TUBERCULOSIS IN NEW ZEALAND
ANNUAL REPORT 2014

Prepared as part of a Ministry of Health contract for scientific services by
the Health Intelligence Team, Institute of Environmental Science and Research Limited

December 2015

This report is available at www.surv.esr.cri.nz

First published: 18 December 2015

Suggested citation:

Institute of Environmental Science and Research Ltd (ESR).
Tuberculosis in New Zealand: Annual Report 2014. Porirua: ESR; 2015.

Client Report: FW15062

Acknowledgements

This report was prepared by Ange Bissielo, Helen Heffernan and Jill Sherwood.

Thanks to the following people and organisation for their contributions to this report:

- The Mycobacteriology Section of the Department of Microbiology, Auckland City Hospital; the Mycobacteriology Laboratory, Waikato Hospital; the Mycobacteriology Laboratory, Wellington Hospital; and the Mycobacteriology Laboratory, Canterbury Health Laboratories, for provision of the species and antimicrobial susceptibility data.
- The Molecular Section of the Department of Microbiology, Auckland City Hospital, for the provision of molecular typing data.
- Bible Lee (AIDS Epidemiology Group) for providing the HIV/TB co-infection data.
- Liza Lopez (ESR) for peer checking and Maritza Marull for formatting this report.
- Ayesha Verrall, Graham Mackereth (ESR), Lavinia Perumal and Sally Roberts (Auckland District Health Board) for peer reviewing this report.
- Grant Storey and Tom Kiedrzynski (Ministry of Health) for their helpful comments and feedback.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

Summary

SUMMARY

In this report we describe the epidemiology of tuberculosis in New Zealand for 2014 as well as trends during the past 5–10 years.

Tuberculosis disease (TB) is a notifiable condition in New Zealand and the TB notification rate has been stable over the last 7 years. The 2014 TB notification rate was 6.7 per 100,000 population (302 cases). The majority of TB notifications were for new disease, with relapse/reactivation cases contributing sparingly to the notifications. A high proportion of TB cases (87.7%) were laboratory confirmed.

As in previous years, there were demographic differences among new TB case rates. Rates were higher in males than females, especially in the older age groups. The Asian and Middle Eastern/Latin American/African (MELAA) ethnic groups have consistently experienced the highest notification rates, although the absolute number of MELAA cases remains relatively low. As in previous years, higher rates of TB occurred in socioeconomically deprived areas.

Being born outside of New Zealand and current or recent residence with a person born outside New Zealand have consistently been dominant risk factors, whereas exposure in a healthcare setting and current or recent residence in an institution were reported for comparatively few new TB cases.

The pattern of disease detection for new TB cases has been consistent over the past 5 years, with more than two thirds of TB cases diagnosed when they presented with symptoms to a health practitioner. Around 7% of cases were identified through immigrant/refugee screening.

Pulmonary disease was more common among new TB cases born in New Zealand than in cases born overseas. One case of miliary TB in a child aged <5 years was reported in 2014 and only two cases have been reported in this age group in the last 5 years. There were no cases of tuberculous meningitis reported in this age group over the last 5 years.

Most (92.8%) new TB cases in 2014 were reported to have received treatment. For pulmonary cases where the time between the onset of symptoms and start of treatment could be calculated, 17.1% of cases started treatment within 1 month of the onset of illness and 64.9% started treatment between 1 and 3 months.

Two of the new TB cases notified in 2014 were co-infected with HIV compared with none being co-infected with HIV in 2013.

Two outbreaks of *Mycobacterium tuberculosis* with 14 associated cases were reported in 2014.

Ministry of Health hospitalisation data showed a decreasing trend in hospital admissions for TB over the last decade. This was true for all age groups analysed.

Three (1.2%) of the 247 culture-positive TB cases reported in 2014 were multidrug-resistant TB (MDR-TB, defined as resistance to at least isoniazid and rifampicin). One of these MDR-TB cases appears to have developed resistance during anti-tuberculous drug treatment in New Zealand. Resistance to all antimicrobials except pyrazinamide was higher among isolates from cases born overseas than among isolates from New Zealand-born cases, although only streptomycin resistance was significantly higher.

Between 2005 and 2014, there has been a significant trend of decreasing pyrazinamide resistance, but no significant changes in resistance to isoniazid, rifampicin, ethambutol or streptomycin. Over the same 10 years, on average, 1.3% of culture-positive TB cases were MDR-TB.

Approximately one third of the *M. tuberculosis* isolates that underwent molecular typing between 2010 and 2014 had results that matched other typed isolates, that is, were non-unique and could be assigned to a cluster. Most clusters contained fewer than five cases. Five new clusters were identified in 2014 including four clusters with two cases in each and one with three cases.

INTRODUCTION

INTRODUCTION

Globally, tuberculosis disease (TB) is one of the most common causes of death from a communicable disease. TB had almost disappeared from the world's public health agenda in the 1960s, but returned in the early 1990s following the HIV/AIDS pandemic, and was sustained by a subsequent increase in drug resistance. Infection is usually curable with a combination of specific antibiotics, but this relies upon full compliance with treatment. TB is more prevalent in, but not confined to, low-income countries.

The World Health Organization's (WHO) most recent estimated global TB incidence rate was 126 per 100,000 population for 2013. WHO estimates also show an average annual reduction in TB incidence of 1.5% between 2000 and 2013, rising to 2% in 2015 [1, 2]. This means that the 2015 Millennium Development Goal of halting and reversing TB incidence has been achieved globally. However, there is wide variation in regional rates and recent national population-based surveys in some countries have resulted in an upwards revision in global incidence. Under the post-2015 WHO Global TB Strategy (End TB Strategy) adopted in May 2014 new indicators have been set to achieve the goal to end the global tuberculosis epidemic. By 2035 the targets are: a 95% reduction in the numbers of TB deaths compared with 2015, a 90% reduction in the TB incidence rate compared with 2015 and zero TB-affected families facing catastrophic costs due to TB. The annual decline in global TB incidence rates will need to accelerate from the current 2% to 10% by 2025 and the proportion of people with TB who die from the disease will need to decline from a projected 15% in 2015 to 6.5% by 2025. It is recognised that achieving these targets will require integrated, patient-centred care and prevention, supportive systems and policies, and intensified research and innovation to provide new tools such as vaccines [2].

In New Zealand, TB is notifiable under the Tuberculosis Act 1948. The 2013 notification rate was 6.2 per 100,000, the lowest observed in the past 30 years. Notification rates decreased during the 1980s, ranging between 8.5 and 11.6 per 100,000 from 1990 to 2003, then decreased between 2003 and 2007 to 6.7 per 100,000 [3]. Although rates have been relatively stable since 2007, TB is one of a number of infectious diseases (including acute rheumatic fever, meningococcal disease and skin infections), that play a major role in ethnic and socioeconomic inequalities in New Zealand [4].

In this report we describe the epidemiology of TB in New Zealand for 2014 and detailed trends during the past 5–10 years. The report includes the distribution of TB disease notifications geographically, by age and sex, among specific ethnic groups and across protective and risk factors where information is available. We describe clinical outcomes based on hospitalisation and death data from the Ministry of Health's National Minimum Dataset and the National Mortality Collection. TB drug susceptibility and molecular typing data is also summarised.

The primary audience of this report is the New Zealand Ministry of Health and TB practitioners, including Medical Officers of Health, respiratory and infectious disease physicians, clinical microbiologists and medical laboratory scientists.

METHODS

METHODS

Data sources

Tuberculosis disease (TB) notification data recorded on EpiSurv, the national notifiable diseases database, is used in this report. Data provided by the four reference mycobacteriology laboratories in New Zealand (LabPlus at Auckland City Hospital, Waikato Hospital Laboratory, Wellington Hospital Laboratory and Canterbury Health Laboratories) on the species identification, antimicrobial susceptibility and molecular types of *Mycobacterium tuberculosis* complex isolates from cases of TB is also included. In addition, Ministry of Health data on hospitalisations and deaths due to tuberculosis is presented.

Notifications

Clinicians are required to notify all cases of TB to their local Medical Officer of Health under the Tuberculosis Act 1948. However, cases diagnosed with latent tuberculosis infection (LTBI) or with old inactive tuberculosis disease are not notifiable under the Tuberculosis Act 1948[i]. Only cases of active tuberculosis disease (referred to as TB) are presented in this report.

TB notification data is entered into EpiSurv by staff at each public health unit (PHU) via a secure web-based portal. This near real-time data is collated and analysed by ESR on behalf of the Ministry of Health. Notification data includes information such as the type of TB, case demography, clinical details, laboratory results, risk factors and case management details.

TB cases are recorded in EpiSurv as one of the following:

- **Tuberculosis disease – new case**: active TB in a person who has never been treated for TB before, or has active disease from a new genotype.
- **Tuberculosis disease – relapse or reactivation**: active TB in a person whose tuberculosis has been non-infectious or quiescent following full, partial or no treatment.

The case classification for TB, as defined by the Ministry of Health's Communicable Disease Control Manual in 2012 [5], is provided below.

Under investigation:	A suspected case that has been notified, but information is not yet available to classify it as probable, confirmed or not a case.
Probable:	Presumptive (without laboratory confirmation). There is no laboratory confirmation but: • there are symptoms or signs compatible with active tuberculosis, such as compatible radiology or clinical evidence of current disease; and • full anti-tuberculosis treatment has been started by a clinician.
Confirmed:	A clinically compatible illness that is laboratory confirmed. Laboratory confirmation requires at least one of the following: • positive culture for *Mycobacterium tuberculosis* complex • positive microscopic examination for acid-fast bacilli when a culture has not been or cannot be obtained • demonstration of *M. tuberculosis* complex nucleic acid directly from specimens • histology strongly suggestive of tuberculosis when there is a strong clinical probability.
Not a case:	A case that has been investigated and subsequently found not to meet the case definition.

[i] Cases of latent TB infection or with old inactive TB may be entered onto EpiSurv with patient consent for case management purposes.

Hospitalisations

Hospital discharge data for TB (*ICD-10* AM codes A15−A19 and P37.0) was extracted from the Ministry of Health's National Minimum Dataset (NMDS) (see www.health.govt.nz for more information). Hospitalisation numbers from the NMDS may differ from EpiSurv, since the NMDS data can include multiple hospital discharges for the same individual and discharges that relate to cases notified in previous years. In addition, the criteria for TB notification differ from that required for diagnostic coding.

Deaths

Mortality data for TB was extracted from the National Mortality Collection, which records a classification for the underlying cause of each death registered in New Zealand. Mortality data is available only up to 2012 due to the time taken to complete coronial inquiries. In the Mortality Collection, deaths due to TB are assigned to the year in which the person died, while in EpiSurv, deaths are assigned to the year of initial disease notification. For this reason the number of deaths per year may differ.

Co-infections

Data for TB/HIV co-infection cases was provided by the AIDS Epidemiology Group at the University of Otago.

Speciation and drug susceptibility

First-line drug susceptibility testing (DST) is undertaken by the mycobacteriology laboratories at Auckland City Hospital (LabPlus), Waikato Hospital, Wellington Hospital and Canterbury Health Laboratories. Susceptibility to isoniazid (at concentrations of 0.1 and 0.4 mg/L), rifampicin, ethambutol, pyrazinamide and streptomycin is routinely tested. In addition, first-line DST at Wellington Hospital includes fluoroquinolone (ofloxacin) susceptibility testing. Multidrug-resistant TB (MDR-TB) isolates (ie, isolates resistant to at least isoniazid and rifampicin) are tested at LabPlus for susceptibility to second-line antituberculous agents, including ethionamide, moxifloxacin (at a concentration of 2 mg/L), amikacin, capreomycin, *p*-aminosalicylic acid and linezolid.

The BACTEC® MGIT 960 method is used to test phenotypic drug susceptibility. Pyrazinamide DST can be performed by either the BACTEC® MGIT 960 method or the Wayne's pyrazinamidase assay.

Molecular methods are used to aid the detection of drug resistance in certain cases. For example:

- All isoniazid-resistant isolates are screened for rifampicin resistance using the Cepheid GeneXpert® system. Rifampicin resistance detected in the GeneXpert system or in phenotypic susceptibility tests is further investigated by sequencing the *rpoB* gene.
- The *pncA* gene is sequenced in all MDR-TB isolates, regardless of their phenotypic susceptibility to pyrazinamide, and in all other isolates that are resistant to pyrazinamide in phenotypic susceptibility tests.
- For cases in which mixed cultures (eg, *M. tuberculosis* mixed with a rapid-growing *Mycobacterium* species) are suspected, the Hain Lifescience GenoType® line probe, Mycobacterium CM, may be used to identify *Mycobacterium* species in clinical specimens or cultures. The presence of two or more *Mycobacterium* species will delay phenotypic DST, as pure cultures are needed before DST can be performed.
- For cases where there is a high index of clinical suspicion for MDR-TB, Hain Lifescience GenoType® line probes, MTBDR*plus* and MTBDR*sl,* may be used directly on smear-positive

clinical specimens and on cultures before DST results are available. These assays detect the presence of mutations in the *inhA*, *katG*, *rpoB*, *embB*, *gyrA* and *rrs* genes that are associated with resistance to low-level isoniazid, high-level isoniazid, rifampicin, ethambutol, fluoroquinolone and aminoglycosides, respectively. As these assays only target the common mutations associated with resistance, results need to be reported in conjunction with the phenotypic DST results.

- In addition to these commercial assays, in-house PCR (polymerase chain reaction) assays are used to detect mutations in the *rpoB* gene, within and outside the 81 bp mutation hotspot, and in the *katG* gene. These assays are useful tools to confirm phenotypic rifampicin and high-level isoniazid resistance where no mutations in the *rpoB* gene or *katG* gene are detected by the GeneXpert® or Hain Lifescience GenoType® line probe assays.

Susceptibility testing and species identification results are sent to ESR and integrated with the TB notifications recorded on EpiSurv.

Molecular typing

The national TB molecular typing database is maintained by LabPlus, which carries out all human TB molecular typing in New Zealand. Since October 2011, typing of TB isolates has been undertaken by mycobacterial interspersed repetitive units (MIRU) analysis alone. Primary typing includes analysis at 12 loci (MIRU 12). Secondary typing at a further 12 loci (MIRU 24) is performed when an isolate has the same MIRU 12 as a previously typed isolate. Between October 2009 and October 2011, primary typing was by MIRU and secondary typing was by restriction fragment length polymorphism (RFLP). Prior to October 2009, RFLP was the primary typing method and MIRU was only performed where isolates had ≤5 bands on RFLP.

A TB isolate is defined as having a unique molecular type if either the MIRU 12 alone or the MIRU 12 + MIRU 24 combination does not match that of any other isolate in the national database. At least one isolate from each of the known MIRU/RFLP or RFLP-based clusters has been MIRU 12- and MIRU 24-typed so that new isolates can be matched to these existing clusters. The TB molecular typing data from LabPlus is routinely reported to ESR and periodically integrated with the TB notifications recorded in EpiSurv.

Analytical methods

The analytical methods used in this report are outlined below. The analyses were done using the statistical software SAS 9.3.

Dates

In this report, data is presented by the date the case was notified rather than by the date of onset of illness and focuses on cases of TB notified in 2014 and trends since 2005 or 2010, depending on the availability of data. Due to the length of time taken to complete TB treatment, information regarding the use of directly observed treatment (DOT) and treatment outcomes is presented for cases reported in 2013 rather than 2014.

Notification data presented in this report is based on information recorded in EpiSurv as at 04 August 2015. Changes made to EpiSurv data by PHU staff after this date will not be reflected in this report. Consequently, future data analysis may produce revised results. Notification data from 2005 to 2013 has been updated to reflect the cases in EpiSurv as at 04 August 2015.

Case status for notifications

All notifications of TB recorded in EpiSurv that meet the case classification criteria are included for analysis in this report, although their status may not be final. Any subsequent changes in the status of a case will be reflected in future surveillance reports.

Population rate calculations

Population data used to determine all disease rates, except that used to determine disease rates for ethnic groups and country of birth, has been derived from the 2014 mid-year population estimates published by Statistics New Zealand.

The denominator data used to determine ethnic-specific disease rates for 2010–2014 is based on the proportion of people in each ethnic group from the usually resident 2013 census population applied to the corresponding mid-year population estimates.

The denominator used to determine rates in the New Zealand-born children between 2005–2014 is based on the proportion of people born in New Zealand from the usually resident 2006 (for 2005 to 2009) and 2013 (for 2010 to 2014) census population applied to the corresponding mid-year population estimates.

Population data used to determine disease rates for each country of birth is derived from the 2013 Census usually resident population count by birthplace.

In this report, disease rates are written as cases per 100,000 population where they first appear in a section and subsequently as cases per 100,000.

Disease rates are not presented in the tables in this report if there were fewer than five notified cases in a category. Calculating population rates from fewer than five cases may produce unstable rates, especially in smaller populations.

Percentages

Percentages are calculated with the denominator as the total number of cases for which information was recorded, unless otherwise specified.

Categorisation

Countries of birth were grouped into regions according to the Statistics New Zealand standard.

Ethnic groups presented are based on a prioritised classification of ethnicity, with the Māori ethnic group at the top of the hierarchy, followed by Pacific peoples, Asian, Middle Eastern/Latin American/African (MELAA) and European or Other (including New Zealander) ethnic groups. More information about ethnicity classification is available on the Ministry of Health website:

http://www.health.govt.nz/publication/ethnicity-data-protocols-health-and-disability-sector.

Socioeconomic deprivation is based on the 2013 New Zealand Deprivation Index (NZDep13). The index, which measures relative socioeconomic deprivation, is derived from a weighted combination of nine variables from the 2013 census, with each reflecting a different aspect of material and social deprivation. The deprivation score is calculated for each geographical meshblock in New Zealand [6]. Quintiles of NZDep13, ranging from 1 (least deprived) to 5 (most deprived), are presented in this report. Approximately equal numbers of people reside in areas associated with each of the five deprivation levels.

Drug susceptibility

Drug susceptibility data is only available for cases of TB that were culture positive. An isolate is considered resistant if either the phenotypic susceptibility testing indicates such resistance or the molecular testing detects a mutation associated with resistance.

The Chi-square test or Fisher's exact test, as appropriate, were used to determine the significance of any observed differences. The Cochran-Armitage trend test was used to calculate the significance of time trends. An associated *p*-value of ≤0.05 was used to assess whether a difference or trend was significant.

Molecular typing

Analysis of molecular typing data was only undertaken for culture-positive TB cases infected with *M*. *tuberculosis*. A case was categorised as having a non-unique molecular type if the combination of their MIRU 12 and MIRU 24 typing results matched at least one other case in the national database. If there was no matching strain type in the national database, the case was considered to have a unique strain.

Quality of surveillance data

The level of completeness of data recorded in EpiSurv for key TB surveillance variables from 2010 to 2014 is shown in Table 1.

For most variables the level of completeness was more or less stable over the 5 year period, but there were two notable exceptions. The completeness of the extra-pulmonary involvement variable improved to 99% or above following changes to this section of the case report form during 2012. Completion of risk factor information for the variables exposure in a healthcare setting and current or recent residence in an institution has gradually improved over the 5 years (73% to 91% and 79% to 94%, respectively).

Variables with consistently high levels of data completeness (≥93%) were the demographic variables (age, sex, ethnicity and geocoding accuracy), basis of discovery, pulmonary disease and the risk factor relating to being born outside New Zealand. The completeness of data associated with the treatment variables was also high (≥97%) across the 4 years analysed (2010–2013).

The date of onset of illness variable had the lowest levels of completeness, ranging from 59% to 71%. However, this is partly explained by the nature of the disease as some cases are asymptomatic.

Table 1. Percentage of data completeness for tuberculosis notifications (new cases) by variable and year, 2010–2014

Variable	2010	2011	2012	2013	2014
Basis of diagnosis					
Basis of discovery	96	97	100	96	93
Laboratory confirmation	88	89	97	98	98
Demographic details					
Age	100	100	100	100	100
Sex	100	100	100	100	100
Ethnicity	98	97	99	99	98
Geocoding accuracy[a]	95	96	96	96	97
Clinical course and outcomes					
Onset date	66	61	59	71	71
Hospitalisation status	99	99	99	99	98
Survival status	98	100	98	98	99
Protective and risk factors					
BCG vaccination[b]	100	100	100	100	92
Has immunosuppressive illness	95	94	95	92	96
On immunosuppressive medication	95	94	95	93	96
Contact with confirmed case of tuberculosis	80	79	82	82	86
Case born outside New Zealand	100	100	100	100	100
Date of arrival[c]	76	74	89	76	78
Current/recent residence with person born outside New Zealand	87	91	91	89	90
Exposure in a healthcare setting	73	80	84	87	91
Current/recent residence in an institution	79	82	87	89	94
Clinical characteristics					
Pulmonary disease	97	97	100	100	99
Extra-pulmonary involvement	89	87	99	100	99
Treatment[d]					
Date treatment started	98	97	100	100	99
Treatment outcome[e]	99	100	99	99	-
Use of directly observed therapy (DOT) [d]	100	100	100	98	-

[a] Geocoding accuracy is based on exact and nearest match to LINZ addresses.

[b] Cases in the <5 years age group only.

[c] Cases born outside New Zealand only.

[d] Cases reported as having received treatment only.

[e] Data is only reported for 2010−2013 due to length of time taken for TB treatment to be completed.

NOTIFICATIONS

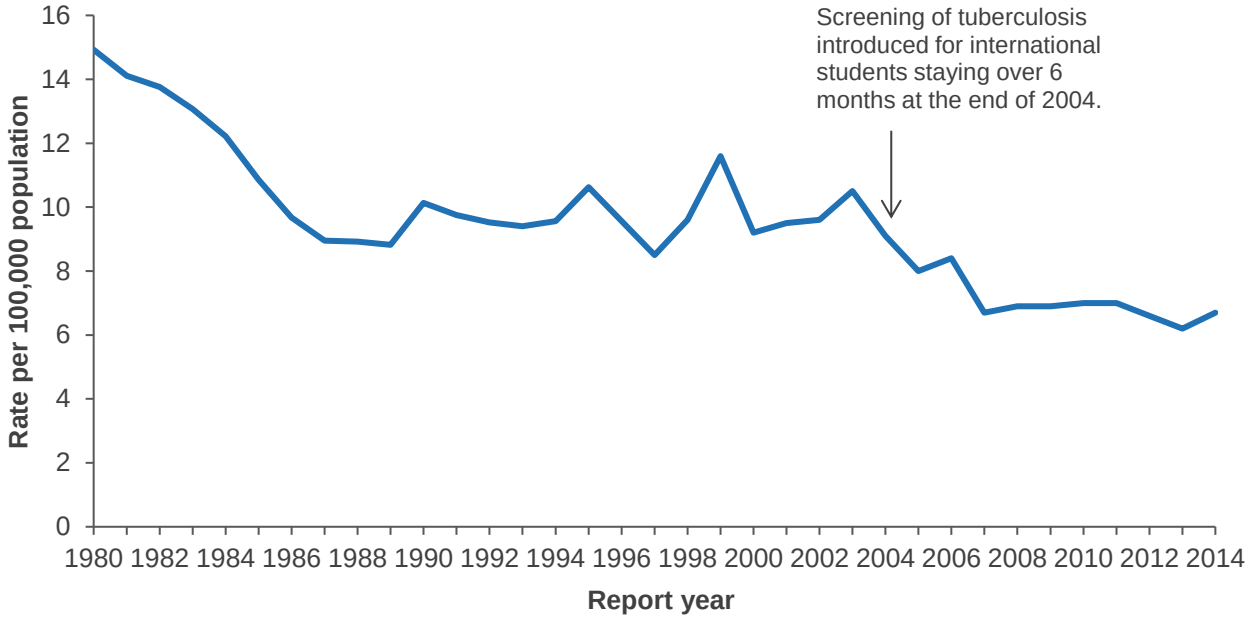
Notifications

NOTIFICATIONS

There were 302 cases of TB notified in 2014, including 290 (96.0%) new cases. The 2014 notification rate was 6.7 per 100,000 population, an 8.1% increase from the rate recorded in 2013 (6.2 per 100,000). A high proportion of TB cases (87.7%, 265/302) were laboratory confirmed.

Trends in rates since 1980 are shown in Figure 1. The notification rate in 2013 was the lowest observed since 1980. From 1980 to 1989 the rate decreased from 14.9 to 8.8 per 100,000; between 1990 and 2003 the rate remained between 8.5 and 11.6 per 100,000; there was a decrease between 2003 and 2007 to 6.7 per 100,000; followed by comparatively stable rates over the last 7 years, apart from a small decrease to 6.2 per 100,000 in 2013. On average, the TB incidence rate declined by 2% per year between 1980 and 2014.

Figure 1. Notification rate of tuberculosis disease by year, 1980−2014



Note: Census population data was used as the denominator to calculate rates before 1991 and the Statistics New Zealand mid-year population estimates were used from 1991 onwards.

Tuberculosis disease – new cases

This section presents data for notifications of "tuberculosis disease – new case" only. These notifications will be referred to as new TB cases.

There were 290 new TB cases notified in 2014, giving a notification rate of 6.4 per 100,000 population. This is an 8.5% increase from the 2013 rate of 5.9 per 100,000 (262 new TB cases). Between 2010 and 2014, the notification rate showed a slight decrease from 6.7 to 6.4 per 100,000 (Table 11).

Basis of discovery and diagnosis

Information on the means by which TB was discovered was recorded for 92.8% (269/290) of the new TB cases. More than 80% (217/269) were diagnosed when the symptomatic case presented to a health practitioner. Other recorded means of discovery included contact follow-up (7.8%, 21 cases), and immigrant or refugee screening (7.4%, 20 cases) (Table 2).

Between 2010 and 2014, the proportion of cases discovered by each method ranged from 71−85% for symptomatic case presented to health practitioner, 4−12% for immigrant/refugee screening, 4−9% for contact follow-up, and 4−13% for other means of discovery.

Table 2. Tuberculosis notifications (new cases) by basis of discovery, 2014

Basis of discovery	Cases	%[a]
Symptomatic case presented to health practitioner	217	80.7
Contact follow-up	21	7.8
Immigrant/refugee screening	20	7.4
Other	11	4.1
Unknown	21	-
Total	**290**	

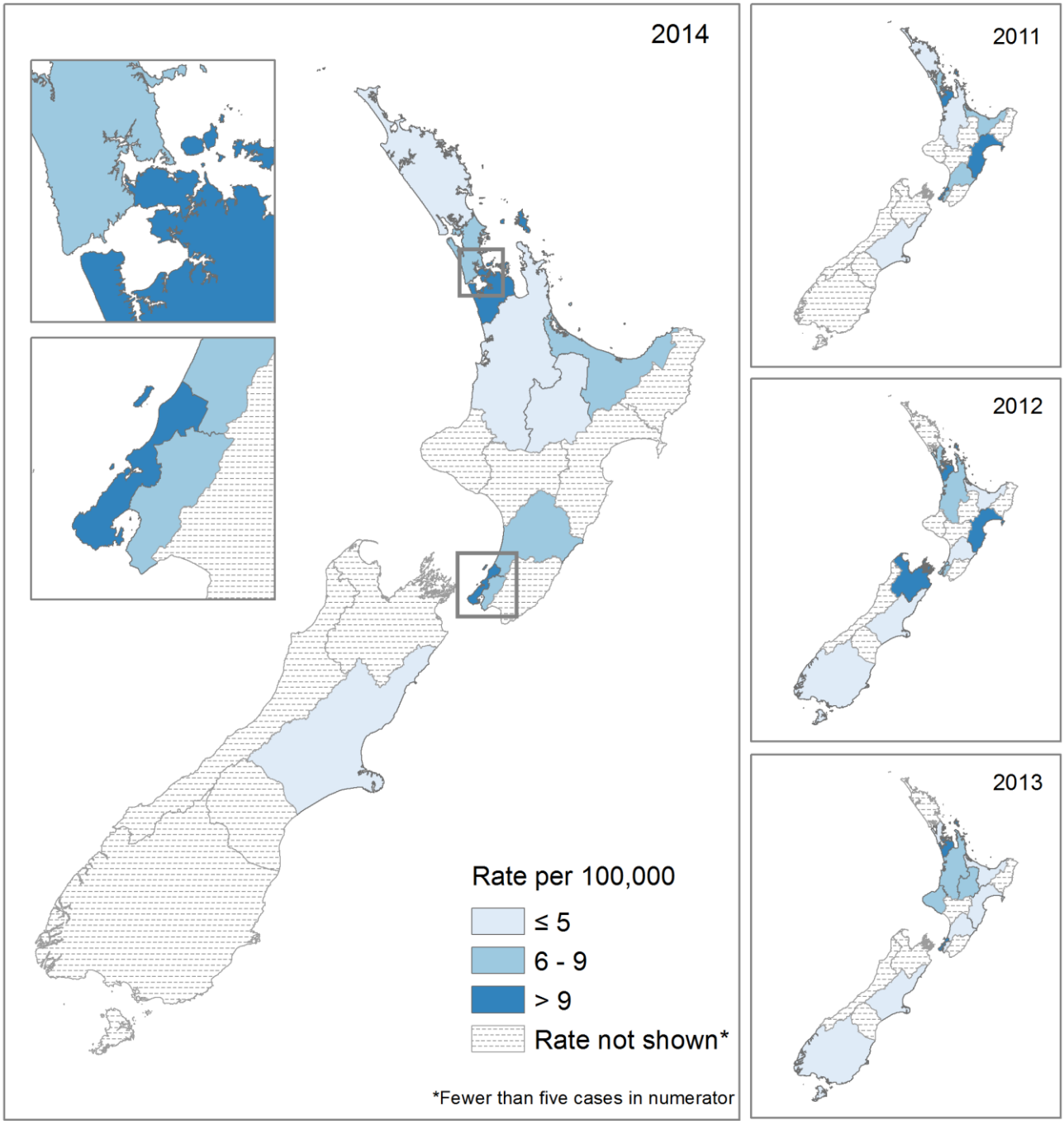
[a] The denominator used to calculate this percentage was the total number of cases for which the information was available.

In 2014, 255 (87.9%) new TB cases were laboratory confirmed. Among the 255 cases for which the method of laboratory confirmation was recorded, 239 (93.7%) were confirmed by isolation of *M. tuberculosis* (238) or *M. bovis* (1) from a clinical specimen. A further 5 cases (2.0%) were confirmed by demonstration of acid-fast bacilli in a clinical specimen, 7 cases (2.7%) by demonstration of *M. tuberculosis* nucleic acid directly from specimens and 4 cases (1.6%) by histology strongly suggestive of TB.

Notifications by District Health Board

The spatial distribution of notification rates by District Health Board (DHB) for the last 4 years is shown in Figure 2. The DHBs with the highest notification rates for new TB cases in 2014 were Auckland (14.6 per 100,000, 69 cases), followed by Capital & Coast (11.8 per 100,000, 35 cases), Counties Manukau (9.4 per 100,000, 48 cases), Hutt Valley (8.4 per 100,000, 12 cases), MidCentral (6.5 per 100,000, 11 cases), and Waitemata (6.4 per 100,000, 36 cases) DHBs. More details can be found Table 11 in the appendix.

Figure 2. Notification rate of tuberculosis (new cases) by District Health Board and year, 2011–2014



Notifications by age and sex

In 2014, TB rates increased for all age groups compared with those recorded in 2013 (Table 11). Table 3 shows that TB rates were higher among adults (≥15 years) than children (<15 years). The age group with the highest notification rate for new TB cases in 2014 was the 15–39 years age group (9.7 per 100,000, 143 cases), followed by the ≥60 years (6.6 per 100,000, 59 cases) and the 40–59 years (5.6 per 100,000, 69 cases) age groups. The lowest rates were in the 5–14 years age group (1.2 per 100,000, 7 cases) followed by the <5 years age group (3.9 per 100,000, 12 cases).

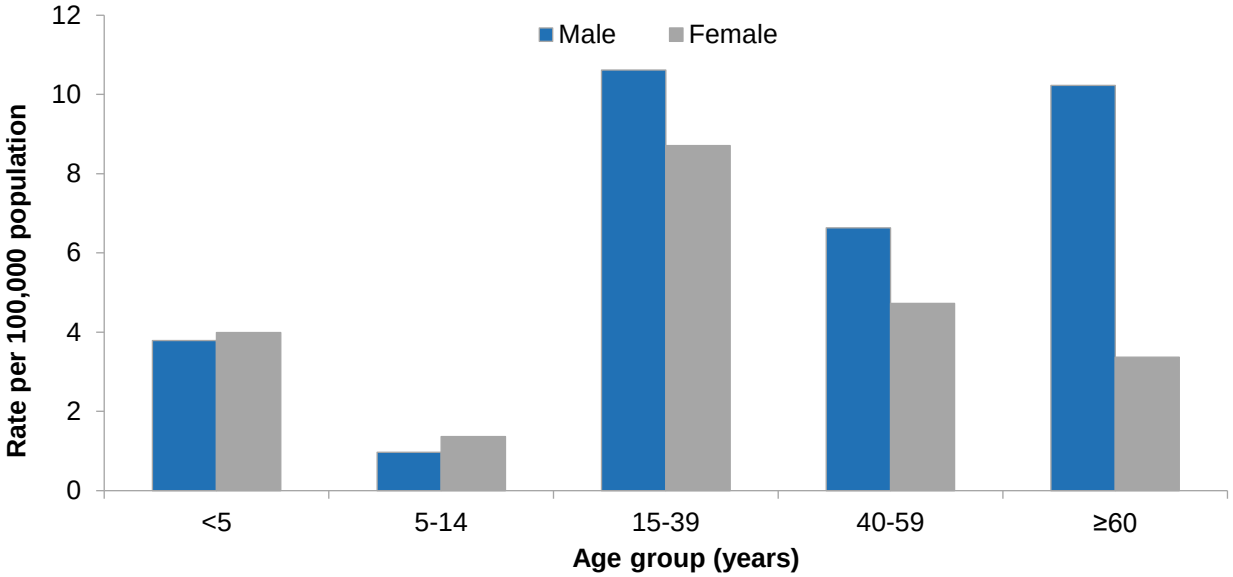
Table 3. Number and rate of tuberculosis notifications (new cases) by age group and sex, 2014

Age group (years)	Male		Female		Total	
	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]
<5	6	3.8	6	4	12	3.9
5-14	3	-	4	-	7	1.2
15-39	78	10.6	65	8.7	143	9.7
40-59	39	6.6	30	4.7	69	5.6
≥60	43	10.2	16	3.4	59	6.6
Total	**169**	**7.6**	**121**	**5.3**	**290**	**6.4**

[a] Rate per 100,000 based on 2014 mid-year population estimates; not shown for counts less than 5 cases

The notification rate for males (7.6 per 100,000, 169 cases) was 1.4 times higher than the rate for females (5.3 per 100,000, 121 cases). This difference was more evident with increasing age and a substantially higher male rate was reported in the ≥60 years age group (Table 3). However, the 15–39 years age group had the highest rate for both males and females with 10.6 per 100,000 (78 cases) and 8.7 per 100,000 (65 cases), respectively (Figure 3, Table 3). Higher rates in males were also seen in the last 5 years and the male to female ratio has increased since 2010 (Table 11).

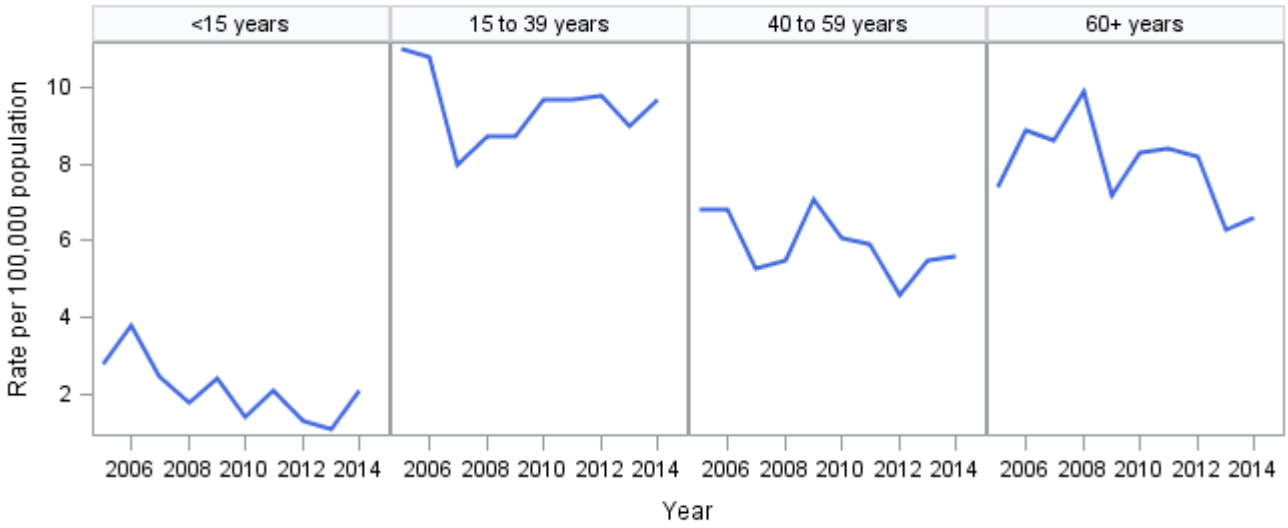
Figure 3. Notification rate of tuberculosis (new cases) by age group and sex, 2014



Between 2005 and 2014, there was an overall decreasing trend in the notification rate for all age groups (Figure 4). The decrease was mainly observed in those aged <15 years (down 25.0% from 2.8 to 2.1 per 100,000), 40–59 years (down 17.6% from 6.8 to 5.6 per 100,000), and ≥60 years (down 10.8% from 7.4 to 6.6 per 100,000). However, in the 15–39 years age group, despite the overall decreasing trend (down 11.8% from 11.0 to 9.7 per 100,000) for this time period, since 2007 the rate has been increasing.

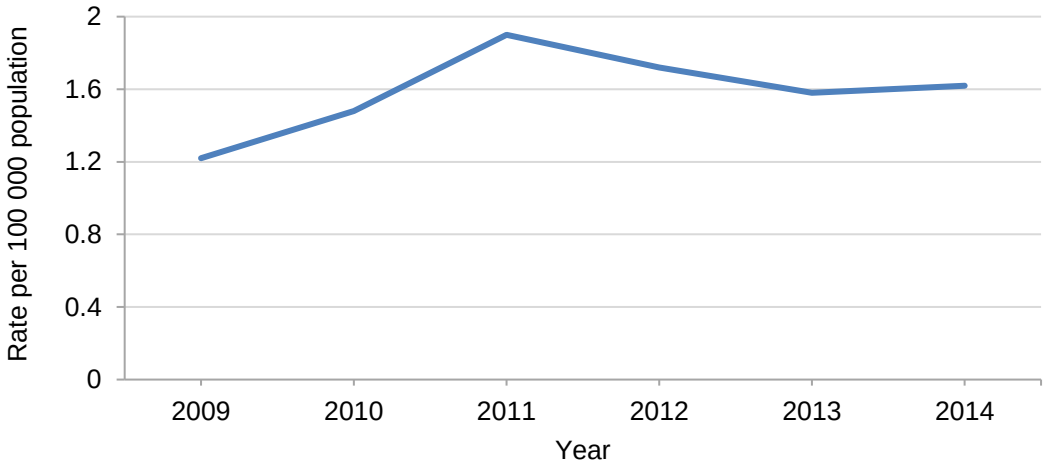
Over the past 10 years, the average annual notification rate has been highest in the 15–39 years age group (9.5 per 100,000), followed by the ≥60 years (8.0 per 100,000), 40–59 years (5.9 per 100,000) and the <15 years (2.1 per 100,000) age groups.

Figure 4. Notification rate of tuberculosis (new cases) by age group and year, 2005–2014



In 2014, the rate of TB in New Zealand-born children in the <15 years age group, an indirect indicator of recent transmission within the country, was 2.4 per 100,000. Although this was an increase from the 2010 rate of 1.3 per 100,000, the low case numbers (0–15 over the years 2005 to 2014) mean that the trend is better assessed by the 5 year moving average annual rate. The 5 year moving average annual rates since 2009 range between 1.2 and 1.9 per 100,000 with a peak in 2011 and a plateau the past two years (Figure 5).

Figure 5. Five year moving average annual rate of tuberculosis (new cases) in the New Zealand-born children (<15 years old), 2009–2014

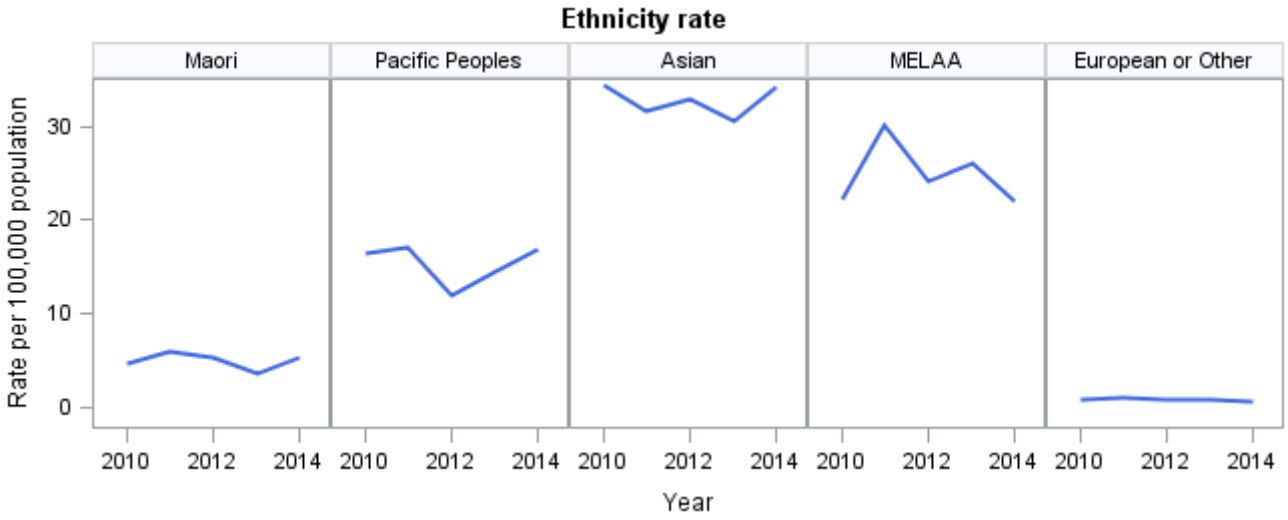


Notifications by ethnicity

Prioritised ethnicity was available for 285 (98.3%) of the new TB cases notified in 2014. The Asian ethnic group had the highest notification rate (34.1 per 100,000, 174 cases), followed by the Middle Eastern/Latin American/African (MELAA) (22.1 per 100,000, 11 cases), Pacific peoples (16.9 per 100,000, 47 cases), Māori (5.3 per 100,000, 36 cases) and European or Other (0.6 per 100,000, 17 cases) ethnic groups. For the new TB cases born in New Zealand, 51.5% (35/68) were in the Māori ethnic group, 27.9% (19/68) in the Pacific peoples and 16.2% (11/68) in the European or Other ethnic groups. A further 4.4% (3/68) were in the Asian ethnic group.

Between 2010 and 2014 the Asian and the MELAA ethnic groups have consistently had the highest notification rates (Figure 6), although it should be noted that the number of cases in the MELAA ethnic group in any one year was low (11–15 cases annually).

Figure 6. Notification rate of tuberculosis (new cases) by ethnic group and year, 2010–2014



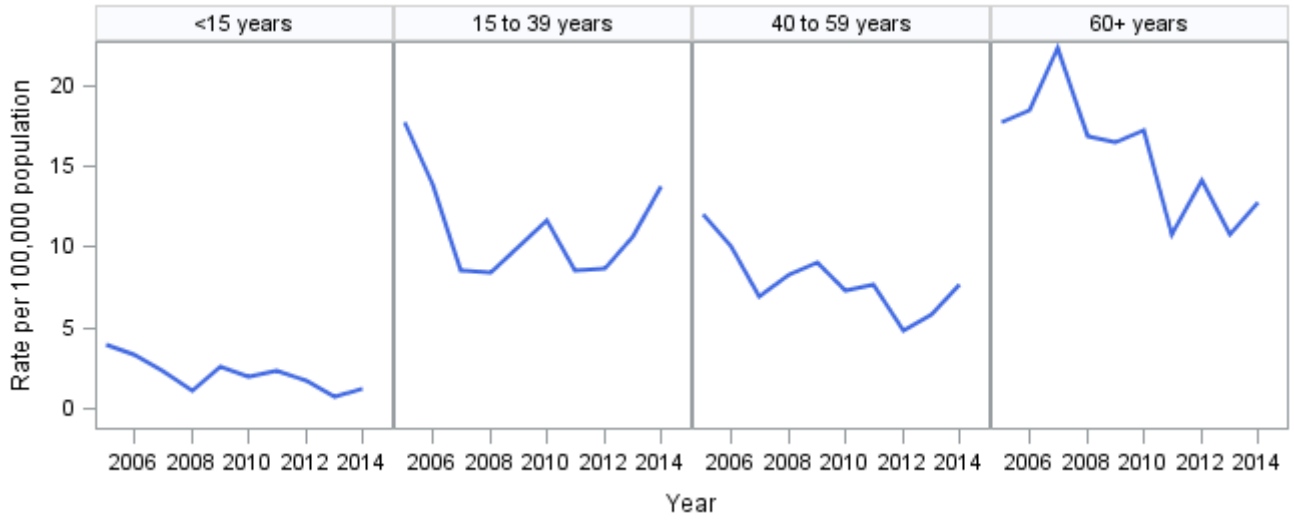
MELAA: Middle Eastern/Latin American/African.

Hospitalisations

Hospitalisation status was complete for 284 (97.9%) of the new TB cases notified to EpiSurv in 2014, of which 170 (59.9%) were hospitalised. The 170 hospitalised cases were distributed in the following age groups: <5 years (4/11, 36.4%), 5−14 years (1/6, 16.7%), 15–39 years (77/142, 54.2%), 40–59 years (45/67, 67.2%), and ≥60 years (43/58, 74.1%).

Data from the Ministry of Health's NMDS shows a decreasing trend in the TB hospitalisation rate for all age groups over the past 10 years (Figure 7), which was similar to the trend observed in TB notification rates (Figure 4). Those aged 0–59 years showed a sharp drop between 2005 and 2007 or 2008 followed by a plateau apart from the 15–39 years age group which also showed an increase starting in 2013. For the age group ≥60 years, the decline started in 2008 after a peak in 2007, followed by a plateau from 2011.

Figure 7. Hospitalisation rate for tuberculosis by age group and year, 2005–2014



Source: National Minimum Dataset, Ministry of Health.

Deaths

Of the 290 new TB cases notified in 2014, the disease was recorded as fatal for four cases. The four deaths were in the ≥60 years age group. In the last 10 years (2005−2014), 42 new TB cases notified were reported to have died from the disease. Reported fatalities varied from 3–8 cases annually, all of whom were aged ≥20 years. The majority of cases (90.5%, 38 cases) were aged ≥50 years.

Between 2005 and 2012 TB was recorded in the Mortality Collections dataset as the underlying cause of death in 59 cases. During this period 6–11 deaths were recorded each year, all of whom were aged ≥20 years. The majority of cases (91.5%, 54 cases) were aged ≥50 years.

Protective factors

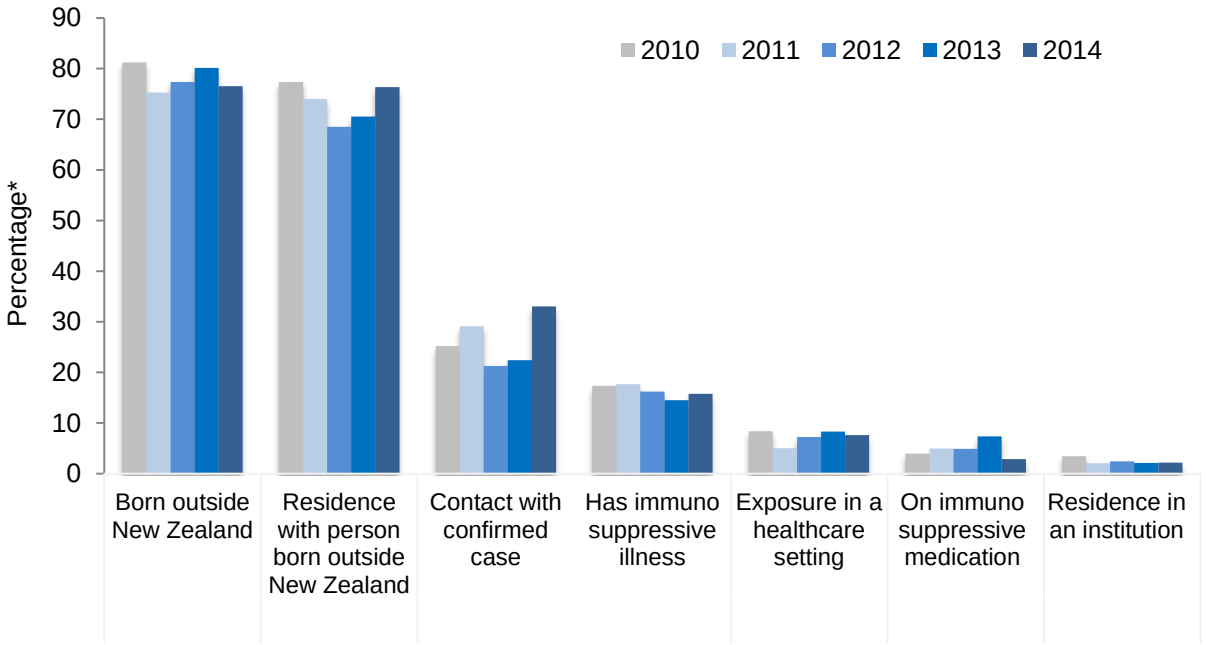
Immunisation of neonates with the Bacillus Calmette-Guérin (BCG) vaccine was introduced in New Zealand in 1976. It is currently available to neonates at increased risk of exposure to TB and is primarily given to protect young children from developing severe disease, particularly miliary TB and tuberculous meningitis [7].

There were 12 cases of TB in the <5 years age group in 2014, including 11 cases born in New Zealand. Two of the 11 cases born in New Zealand were reported to have received BCG vaccine. The case born overseas arrived in the country aged 1 year and was unvaccinated. There was insufficient information to know if the unvaccinated children were eligible for the high risk BCG vaccination programme.

Risk factors

The percentage of cases with available information for the various risk factors ranged from 73.4% to 100% over the last 5 years. In 2014, the most common risk factors reported by new TB cases were being born outside New Zealand (76.6%) and current/recent residence with person(s) born outside New Zealand (76.3%), followed by contact with a confirmed case of TB (33.1%), or having an immunosuppressive illness (15.8%). Less than 10% of cases reported exposure in a healthcare setting, being on immunosuppressive medication or having current/recent residence in an institution (Table 4, Figure 8).

Figure 8. Percentage of tuberculosis notifications (new cases) reporting exposure to risk factors by year, 2010–2014



*Number of cases with the factor divided by the total number of cases for which the response is known, for the year.

Table 4. Risk factors reported for tuberculosis notifications (new cases), 2014

Risk factor	Cases[a]	Total[b]	%
Born outside New Zealand	222	290	76.6
Current/recent residence with person born outside New Zealand	200	262	76.3
Contact with confirmed case	82	248	33.1
Has immunosuppressive illness	44	279	15.8
Exposure in a healthcare setting	20	263	7.6
On immunosuppressive medication	8	277	2.9
Current/recent residence in an institution	6	272	2.2

[a] Number of cases with 'yes' recorded for the risk factor.

[b] Number of cases for which information was recorded for the risk factor.

Cases born in the Southern and Central Asia region had the highest notification rate in 2014 (120.5 per 100,000, 104 cases), followed by the South-East Asia region (55.8 per 100,000, 49 cases) (Table 5). More than 80% (87/104) of the cases born in the Southern and Central Asia region were born in India. The most commonly reported country of birth for cases born in South-East Asia was the Philippines (46.9%, 23/49).

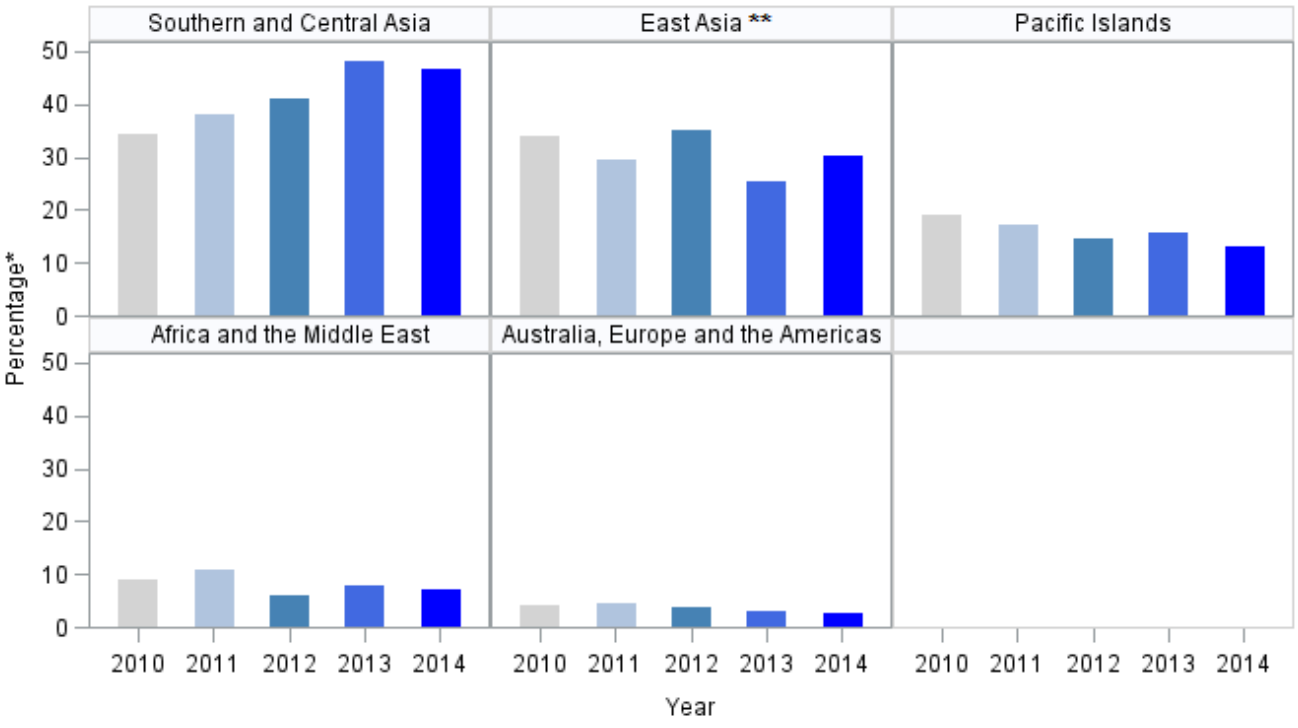
Table 5. Tuberculosis notifications (new cases) by region of birth, 2014

Region of birth	Cases	Rate[a]
Born in New Zealand	**68**	**2.3**
Born outside New Zealand	**222**	**17.5**
Australia	1	-
Pacific Islands	29	19.1
North Africa and the Middle East	2	-
Sub-Saharan Africa	14	19.4
North-East Asia	18	12.6
South-East Asia	49	55.8
Southern and Central Asia	104	120.5
Europe	3	-
The Americas	2	-
Total	**290**	

[a] Rate per 100,000 population. Population data used for the denominator was derived from the 2013 census usually resident population count by birthplace, published by Statistics New Zealand.

Among new TB cases born outside New Zealand, the proportion of cases born in the Southern and Central Asia region increased between 2010 and 2014 from 34.2% to 46.8% (Figure 9). Conversely, the percentage of cases born in the Pacific Islands shows a decreasing trend while the trend is relatively stable for those born in other regions.

Figure 9. Percentage of tuberculosis notifications (new cases) born outside New Zealand by birth region and year, 2010−2014



* Number of cases born in a region divided by the total number of cases born outside New Zealand, and for which the country of birth is known, for the year.

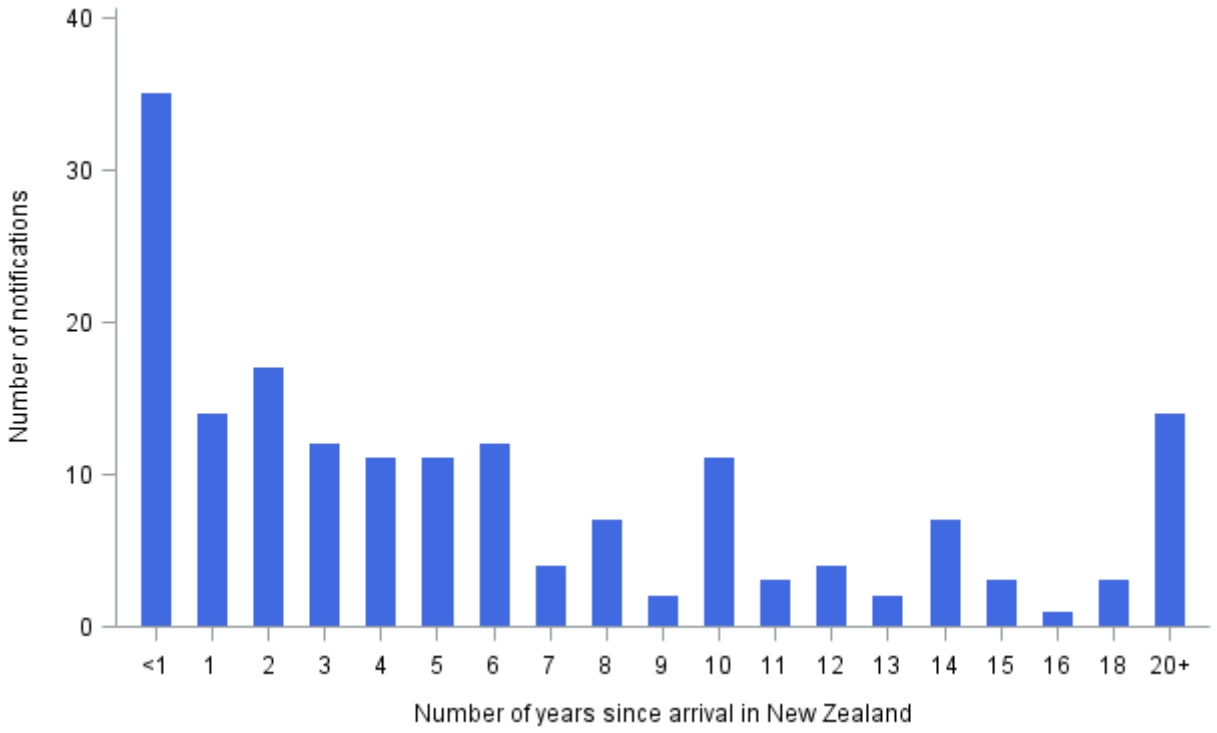
** East Asia includes North-East and South-East Asia.

Years since arrival in New Zealand

The date of arrival in New Zealand was recorded for 173 (77.9%) of the 222 new TB cases born outside New Zealand. Of these, the interval between the date of arrival in New Zealand and the TB notification date ranged from 0 to 62 years, with a mean interval of 7.3 years and median interval of 4 years. TB notification occurred in the first year of arrival in New Zealand for 20.2% (35/173) of cases born outside New Zealand, for 51.4% of cases within the first 5 years after arrival in New Zealand and for 57.8% within the first 6 years after arrival (Figure 10).

Between 2010 and 2014, the annual median interval between arrival in New Zealand and the date of TB notification remained stable at 4 years. The annual mean interval ranged between 7.1 and 8.3 years.

Figure 10. Tuberculosis notifications (new cases) born outside New Zealand by the number of years since arrival in New Zealand, 2014



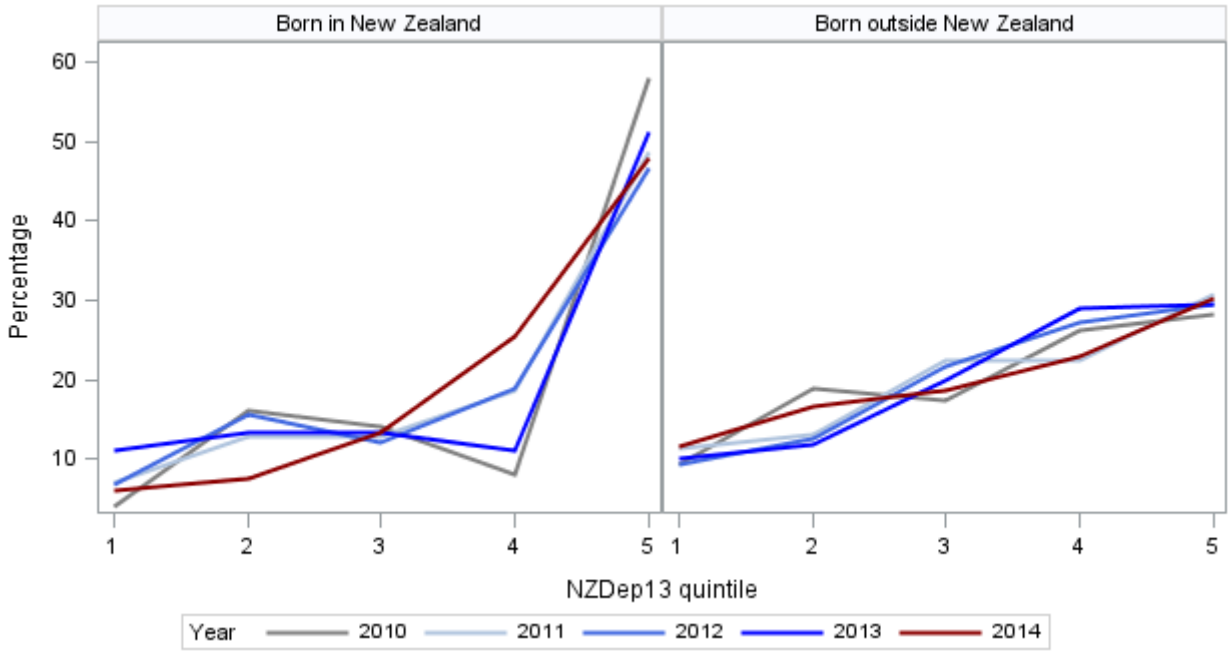
Note: The date of arrival was not recorded for 49 cases.

Socioeconomic deprivation

In 2014, 282 (97.2%) of new TB cases could be assigned a 2013 New Zealand Socioeconomic Deprivation Index (NZDep13) score. Of the 282 cases, 57.8% (163) resided in the most deprived areas (NZDep13 quintile 4 or 5).

Figure 11 shows the relationship between deprivation quintile and percentage of new TB cases in the last 5 years. Of the 1351 cases with available information, 290 (21.5%) cases were born in New Zealand. A disproportionate number of new TB cases lived in the most deprived areas. This result is observed each year and is notable for cases born in New Zealand living in quintile 5 areas.

Figure 11. Percentage of tuberculosis notifications (new cases) by birth place (New Zealand/non-New Zealand), 2013 New Zealand Deprivation Index (NZDep13) and year, 2010−2014

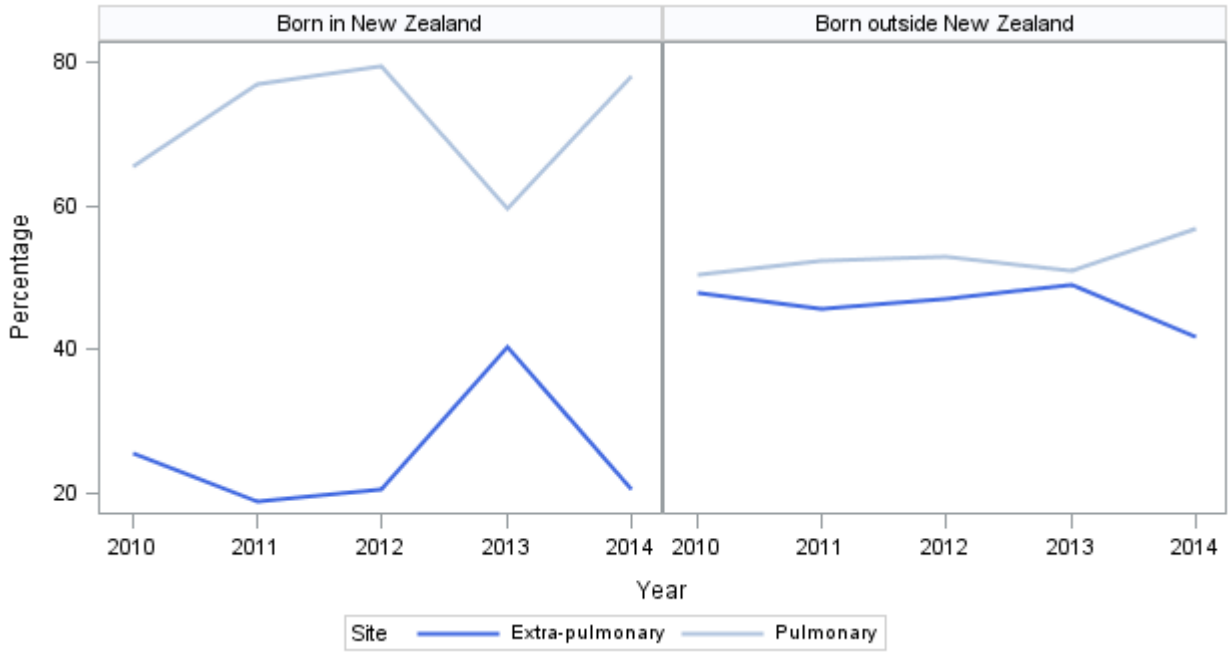


Site of infection

There were 179 (61.7%) new TB cases in 2014 with pulmonary disease, including 55 cases who also had extra-pulmonary involvement. A further 111 cases (38.3%) reported having extra-pulmonary involvement solely.

As in most previous years, in 2014 marked differences were seen in the clinical characteristics of cases born in New Zealand compared with cases born outside New Zealand. Among cases born in New Zealand, approximately 75% were reported with pulmonary disease between 2010 and 2014, increasing from 59.6% in 2013 to 79.1% in 2014. In contrast, new TB cases born outside New Zealand had less pulmonary disease, the percentage being fairly stable at approximately 53% between 2010 and 2013, with a slight increase to 57.5% in 2014 (Figure 12).

Figure 12. Comparison of pulmonary versus solely extra-pulmonary involvement for tuberculosis (new cases) by birth place (New Zealand/non-New Zealand) and year, 2010−2014



Note: Cases of pulmonary disease presented in this graph include cases with both pulmonary disease and extra-pulmonary involvement.

Of the 179 new TB cases in 2014 with pulmonary disease, 164 had available information on whether acid-fast bacilli were demonstrated in a direct smear of a clinical specimen. Of these, 65.2% (107/164) were smear positive, with sputum reported as the specimen site for 75.7% (81/107) of these cases.

For cases with extra-pulmonary involvement in 2014, 48.2% (80/166) had lymph node (excluding abdominal) recorded as a site of infection. Six cases of tuberculous meningitis were reported in 2014: two cases in the 15–39 years, one case in the 40–59 years and three cases in the ≥60 years age groups. Ten cases of miliary TB were reported, including one case aged <5 years and nine cases aged ≥15 years. Of these cases, nine cases had available information on whether they had an underlying immunosuppressive illness with three of these cases reported to have an underlying immunosuppressive illness (diabetes).

Between 2010 and 2014, the most common site of infection recorded for cases with extra-pulmonary involvement was lymph node (excluding abdominal), followed by pleural and intra-abdominal (excluding renal). During this period, there were 24 cases of tuberculous meningitis and 29 cases of miliary TB. There were two miliary TB cases aged <5 years; one an infant aged <1 year who had not received BCG vaccine and the other aged 1 year who also had not received BCG vaccine. There were no cases of tuberculous meningitis in the <5 years age group. A breakdown of the new TB cases with extra-pulmonary involvement by site of infection and year is shown in Table 12 in the Appendix.

HIV status

Two of the new TB cases notified in 2014 were co-infected with HIV compared with none being co-infected with HIV in 2013.

Of the 290 new TB cases in 2014, information on whether an HIV test was done was recorded for 93.1% (270). Of these 270 cases, 80.4% (217) were reported to have been tested for HIV.

Receipt of treatment

In 2014, 92.8% (269 /290) of new TB cases were reported to have received treatment. The interval between the onset of symptoms and start of treatment could be calculated for 195 cases (72.5%). Of these, 22 (11.3%) started treatment within 1 month of the onset of symptoms and 114 (58.5%) started treatment between 1 and 3 months. The median interval to the start of treatment was 2 months from the onset of symptoms.

A treatment delay for patients with pulmonary TB represents a risk to public health from disease transmission. Of the 179 new TB cases with pulmonary disease, 166 cases (92.7%) were reported to have received treatment. The interval between the onset of symptoms and the start of treatment could be calculated for 66.9% (111/166) of these cases. Among these, 19 (17.1%) started treatment within 1 month of the onset of symptoms and 72 (64.9%) started treatment between 1 and 3 months. The median interval to the start of treatment was 1 month from the onset of symptoms.

Treatment outcomes for cases notified in 2013

Due to the length of time taken for the treatment of TB to be completed, the data presented in this section is for the 262 new TB cases notified in 2013. Of these, 95.4% (250/262) were reported to have received treatment for TB.

The majority of these cases (88.4%, 221 cases) completed treatment to the satisfaction of the prescribing doctor. TB treatment for the remaining 29 cases ended earlier than planned for the following reasons: case died (4.4%, 11 cases), case transferred to overseas medical care (2.4%, 6 cases), case went overseas (2.0%, 5 cases), treatment was stopped because of adverse effects (1.6%, 4 cases), and case refused to complete treatment (0.4%, 1 case). Two of the cases (0.8%) were still on treatment at the time of data extraction.

Of the 12 cases reported as not receiving treatment, six cases were not treated because they died before treatment was initiated or the diagnosis was a post-mortem finding, five cases transferred overseas before treatment was initiated and one case, who was not infectious, was not treated because susceptibility data was not available and it was considered safer to monitor the case closely rather than risk selecting for resistance.

Of the 221 new TB cases who completed treatment to the satisfaction of the prescribing doctor, 47.0% (103/219) received directly observed therapy (DOT) throughout the course of their treatment. The proportion of cases who received DOT throughout their course of treatment was higher in those born in New Zealand (51.2%) than those born outside New Zealand (46.0%). However, for cases with pulmonary disease, the proportion who received DOT throughout the course of treatment was higher in cases born outside New Zealand (65.9%) than those born in New Zealand (57.7%).

Tuberculosis disease – relapses or reactivations

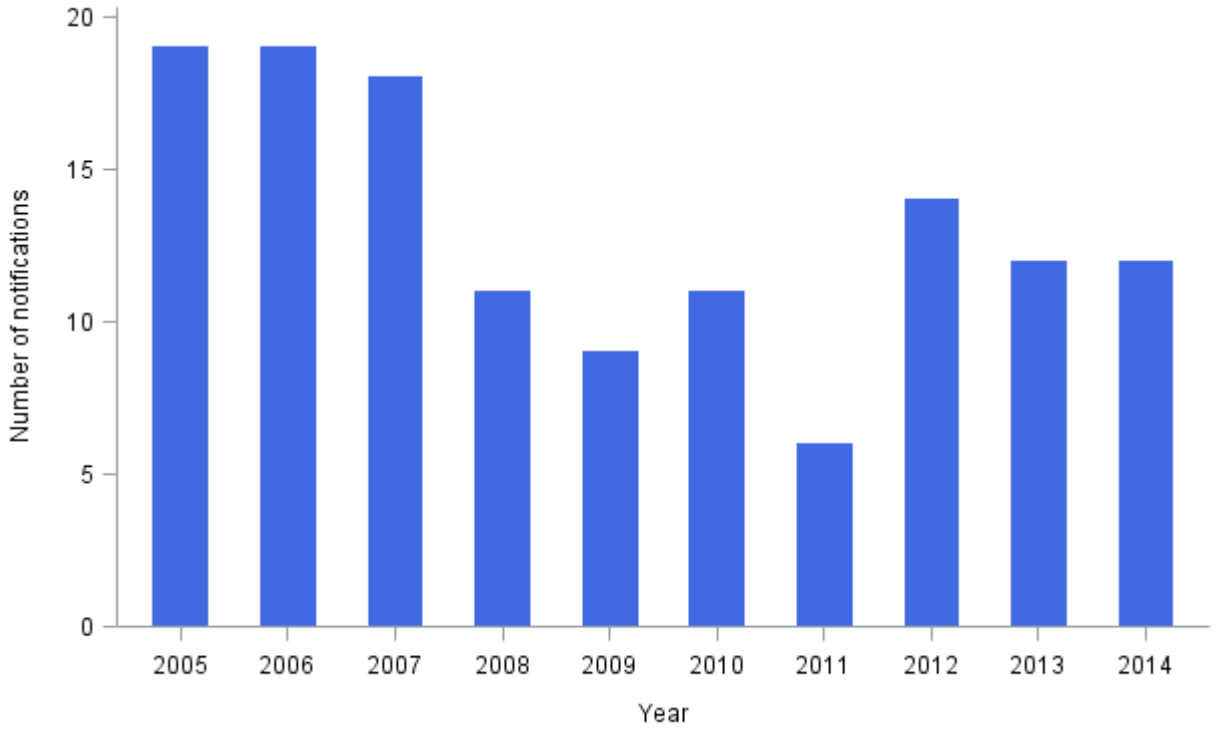
In 2014, 12 TB relapse/reactivation cases were notified from seven DHBs: MidCentral (3 cases), Counties Manukau and Canterbury (2 cases each), Bay of Plenty, Taranaki, Whanganui, Wairarapa and Capital & Coast (1 case each) DHBs. The cases were distributed in the 15–39 years (3 cases), 40–59 years (3 cases) and ≥60 years age groups (6 cases). Relapse/reactivation cases included those in the Asian (5 cases), European or Other (3 cases), Pacific peoples (2 cases), and Māori and MELAA (1 case each) ethnic groups. This category of disease could also include cases of re-infection.

Information about the place of birth, place of original diagnosis and whether the case had been previously treated for TB was recorded for all of the relapse/reactivation cases. Three cases were both born and originally diagnosed with TB in New Zealand. Of the nine cases born overseas, four were originally diagnosed in New Zealand and five were diagnosed overseas. Ten of the cases had been previously treated for TB. Four of the seven cases that had been diagnosed in New Zealand had previously received treatment for 3, 6, 8 and 10 months, respectively. Three cases diagnosed overseas had previously received treatment for 6 months. The duration of treatment was unknown for the remaining three cases.

Hospitalisation status was recorded for all 12 relapse/reactivation cases and eight (66.7%) were hospitalised. No deaths from disease were reported among reactivation cases.

The number of TB relapse/reactivation cases has remained low over the last 10 years ranging from 6 to 19 cases annually (Figure 13).

Figure 13. Tuberculosis notifications (reactivation cases) by year, 2005−2014



Outbreaks

In 2014, two TB outbreaks were reported, one each from Auckland and Capital & Coast DHBs.

The outbreak in Auckland DHB comprised 12 cases. The exposures occurred in a private home and other setting.

The outbreak in Capital & Coast DHB comprised two cases. The exposure occurred in a private home.

Notifications

CULTURE CONFIRMATION, SPECIATION AND DRUG SUSCEPTIBILITY

Culture confirmation, speciation and drug susceptibility

CULTURE CONFIRMATION, SPECIATION AND DRUG SUSCEPTIBILITY

Data presented in this section was collected from the four mycobacteriology reference laboratories in New Zealand.

Culture confirmation and speciation

In 2014, 239 (82.4%) new TB cases were reported as culture positive. The mycobacterial species identified were *M. tuberculosis* (238 cases) and *M. bovis* (1 case). Almost 87.2% (156/179) of the new TB cases with pulmonary disease were culture positive, comprising 155 cases identified as *M. tuberculosis*, and one case as *M. bovis.*

Of the 12 TB relapse/reactivation cases notified in 2014, eight were culture positive and the isolates were identified as *M. tuberculosis*.

Fewer than five cases of culture-positive TB due to *M. bovis* were reported each year between 2010 and 2014.

Drug susceptibility

Antimicrobial susceptibility data for the isolates from all 247 (239 new cases and 8 relapses/reactivations) culture-positive TB cases in 2014 was available. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 6.

In addition to the five antimicrobials routinely tested, 59 isolates were tested for susceptibility to either moxifloxacin or ofloxacin. All 59 isolates were susceptible to the fluoroquinolone tested. A further isolate was tested for susceptibility to both moxifloxacin and ofloxacin and had discordant results: ofloxacin resistant but moxifloxacin susceptible.

Table 6. Resistance to each antimicrobial, by mycobacterial species, 2014

Antimicrobial	Resistant[a]					
	M. tuberculosis *n* = 246		*M. bovis* *n* = 1		All isolates *n* = 247	
	No.	%	No.	%	No.	%
Isoniazid (0.1 mg/L)	18	7.3	0	-	18	7.3
Isoniazid (0.4 mg/L)[b]	12	4.9	0	-	12	4.9
Rifampicin	5	2.0	0	-	5	2.0
Ethambutol	1	0.4	0	-	1	0.4
Pyrazinamide	2	0.8	1[c]	100	3	1.2
Streptomycin	14	5.7	0	-	14	5.7

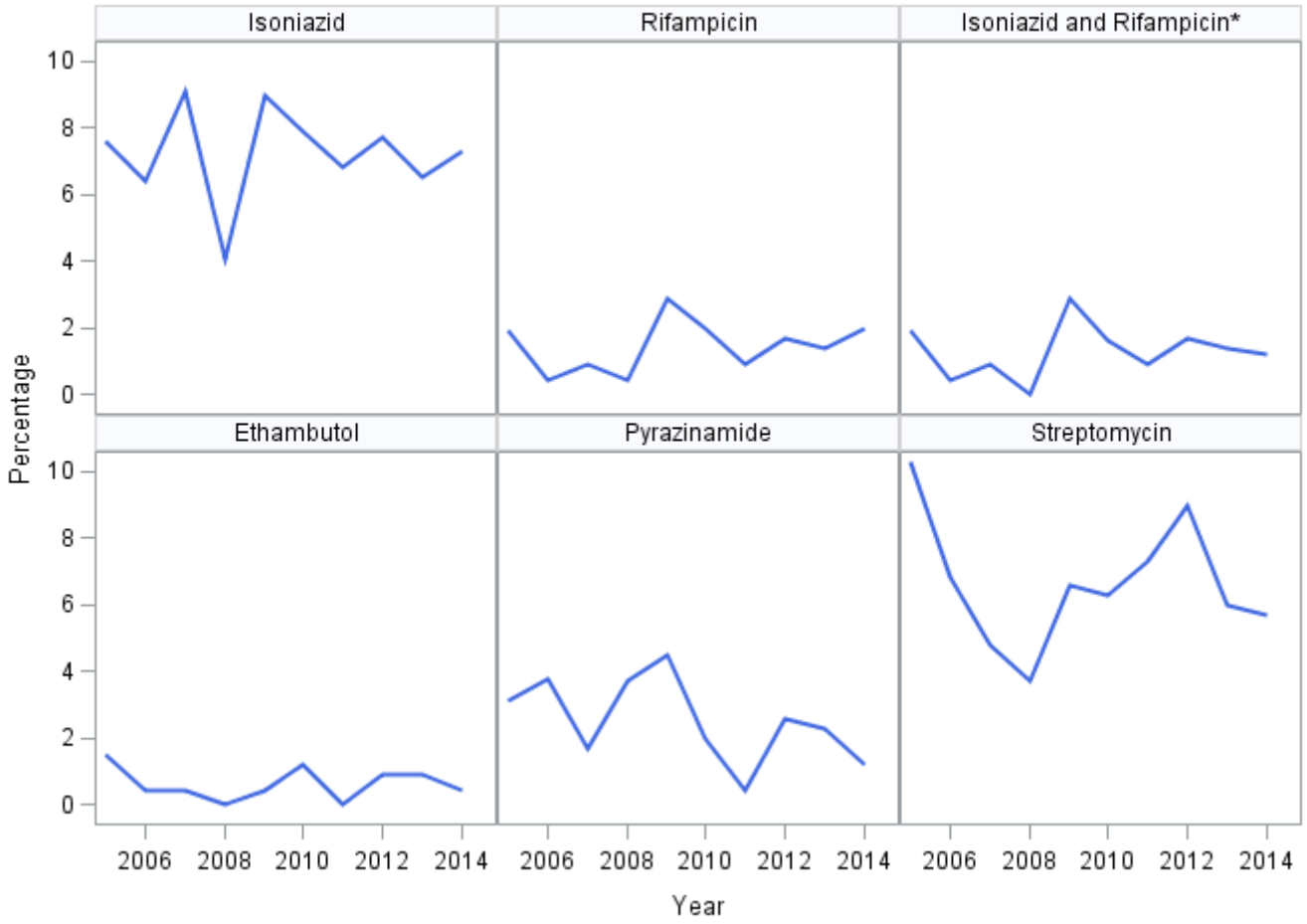
[a] Includes resistance alone or in combination with other antimicrobials.

[b] All isolates resistant to isoniazid at the standard breakpoint concentration of 0.1 mg/L were also tested at the higher concentration of 0.4 mg/L.

[c] *M. bovis* is intrinsically resistant to pyrazinamide.

In the 10 years from 2005 to 2014, there has been a significant trend ($p \leq 0.05$) of decreasing pyrazinamide resistance, but no significant changes in resistance to isoniazid, rifampicin, ethambutol or streptomycin have been observed (Figure 14).

Figure 14. Resistance among tuberculosis isolates by antimicrobial and year, 2005−2014



*Isoniazid and rifampicin resistant isolates are defined as multidrug-resistant tuberculosis (MDR-TB).

In 2014, 87.9% (217/247) of the isolates were fully susceptible to all five routinely tested antimicrobials. There were three (1.2%) cases of multidrug-resistant tuberculosis (MDR-TB, defined as resistance to at least isoniazid and rifampicin). In addition to these three MDR-TB cases, isolates from two other cases demonstrated mono-resistance to rifampicin (Table 7).

During the last 10 years there have been a total of 31 cases of MDR-TB – an average annual rate of 1.3% among culture-positive TB cases.

MDR-TB isolates are tested for susceptibility to an extended range of antibiotics to detect extensively drug-resistant tuberculosis (XDR-TB, defined as MDR-TB with additional resistance to any fluoroquinolone and at least one of the following second-line injectable drugs: amikacin, capreomycin or kanamycin). Only one case of XDR-TB has been identified in New Zealand - this case occurred in 2010.

Table 7. Distribution of antimicrobial resistance patterns among tuberculosis isolates, 2014

	Resistance pattern[a]	% (No.) of isolates with each pattern	
Fully susceptible		**87.9**	**(217)**
Resistant to 1 agent		**8.9**	**(22)**
	H	4.0	(10)
	R	0.8	(2)
	Z[b]	0.4	(1)
	S	3.6	(9)
Resistant to 2 agents		**2.8**	**(7)**
	HS	1.6	(4)
	HR[c]	0.8	(2)
	HZ	0.4	(1)
Resistant to 5 agents		**0.4**	**(1)**
	HREZS[c]	0.4	(1)

[a] H, isoniazid resistance at the standard concentration of 0.1 mg/L; R, rifampicin; E, ethambutol; Z, pyrazinamide; S, streptomycin.

[b] The isolate with this resistance pattern was the one *M. bovis* isolate.

[c] MDR-TB, multidrug-resistant tuberculosis, that is, resistant to at least isoniazid and rifampicin.

Table 8 compares antimicrobial resistance among isolates from cases born in New Zealand and cases born overseas. Resistance to all antimicrobials, except pyrazinamide, was higher among isolates from cases born overseas than among isolates from New Zealand-born cases, although only streptomycin resistance was significantly higher.

All three MDR-TB cases in 2014 were born overseas, although one of these cases appears to have developed MDT-TB during treatment in New Zealand. This patient was first notified as a new case of TB in 2013, at which time a fully susceptible isolate of *M. tuberculosis* was cultured. The patient was notified in 2014 as a TB relapse/reactivation case with MDR-TB.

All but two of the 31 MDR-TB cases that have occurred in the last 10 years were born overseas and assumed to have acquired MDR-TB overseas. The majority (27, 93.1%) of the 29 MDR-TB cases assumed to have acquired MDR-TB overseas were born in an Asian country.

Table 8. Antimicrobial resistance by place of birth, 2014

	Born in New Zealand (*n* = 52)[a]		Born overseas (*n* = 194)[a]		*p*-value[b]
	No.	%	No.	%	
Fully susceptible					
	50	96.2	166	85.6	0.038
Resistant to:[c]					
Isoniazid[d]	1	1.9	17	8.8	0.133
Rifampicin	0	-	5	2.6	0.587
Ethambutol	0	-	1	0.5	1.000
Pyrazinamide	1	1.9	2	1.0	0.511
Streptomycin	0	-	14	7.2	0.046
MDR-TB[e]					
	0	-	3	1.5	1.000

[a] Place of birth not known for one case.

[b] Rates compared by the Chi-square test or Fisher's Exact test, as appropriate.

[c] Includes resistance alone or in combination with other antimicrobials.

[d] Isoniazid resistance at the standard concentration of 0.1 mg/L.

[e] Multidrug-resistant tuberculosis, that is, resistant to at least isoniazid and rifampicin

Isoniazid, rifampicin, ethambutol, pyrazinamide and streptomycin resistance was most frequent among isolates from cases of Asian ethnicity (Table 9). Two of the MDR-TB cases were of Asian ethnicity. The third MDR-TB case, which was in a person belonging to the Pacific peoples ethnic group, was the case that appeared to have developed during treatment in New Zealand (see previous page).

Table 9. Antimicrobial resistance by ethnicity, 2014

	Māori[a] (*n* = 26)		Pacific peoples (*n* = 40)		Asian (*n* = 147)		MELAA (*n* = 12)		European or Other (*n* =17)		Unknown (*n* = 5)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fully susceptible												
	25	96.2	38	95.0	123	83.7	10	83.3	16	94.1	5	100
Resistant to:[b]												
Isoniazid[c]	0	-	1	2.5	16	10.9	0	-	1	5.9	0	-
Rifampicin	0	-	1	2.5	4	2.7	0	-	0	-	0	-
Ethambutol	0	-	0	-	1	0.7	0	-	0	-	0	-
Pyrazinamide	1	3.8	0	-	2	1.4	0	-	0	-	0	-
Streptomycin	0	-	1	2.5	11	7.5	2	16.7	0	-	0	-
MDR-TB[d]												
	0	-	1	2.5	2	1.4	0	-	0	-	0	-

[a] Ethnic groups were prioritised in the following order: Māori, Pacific peoples, Asian, Middle Eastern/Latin American/African (MELAA), European or Other Ethnicity (including New Zealander).

[b] Includes resistance alone or in combination with other antimicrobials.

[c] Isoniazid resistance at the standard concentration of 0.1 mg/L.

[d] Multidrug-resistant tuberculosis, that is, resistant to at least isoniazid and rifampicin.

In 2014, 3.2% (8/247) of the culture-positive cases were reported to be TB relapses/reactivations. Because the number of cases notified as TB relapses/reactivations in any one year is small, the following analysis of drug resistance among relapses/reactivations is for the 5 years from 2010 to 2014. During this period, 3.8% (45/1183) of the culture-positive cases were reported to be relapses/reactivations. Information about previous treatment was recorded for 34 of the 45 relapses/reactivations and 33 were recorded as having received previous anti-tuberculosis drug treatment.

Antimicrobial resistance among new cases of TB, cases reported to be relapses/reactivations and cases who were reported to have been previously treated, is shown in Table 10. Compared with isolates from new cases, isolates from previously treated cases were significantly more resistant to isoniazid and rifampicin, and consequently also more likely to be MDR-TB.

Table 10. Antimicrobial resistance among new cases, relapses or reactivations and previously treated cases, 2010–2014

	New cases (*n* = 1138)	Relapse/reactivation cases			
		All (*n* = 45)		Previously treated[a] (*n* = 33)	
	%	%	*p*-value[b]	%	*p*-value[b]
Fully susceptible					
	87.4	77.8	0.058	78.8	0.179
Resistant to:[c]					
Isoniazid[d]	6.9	15.6	0.040	18.2	0.028
Rifampicin	1.2	11.1	<0.001	12.1	0.001
Ethambutol	0.7	0.0	1.000	0.0	1.000
Pyrazinamide	1.6	4.4	0.175	3.0	0.422
Streptomycin	6.7	11.1	0.228	12.1	0.277
MDR-TB[e]					
	1.0	11.1	<0.001	12.1	<0.001

[a] Information on previous treatment was reported for only 34 of the 45 relapse/reactivation cases, 33 of whom were recorded as being treated.

[b] Rate compared with that among new cases by the Chi-square test or Fisher's Exact test, as appropriate.

[c] Includes resistance alone or in combination with other antimicrobials.

[d] Isoniazid resistance at the standard concentration of 0.1 mg/L.

[e] Multidrug-resistant tuberculosis, that is, resistant to at least isoniazid and rifampicin.

Culture confirmation, speciation and drug susceptibility

MOLECULAR TYPING

Molecular typing

MOLECULAR TYPING

TB molecular typing results were available for 239 culture-positive new TB cases in 2014. The mycobacterial species identified were *M. tuberculosis* (238 cases), *M. bovis* (1 case). Among the 238 *M. tuberculosis* cases, 93 (39.1%) had non-unique molecular types and were in 56 separate molecular clusters. Five new clusters were identified in 2014, including four clusters with two cases in each and one cluster with three cases. The remaining 145 cases (60.9%) had a unique strain type.

In the last 5 years (2010–2014), 1,085 *M. tuberculosis* cases had TB molecular typing results, of which 405 (37.3%) had non-unique molecular types and were in 145 separate molecular clusters.

The median cluster size, based on cases in the last 5 years, was two cases (range 1-41)[ii] and 91.0% (132/145) of clusters had fewer than five cases. The remaining 13 clusters were distributed into the following cluster sizes: 5−9 cases (7), 10−19 cases (4) and 20 or more cases (2).

Figure 15 to Figure 20 show the proportion of non-unique molecular types in new TB cases for subgroups within selected variables between 2010 and 2014 compared with the mean proportion for each variable.

There was a high proportion of cases with non-unique molecular types in cases aged <15 years (84.6%), but a lower proportion across all other age groups apart from the 40–49 years age group (40.4%) where the proportion was just above the mean. Proportions were similar to the mean in both sexes.

Māori (77.1%) and Pacific peoples (75.4%) ethnic groups also had a high proportion of cases with non-unique molecular types whereas the proportion was much lower and in the Asian (23.5%), MELAA (13.0%) and European or Other (26.7%) ethnic groups.

Figure 15. Percentage of cases that were non-unique by age group and sex

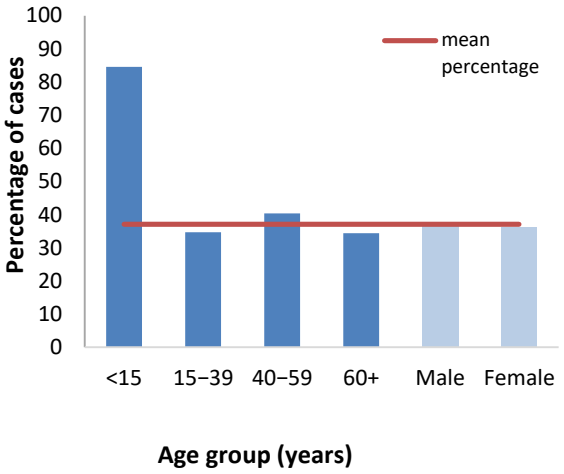
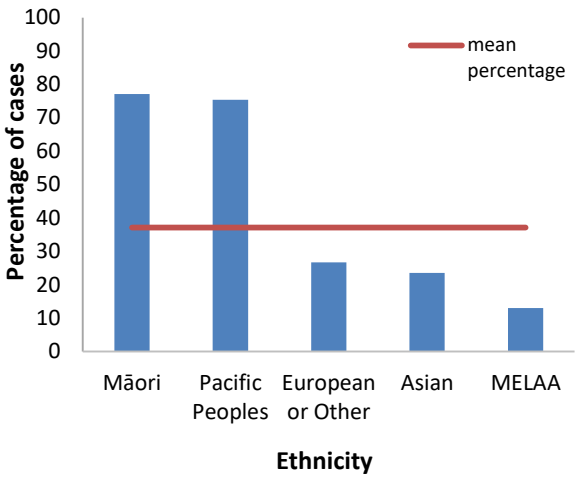


Figure 16. Percentage of cases that were non-unique by ethnicity

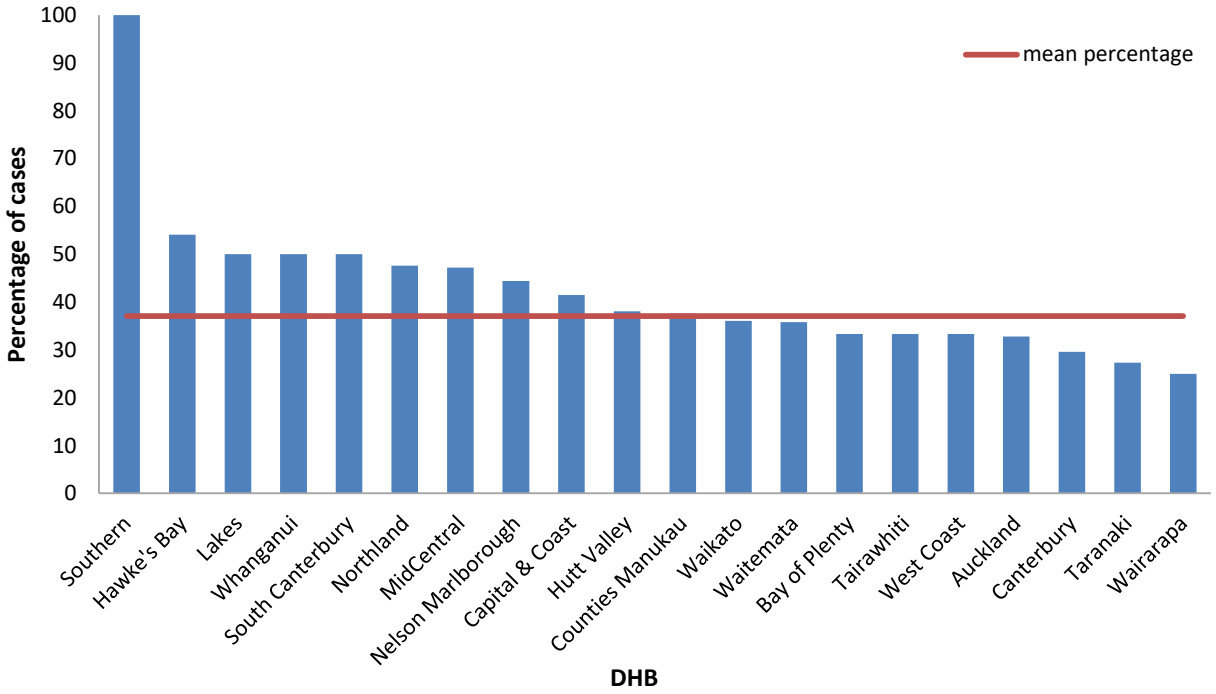


[ii] A cluster can contain just one case when the other cases within that cluster were either not notified on EpiSurv or were notified prior to the last 5 years.

Molecular typing

Across the DHBs the proportion was highest in cases from Hawke's Bay (54.1%), Lakes (50.0%), Whanganui (50.0%), Northland (47.6%) and MidCentral (47.2%) DHBs, lower but also above the mean for cases from Nelson Marlborough (44.4%), Capital Coast (41.5%), Hutt Valley (38.1%) and Counties Manukau (37.6%) DHBs and below the mean for all other DHBs.

Figure 17. Percentage of cases that were non-unique by DHB



Cases born in the Pacific Islands (69.5%) and New Zealand-born cases (66.4%) also had a high proportion of non-unique molecular types, whereas for other foreign-born cases the proportion was well below the mean.

There was a high proportion of cases with non-unique molecular types in cases residing in NZDep13 quintile 5 areas (43.5%) compared with a proportion similar to the mean residing in NZDep13 quintile 4 (33.7%) and a lower proportion for all other quintiles.

Figure 18. Percentage of cases that were non-unique by region of birth

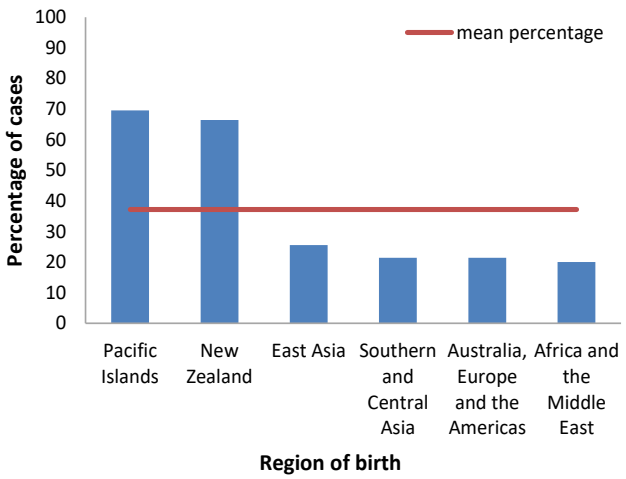
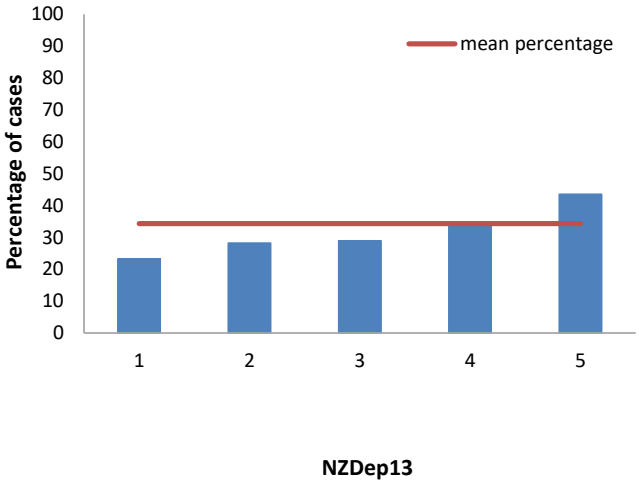


Figure 19. Percentage of cases that were non-unique by deprivation



Cases with pulmonary disease (41.7%) also had a higher proportion of cases with non-unique molecular types.

Figure 20. Percentage of cases that were non-unique by clinical manifestation

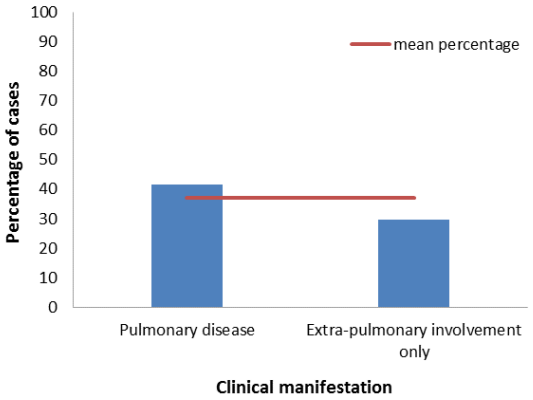


Table 13 (see Appendix) shows the detailed breakdown of non-unique and unique molecular types for new TB cases by age group, sex, ethnic group, DHB, region of birth, NZDep13 quintiles and clinical manifestation.

Molecular typing

DISCUSSION

Discussion

DISCUSSION

The incidence of TB in New Zealand (6.7 per 100,000 population in 2014) has remained fairly stable over the past 5 years. This rate is higher than the 2014 incidences reported in Australia (5.7 per 100,000), and the United States (2.9 per 100,000) and the 2013 incidence reported in Canada (4.7 per 100,000) [8-10], but lower than the 2014 incidence recorded in the United Kingdom (11.0 per 100,000) [11].

Place of residence and ethnicity

The overall incidence rate masks substantial differences in the rates of TB in different areas of the country and between population subgroups.

Geographically Auckland, Capital & Coast, Counties Manukau and Hutt Valley DHBs all had incidence rates above the national rate. These four DHBs have large urban populations and the higher incidence may reflect the ethnic makeup of these communities, settlement patterns of migrants from high endemicity countries and housing issues such as overcrowding. This is similar to the distribution of cases noted in the United Kingdom where TB is concentrated in large urban areas [11, 12]. In 2014, 57.8% of TB cases resided in the most deprived areas of New Zealand (Quintiles 4 and 5), a slightly lower proportion than the 70% of cases residing in the 40% most deprived areas in the England [12].

Among cases born in New Zealand the highest proportion of cases were in the Māori ethnic group (51.5%), an increase from the proportion in 2013. However, although the incidence in the Māori ethnic group (5.3 per 100,000) was almost nine times higher than the incidence in the European or Other ethnic group (0.6 per 100,000), it was lower than for Pacific peoples and for people born overseas. This is different from Australia where, among cases born in Australia, there was a lower proportion of cases in indigenous people compared to non-indigenous Australians [13]. However this may be because the proportion of indigenous peoples in the Australian population is much lower than in New Zealand (about 3% compared with about 15%). The 2013 incidence rate for Australian-born indigenous people (4.6 per 100,000) was six times higher than the rate for Australian-born non-indigenous people (0.8 per 100,000), but is still much lower than the rate in overseas-born people [13]. In Canada the 2013 incidence rate for Canadian-born people was higher among aboriginal people when compared with non-aboriginal Canadians and higher than in people born overseas [10]; and in the United States the 2014 incidence rate is higher in indigenous people compared with those of European ethnicity but lower than in people born overseas [9].

Country of birth

During the past 5 years, 75–80% of TB cases notified were born outside of New Zealand, an increase from earlier periods (61.3% for 1995–1999 and 67.7% for 2000–2004) [14]. A similar pattern has been seen in Australia where the proportion of cases born outside the country was reported to have steadily increased over 10 years, reaching 90% in 2010 and was reported as 88% in 2013 [13]. The proportion of cases born outside New Zealand in 2014 (76.6%) is similar to that reported in England (72.2% in 2014), but higher than in Canada (71% in 2013) and the United States (66% in 2014) [9, 10, 12].

Although the proportion of cases born overseas has been increasing in New Zealand, the incidence rate in people born overseas in 2014 was 17.5 per 100,000 which is lower than the rates reported for 1995–1999 (31.7 per 100,000) and 2000–2004 (32.3 per 100,000). This decrease may be due to changes in immigration screening practices, such as the introduction of screening for international

students staying over 6 months at the end of 2004, as well as the impact of interventions to improve the control of TB transmission both within New Zealand and overseas. Although this rate is higher than the 15.4 per 100,000 reported for foreign-born people in the United States in 2014, the US foreign-born rate excludes several high endemicity territories and countries such as the Federated States of Micronesia, Guam, the Northern Marianas and Palau [9].

Of the cases born outside New Zealand, the majority were born in South and Central Asia, followed by South East Asia, all high TB burden areas. The most frequently reported countries of birth, India, followed by the Philippines, are similar to the most common countries of birth for TB cases reported in 2013 by Australia (India, Vietnam, Philippines, China and Nepal)[13]. However, this differs from the countries of birth most commonly reported for cases notified in England (India, Pakistan, Somalia) [12]. This difference reflects differing immigration patterns but all the countries listed underscore the high risk of being born in country with high endemicity.

The time since arrival in New Zealand and notification date, while only recorded for 77.9% of cases born overseas, showed a similar pattern to that seen in Australia and the United Kingdom. Approximately 20% of cases born overseas were notified with TB in the first year after arrival and approximately 60% within 5 years of arrival. Australia recorded this information for 97% of those born overseas in 2013 and reported that 47% of these cases were notified in the first 4 years after arrival [13]. In 2014, time from arrival until diagnosis was known for 91.5% of non-UK-born cases notified in England with 14.0% diagnosed within 2 years and 39.7% within 6 years of arrival [12].

Clinical presentation and treatment

Pulmonary disease was reported in 61.7% of new TB cases in 2014, an increase from 53.4% of new TB cases in 2013. This is a lower proportion than most recently reported in Canada (67% in 2013), similar to Australia (58% in 2013), and higher than in England (52.9% in 2014) [10, 12, 13].

One of the 12 children aged <5 years diagnosed with TB in 2014 was reported as having miliary TB but none were reported with meningeal TB. Only two of these 12 children were reported to have had BCG vaccination. Eleven of these children were born in New Zealand and the remaining infant arrived in New Zealand aged 1 year. There was insufficient information to know if the unvaccinated children were eligible for the high-risk BCG vaccination programme. Collection of information about eligibility in future years would be useful to assess whether high-risk children aged <5 years diagnosed with TB had missed out on vaccination.

Nearly all the TB cases notified in 2014 were “new disease” (96.0%), meaning there was no history of prior treatment. This is a similar proportion to that reported from Australia in 2013 (97%) and England (93.2% in 2014) [12, 13]. Of the 12 relapse/reactivation cases, five had been originally diagnosed overseas and 10 were reported to have been previously treated for TB. From the data available it is unclear whether these cases were genuine relapse or reinfection. However, it is of concern that isolates from previously treated cases over the past 5 years were significantly more resistant to isoniazid and rifampicin. This underscores the importance of ensuring adequate treatment is completed for all cases diagnosed in New Zealand, as well as early identification of relapse cases to prevent transmission of resistant organisms.

For cases notified in 2013, 88.4% were reported to have completed treatment, a similar proportion to Canada (87% of cases first reported in 2012) and the United Kingdom (85% of cases first reported in 2013).[10, 12]. These percentages are all lower than the 95.2% reported by Australia for cases diagnosed in 2012 [13]. However, the Australian percentage is not directly comparable as it is based

only on cases considered “assessable”, meaning that cases that had transferred out of Australia, died of other causes or were still under treatment were excluded from the analysis.

The proportion of cases notified in 2013 reported to have died in New Zealand (6.5%) is higher than the 4.6% recorded in England for cases diagnosed in 2013 but the English outcomes only refer to drug-sensitive cases and therefore may not be directly comparable. Similarly, although the New Zealand rate is higher than the 1.2% mortality rate reported by Australia for cases diagnosed in 2012, this rate only refers to deaths due to TB in the cases considered to have assessable outcomes. There were another 2.7% of total cases in Australia that were reported to have died from other causes [13]. All three countries have previously reported problems with the quality of the follow-up data with about 5% of cases lost to follow up for a similar variety of reasons [10, 12, 13].

Drug susceptibilities and MDR-TB

Over the last 10 years (2005-2014), there has been a significant trend of decreasing pyrazinamide resistance, but no significant changes in resistance to isoniazid, rifampicin, ethambutol or streptomycin. However, the apparent decrease in pyrazinamide resistance may be due to changes in the laboratory methods used to detect pyrazinamide resistance rather than a real change in the prevalence of resistance (*Roberts Sally, Personal communication, 2014*).

The proportion of cases (both new disease and relapses/reactivations) with MDR-TB in 2014 (1.2%) was similar to the average proportion for the past 10 years (1.3%). This rate of MDR-TB is similar to that reported in the United States (1.0% for 2014) and England (1.3% for 2014), but lower than the 2% reported in Australia in 2013 [9, 12, 13].

Over the past 10 years, 93.5% (29/31) of MDR-TB cases were both born overseas, the majority in Asian countries, and assumed to have acquired their resistant organisms overseas. In England a high proportion (89%) of MDR-TB cases in 2014 were also reported to be born overseas, but the most common countries of birth for these cases were Lithuania and India [12]. For the United States, the proportion of MDR-TB cases that occurred in foreign-born persons has increased from 25% (103 of 407) in 1993 to 85% (57 of 67) in 2014 [9]. There was a similar pattern reported from Australia in 2013 with the majority of the MDR-TB cases reported as being born overseas [13].

From 2010–2014, 12.1% of New Zealand relapse/reactivation cases that had previously been treated for TB had MDR-TB, a much higher proportion than the 1.0% for cases with “new disease”. This is higher than the 3.7% of MDR-TB in previously treated cases reported from the United Kingdom in 2014 [12].

Transmission and control

Several indicators are used by Public Health England (PHE) to assess transmission in low endemicity countries such as the United Kingdom and New Zealand. For recent transmission the indicator used is the rate of TB in children <15 years of age born within the country [12]. The 2014 rate of TB in New Zealand-born children in the <15 years age group was 2.4 per 100,000, similar to the 2014 rate reported in England of 2.1 per 100,000 in children born in the United Kingdom [12]. However, these rates are well above the rates of TB in Australian-born children <15 years of age in 2013 which were 0.8 per 100,000 for indigenous and 0.6 per 100,000 for non-indigenous children [13]. Although the New Zealand rate was an increase from the rate 5years ago (1.3 per 100,000 in 2010) the 5 year moving average annual rate has been fairly stable since a peak in 2011.

For ongoing transmission within a community, the indicator previously used by PHE was the child (<15 years) to adult (>15 years) ratio but this has not been used in recent reports. Instead identification of clusters of cases with indistinguishable strains that may be due to recent transmission is being used and it is hoped that whole genome sequencing will soon be available to help improve understanding of TB transmission in England [12]. Between 2010 and 2014, 37% of strain typed TB cases in New Zealand were part of a cluster and 91% of these clusters had fewer than five cases. This is lower than the 57% of strain-typed TB cases in England that were part of a cluster during the same period, with 76% of clusters having fewer than five cases [12]. This suggests there may be a lower rate of community transmission of TB within New Zealand compared with England.

The increased proportion of new TB cases reporting contact with a confirmed case in 2014 (33.1%) compared with 2010 (25.2%) may be due to the increased proportion of 2014 cases born overseas who acquired their infection in a high endemicity country prior to arrival in New Zealand.

These indicators suggest decreasing or low transmission of TB infection within New Zealand and support the premise that most cases of TB diagnosed in New Zealand result from infection acquired overseas. As the majority of these cases occur in settled migrants from high endemicity countries, rather than on entry of new migrants, repeat screening sometime after entry could be considered for this group, along with a reminder for increased vigilance by clinicians.

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References

REFERENCES

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Appendix

APPENDIX

Appendix

APPENDIX

Table 11. Number and rate of tuberculosis notifications (new cases) by age group, sex, ethnic group, District Health Board and year, 2010−2014

Category	2010		2011		2012		2013		2014	
	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]
Age group (years)										
<5	3	-	8	2.5	4	-	5	1.6	12	3.9
5−14	10	1.7	11	1.9	8	1.3	5	0.8	7	1.2
15−39	142	9.7	141	9.7	142	9.8	130	9.0	143	9.7
40−59	72	6.1	71	5.9	56	4.6	67	5.5	69	5.6
≥60	66	8.3	69	8.4	69	8.2	55	6.3	59	6.6
Sex										
Male	147	6.9	152	7.1	147	6.8	139	6.4	169	7.6
Female	146	6.6	148	6.6	132	5.9	123	5.4	121	5.3
Ethnic group[b]										
Māori	31	4.7	39	5.9	36	5.4	25	3.7	36	5.3
Pacific peoples	45	16.5	47	17.1	33	12.0	40	14.5	47	16.9
Asian	174	34.4	161	31.7	168	32.9	157	30.5	174	34.1
MELAA	11	22.2	15	30.2	12	24.1	13	26.0	11	22.1
European or Other	27	0.9	30	1.0	26	0.9	24	0.8	17	0.6
Unknown	5	-	8	-	4	-	3	-	5	-
District Health Board										
Northland	6	3.7	6	3.7	3	-	1	-	7	4.2
Waitemata	33	6.2	33	6.1	40	7.3	21	3.8	36	6.4
Auckland	62	13.9	78	17.3	53	11.6	53	11.5	69	14.6
Counties Manukau	61	12.7	51	10.5	45	9.2	54	10.9	48	9.4
Waikato	20	5.5	18	4.8	22	5.9	23	6.1	17	4.4
Lakes	3	-	2	-	2	-	6	5.8	5	4.8
Bay of Plenty	4	-	14	6.6	9	4.2	10	4.7	11	5.1
Tairawhiti	3	-	3	-	2	-	2	-	1	-
Taranaki	1	-	1	-	4	-	6	5.3	3	-
Hawke's Bay	10	6.4	17	10.8	19	12.0	6	3.8	4	-
Whanganui	2	-	1	-	1	-	1	-	1	-
MidCentral	9	5.4	11	6.6	6	3.6	6	3.6	11	6.5
Hutt Valley	12	8.4	9	6.3	10	7.0	6	4.2	12	8.4
Capital & Coast	28	9.7	36	12.4	22	7.5	34	11.6	35	11.8
Wairarapa	1	-	0	-	0	-	2	-	1	-
Nelson Marlborough	5	3.6	4	-	14	9.9	4	-	2	-
West Coast	1	-	0	-	1	-	1	-	1	-
Canterbury	23	4.5	12	2.4	17	3.4	21	4.2	23	4.5
South Canterbury	0	-	0	-	1	-	0	-	1	-
Southern	9	3.0	4	-	8	2.6	5	1.6	2	-
Total	**293**	**6.7**	**300**	**6.8**	**279**	**6.3**	**262**	**5.9**	**290**	**6.4**

[a] Rate is expressed as cases per 100,000 population. Rates are not presented if there are fewer than five cases.

[b] Population data used to determine the rates for ethnic groups is based on the proportion of people in each ethnic group from the estimated resident 2013 census population applied to the mid-year population estimates. Ethnicity is prioritised and grouped in the following order: Māori, Pacific peoples, Asian, Middle Eastern/Latin American/African (MELAA) and European or Other (including New Zealander).

Appendix

Table 12. Site of infection for tuberculosis notifications (new cases) with extra-pulmonary involvement by year, 2010–2014

Site of infection	2010		2011		2012		2013		2014	
	Cases[b]	%	Cases[b]	%	Cases[b]	%	Cases[b]	%	Cases[b]	%
Lymph node (excl. abdominal)	75	46.9	65	44.2	54	35.3	68	40.2	80	48.2
Pleural	25	15.6	18	12.2	30	19.6	25	14.8	24	14.5
Intra-abdominal (excl. renal)	21	13.1	26	17.7	18	11.8	7	4.1	8	4.8
Bone/joint	16	10.0	16	10.9	14	9.2	12	7.1	16	9.6
Renal/genitourinary tract	5	3.1	5	3.4	15	9.8	6	3.6	3	1.8
Soft tissue/skin	6	3.8	7	4.8	8	5.2	7	4.1	5	3.0
Miliary tuberculosis	3	1.9	2	1.4	5	3.3	9	5.3	10	6.0
Tuberculous meningitis	8	5.0	6	4.1	1	0.7	3	1.8	6	3.6
Other	11	6.9	14	9.5	17	11.1	54	32.0	52	31.3
Total[a]	**160**	100	**147**	100	**153**	100	**169**	100	**166**	100

[a] Note: Total number of new tuberculosis cases reported with extra-pulmonary involvement, including cases with pulmonary disease.

[b] Some cases had more than one site of infection recorded.

Table 13. Number and percentage of non-unique and unique strain of tuberculosis notifications (new cases) for selected variables, 2010−2014

Variable[a]	Non-unique		Unique	
	Cases	%[b]	Cases	%[b]
Age group (years)	**412**	**37.1**	**698**	**62.9**
<15	22	84.6	4	15.4
15−39	198	34.7	372	65.3
40−59	103	40.4	152	59.6
≥60	89	34.4	170	65.6
Sex	**412**	**37.1**	**698**	**62.9**
Male	223	37.8	367	62.2
Female	189	36.3	331	63.7
Ethnic group	**405**	**37.1**	**688**	**62.9**
Māori	91	77.1	27	22.9
Pacific peoples	126	75.4	41	24.6
Asian	159	23.5	517	76.5
Middle Eastern/Latin American/African	6	13	40	87
European or Other	23	26.7	63	73.3
District Health Board	**412**	**37.1**	**698**	**62.9**
Northland	10	47.6	11	52.4
Waitemata	48	35.8	86	64.2
Auckland	86	32.8	176	67.2
Counties Manukau	82	37.6	136	62.4
Waikato	26	36.1	46	63.9
Lakes	6	50.0	6	50
Bay of Plenty	13	33.3	26	66.7
Tairawhiti	2	33.3	4	66.7
Taranaki	3	27.3	8	72.7
Hawke's Bay	20	54.1	17	45.9
Whanganui	2	50	2	50
MidCentral	17	47.2	19	52.8
Hutt Valley	16	38.1	26	61.9
Capital & Coast	44	41.5	62	58.5
Wairarapa	1	25	3	75
Nelson Marlborough	8	44.4	10	55.6
West Coast	1	33.3	2	66.7
Canterbury	24	29.6	57	70.4
South Canterbury	1	50	1	50
Southern	2	-	0	-
Region of birth	**411**	**37.2**	**694**	**62.8**
New Zealand	142	66.4	72	33.6
Southern and Central Asia	79	21.4	291	78.6
East Asia	72	25.5	210	74.5
Pacific Islands	98	69.5	43	30.5
Africa and the Middle East	14	20	56	80
Australia, Europe and the Americas	6	21.4	22	78.6
NZ Deprivation Index (NZDep13) quintile	**377**	**34.3**	**722**	**65.7**
1	26	23.2	86	76.8
2	40	28.2	102	71.8
3	61	28.9	150	71.1
4	89	33.7	175	66.3
5	161	43.5	209	56.5
Clinical manifestation	**412**	**37.2**	**695**	**62.8**
Pulmonary disease	289	41.7	404	58.3
Extra-pulmonary involvement only	123	29.7	291	70.3

[a] The total provided for each variable is the number of cases for which the information is recorded.

[b] Percentage of the total number of cases in each sub-category.