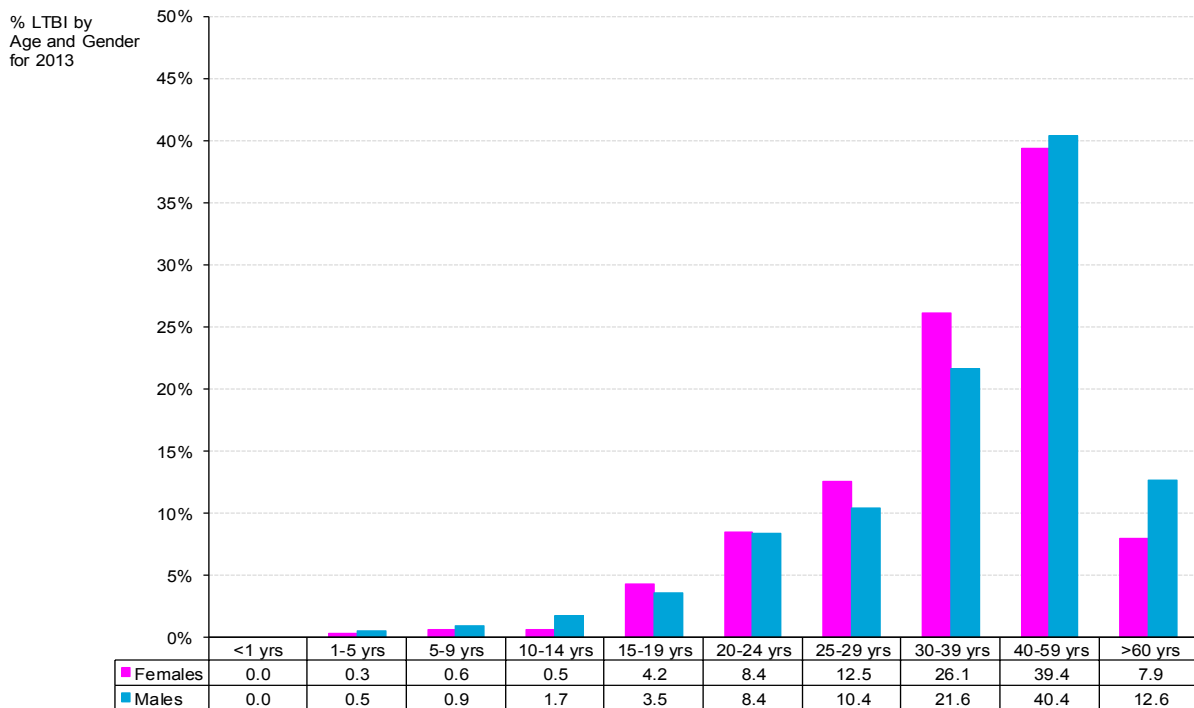


Screening based LTBI estimate for BC:
 $= 11,851 + 1233 + 679 = 13,763$

LTBI by Gender and Age

Positive LTBI screening results were more common in females than males in 2013, with 39.8% occurring in men and 60.2% in women. This gender distribution may be driven by health care worker screening. The age distribution of positive TST or IGRA results was similar in both 2012 and 2013. In 2013, 39.8% of positive results occurred in those 40-59 years of age, followed by 24.3% in those 30-39 years of age. No relevant difference in the age distribution of positive screening results were seen between males and females, although the age distribution does skew slightly younger for women and older for men (Figure 19).

Figure 19. Percent of total positive LTBI screening results by sex and age in BC, 2013

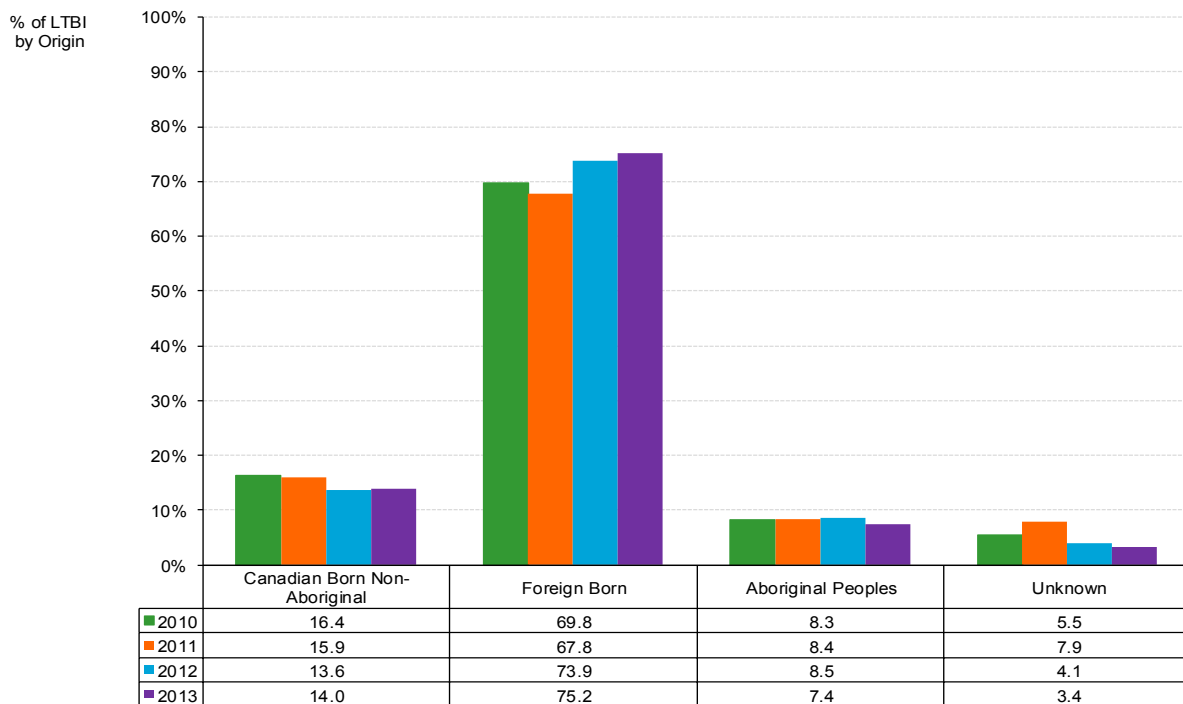


*The results presented here are heavily affected by provincial and regional screening and documentation practices.

LTBI by Origin

In 2013, 3481 clients were identified as having positive LTBI screening results, down from 3703 in 2012. In 2013, 75.2% of these individuals were among foreign-born, 14.0% were among Canadian born non-Aboriginal Peoples, and 7.4% were among Aboriginal Peoples (Figure 20). The high proportion of LTBI in foreign-born populations is expected given the high TB rates observed in many countries.

Figure 20. Percent of total positive LTBI screening results by origin in BC, 2010 to 2013



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

LTBI Treatment

LTBI is a clinical diagnosis in which an individual is suspected to have the non-infectious or dormant phase of TB. The recommendation to treat LTBI is based on a clinical assessment of the patient looking at risks for progression to active TB. Not everyone with LTBI is offered or needs treatment.

In 2013, 807 total clients started LTBI therapy, up from 826 in 2012. A total of 74.9% and 75.2% of those starting treatment completed treatment satisfactorily in 2012 and 2013 (Table 4), respectively. Of those starting treatment in 2013, 41.9% were aged 40-59, 19.7% were greater than 60, and 16.5% were 30-39 (Figure 21). In 2013, 71.0% of those starting LTBI treatment were among foreign-born, 20.2% were among Canadian-born non-Aboriginals, and 7.1% were among Aboriginal; 1.7% were of unknown origin or had missing data.

Of those failing to satisfactorily complete treatment in 2013, 9.0% did so for reasons that are not amenable to intervention (drug reaction, death all causes, and leaving province), down from 12.0% in 2012. In 2013, 13.5% failed to complete LTBI treatment for reasons that can potentially be improved with additional public health intervention (non-adherence, lost to follow up), up from 13.1% in 2012 (Table 4). Of those failing to complete treatment in 2013, the most common reasons were: 7.3% had a documented adverse drug reactions, 7.1% were lost to follow-up, and 6.4% were non-adherent. The percentage of cases with adverse drug reactions decreased over the last 2 years from 11.3% in 2011 (Table 4). Of those starting treatment in 2013, 85.3% received self-administered treatment and 3.7% had directly observed preventative therapy, down from 5.1% in 2012.

Figure 21. Proportion of total LTBI treatment by age in BC for 2013

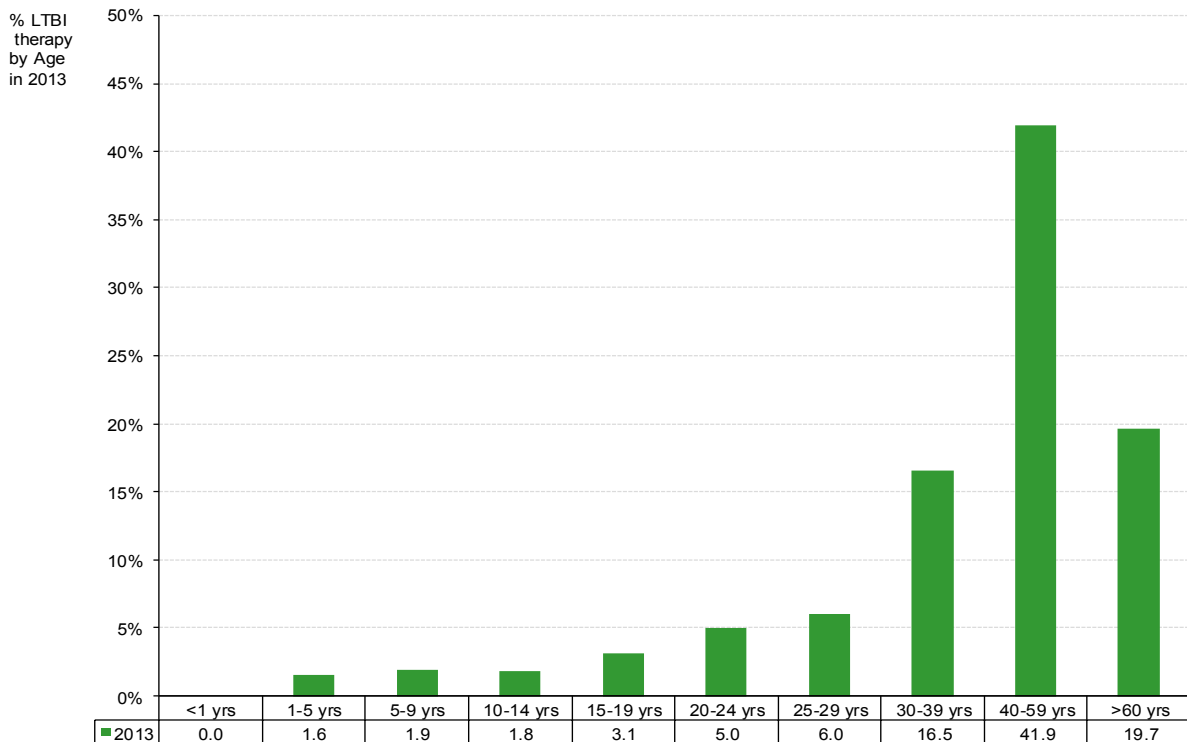


Table 4. Proportion of cases by LTBI treatment outcomes for 2010-2013

Treatment	2010	2011	2012	2013
Satisfactory	71.5	71.8	73.4	75.2
Not Completed - Non Amenable to Intervention	9.8	13.3	12.0	9.0
<i>Drug Reaction</i>	8.8	11.3	9.8	7.3
<i>Left Province</i>	0.8	1.3	1.9	0.9
<i>Death</i>	0.3	0.6	0.2	0.9
Not Completed - Amenable to Intervention	17.2	14.2	13.1	13.5
<i>Non Adherent</i>	4.3	6.2	6.3	6.4
<i>Lost to Follow-up</i>	9.8	8.0	6.8	7.1
<i>Incomplete - Other</i>	3.1	0.0	0.0	0.0
Other	1.2	0.5	1.3	1.5
Not Finished	0.0	0.0	0.0	1.0
No Data	0.2	0.3	0.2	0.7
Total # of LTBI Treatment	1060	777	826	807

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, duration of contact, and contact risk factors. This data presented in this report is from iPHIS only and may be incomplete as regions may have separate databases for contact investigation and for the investigation of clusters/outbreaks. 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 the circumstances of each case and differences in the collection, entry and reporting of contact data.

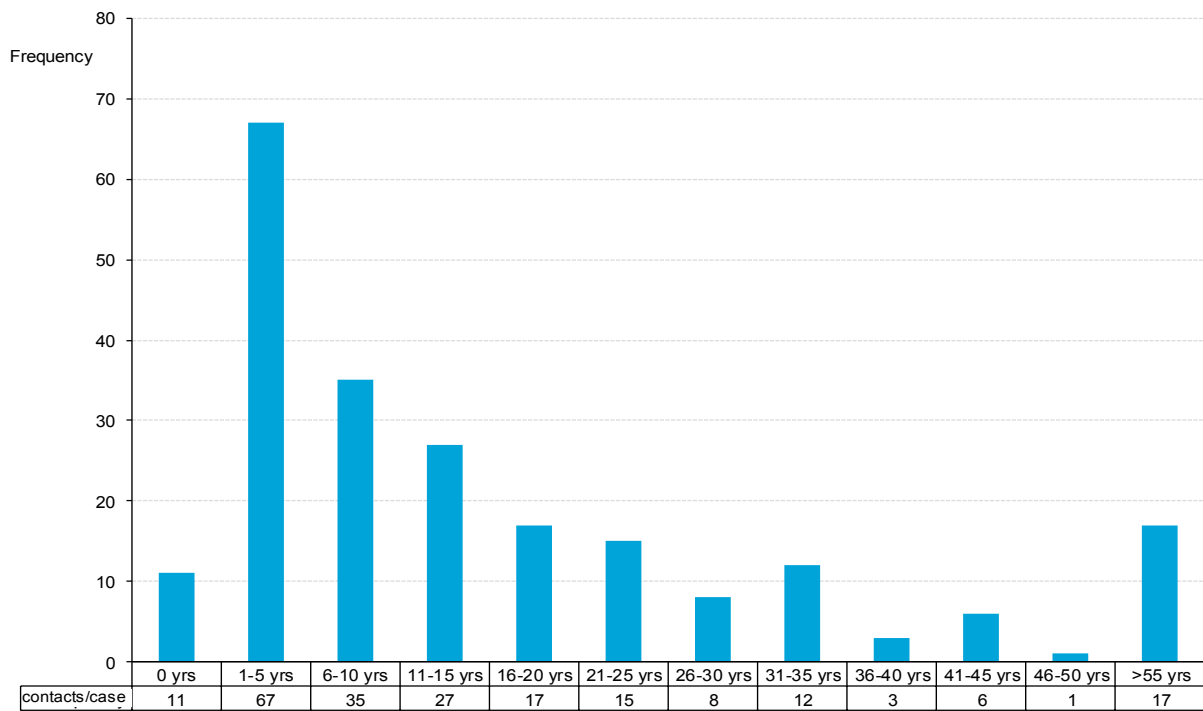
Contacts Per Case

In 2013, a total of 4334 contacts were documented in iPHIS. Of the contacts identified in iPHIS in 2013, 4180 were contacts of respiratory cases. Of these 4334 contacts, 4323 were unique individuals, with 11 contacts associated with more than a single case. The total number of unique contacts in 2013 had decreased from the 5159 contacts reported in 2012.

In 2013, 11 respiratory cases had no documented contacts in iPHIS, down from 13 in 2012; these individuals were excluded from summary calculations. The mean number of contacts per respiratory TB case (primary, pulmonary, miliary, and other respiratory) in 2013 was 19.7 (median=11), down from 22.1 (median=13.00) in 2012. The maximum number of contacts associated with a single respiratory case was 236 and 181 in 2012 and 2013, respectively.

The median number of contacts of respiratory cases in 2013 was 31.0 in TB cases among Aboriginal peoples, 12.0 in cases among Canadian born, 9.5 in foreign-born cases, and 43.0 in contacts of unknown origin. Approximately 49% of respiratory cases (with at least 1 contact) in 2013 had 10 or fewer listed contacts. Five individuals had >100 contacts (Figure 22).

Figure 22. Histogram of number of contacts per respiratory source case in 2013

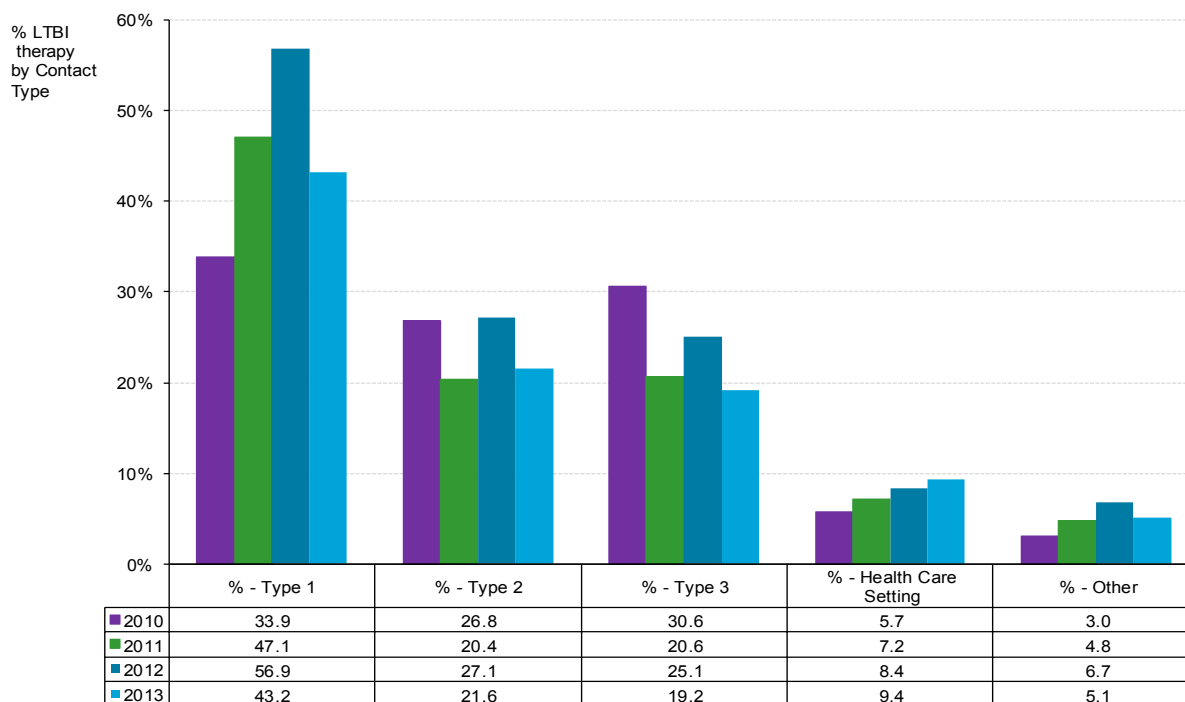


Contact by Type

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.¹⁰

In 2013, 43.2% of all contacts (including individuals listed more than once) were classified as Type 1, 21.6% were Type 2, and 19.2% were Type 3 (Figure 23). The percentage of Type 1 contacts has decreased from 2012 (56.9%).

Figure 23. Percentage of total contacts by contact type for BC in 2010-2013

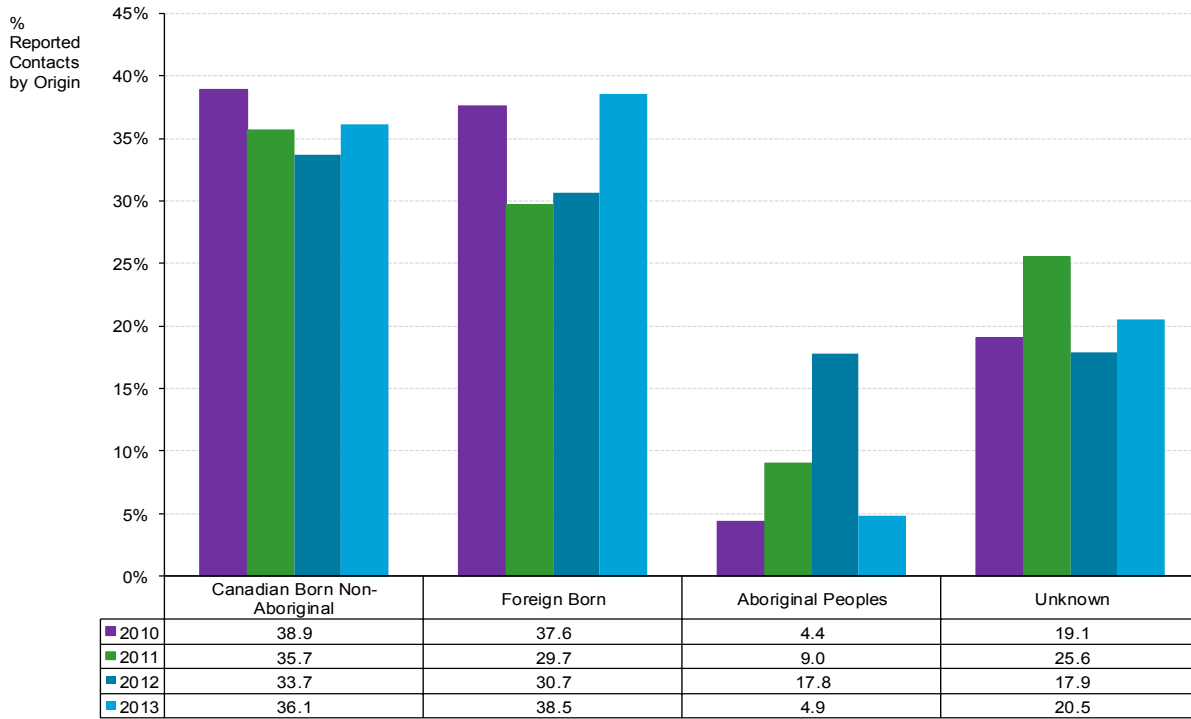


*The results presented here are heavily affected by provincial and regional contact management practices.

Contact by Origin

Canadian Born Non-Aboriginal people accounted for 36.1% of contacts identified in 2013, and 33.7% in 2012, despite accounting for only 15.6% and 9.0% of total cases in these years (Figure 24). Foreign-born people comprised 38.5% and 30.7% of all contacts in 2013 and 2012, with contacts of cases among Aboriginal peoples accounting for 4.9% and 17.8% of contacts in these years, respectively. Note that differential reporting practices from targeted screening and control programs may bias the results presented here.

Figure 24. Percentage of total contacts by case origin for BC in 2010-2013



*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 Public Health Agency of Canada. Tuberculosis in Canada 2011 - Pre-Release. In: Minister of Public Works and Government Services Canada, editor. Ottawa, Canada 2012.
- ⁵ Canada. Facts and Figures: Immigration Overview Permanent and Temporary Residents. Ottawa, Ontario: Research and Evaluation Branch, Citizenship and Immigration Canada; 2011.
- ⁶ For a description of immigrant screening practices, see: Gushulak B, Martin S. Immigration and Tuberculosis Control. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 298-307.
- ⁷ Long R, Schwartzman K. Transmission and Pathogenesis of Tuberculosis. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 37-52.
- ⁸ Zignol, Matteo et al. Surveillance of anti-tuberculosis drug resistance in the world: an updated analysis, 2007-2010. *Bull World Health Organ* [online]. 2012, vol.90, n.2 [cited 2013-05-15], pp. 111-119 .
- ⁹ 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.
- ¹⁰ TB Manual for Professionals to Help Manage TB. BCCDC; 2011. pg. 43. Retrieved from: http://www.bccdc.ca/NR/rdonlyres/57623012-34A9-4886-9B6D-00D8576BA190/0/TB_Manual_BCCDC_June2010.pdf

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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 2003-2013 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 Feb 1st, 2014. TST, IGRA, and LTBI data was extracted March 15th, 2015. iPHIS data may be modified after data extraction 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. Rates or proportion over time for some indicators may reflect minor differences in small numbers, and not meaningful changes in the underlying disease process.
- Tuberculin skin test (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 TSTs occurring in multiple years over the 2009 to 2013 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 PHAC 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. 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-morbidities¹⁰. 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 and IGRA testing results 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 Figure. 32).

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 1993-2013 is based on BC Stats population Estimates Database <http://www.bcstats.gov.bc.ca/StatisticsBySubject/Demography/PopulationEstimates.aspx>.

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, 2013*. 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.