Science for Communities
He Pūtaiao, He Tāngata

TUBERCULOSIS IN NEW ZEALAND ANNUAL REPORT 2019

PREPARED FOR:	**Ministry of Health**
CLIENT REPORT No:	**FW22027**
PREPARED BY:	**Epidemiology Team, Health and Environment Group** **Institute of Environmental Science and Research Limited**
PUBLISHED:	**23 December 2022**

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

First published: 23 December 2022

Suggested citation:
The Institute of Environmental Science and Research Ltd.
Tuberculosis in New Zealand: Annual Report 2019. Porirua: ESR; 2022
Porirua, New Zealand

Client Report: FW22027

ACKNOWLEDGEMENTS

This report was prepared by Liza Lopez, Dr Sherif Ammar, Dr Kristin Dyet and Yvonne Galloway.

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

- The Mycobacteriology Laboratories at Auckland City Hospital; Waikato Hospital; Wellington Southern Community Laboratories; and 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.
- Sue McAllister (AIDS Epidemiology Group) for providing the HIV/TB co-infection data.
- Dr Niki Stefanogiannis (Health Surveillance Group, ESR) for reviewing the report and providing valuable feedback.

Disclaimer

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

Abbreviation	Description
BCG	Bacillus Calmette-Guérin (vaccine)
CNS	Central nervous system
DHB	District health board
DOT	Directly observed therapy
DST	Drug susceptibility testing
ESR	Institute of Environmental Science and Research
HIV	Human immunodeficiency virus
LTBI	Latent tuberculosis infection
MDR-TB	Multidrug-resistant tuberculosis
MELAA	Middle Eastern, Latin American or African ethnicity
MIRU	Mycobacterial interspersed repetitive units
NTM	Non-tuberculosis mycobacteria
NZDep	New Zealand index of deprivation
PCR	Polymerase chain reaction
PHU	Public Health Unit
RFLP	Restriction fragment length polymorphism
TB	Tuberculosis disease
WHO	World Health Organization
XDR-TB	Extensively drug-resistant tuberculosis

SUMMARY

Incidence

- In 2019, 317 cases of tuberculosis disease (TB) were notified in New Zealand, of which 305 (96.2%) were new cases.
- The incidence rate for TB in 2019 was 6.4 per 100,000 population, similar to the rate for the previous five years. New Zealand continues to meet the WHO definition of a low TB incidence country.
- Geographically the highest notification rates for new TB cases in 2019 were reported from Counties Manukau (13.0 per 100,000), Auckland (9.0 per 100,000) and Waikato (6.8 per 100,000) DHBs.
- Males had a higher rate for new TB notifications in 2019 (6.8 per 100,000) than females (5.5 per 100,000).
- By age group, the highest notification rate for new TB cases in 2019 was in the 15–39 years age group (9.0 per 100,000). There were only two new TB cases in children aged <15 years.
- The highest ethnic-specific rates were reported in the Asian ethnic group (25.8 per 100,000), followed by MELAA (20.7 per 100,000) and Pacific peoples (13.7 per 100,000).

Place of birth and trends by country of birth

- People born outside New Zealand accounted for 82.0% (250/305 cases) of notifications of new TB cases in 2019. The most common regions for overseas-born cases were Southern and Central Asia (particularly India) and South-East Asia (particularly Philippines).
- For people born outside New Zealand, 16.6% of new TB cases occurred in the first year after arrival in New Zealand and nearly half occurred within five years.
- Approximately half of New Zealand-born new TB cases were Māori, and a quarter were Pacific peoples. Rates were highest for Pacific peoples (3.7 per 100,000) and Māori (3.2 per 100,000).
- In 2019, the three-year moving average annual rate for new TB in New Zealand-born children aged <15 years (a proxy for recent transmission within the country) was 0.6 per 100,000; lower than in 2018 (1.0 per 100,000).

Socioeconomic deprivation

- Around 60% of new TB cases lived in the most deprived areas (NZDep2013 quintile 4 or 5).
- The rate for new TB cases in the most deprived quintile was three times the rate in the most deprived quintile.

Diagnosis

- The majority (80.7%) of new TB cases present symptomatically to their health practitioner. A further 9.5% of cases were identified through immigrant/refugee screening and 5.9% through contact follow up.

Receipt of treatment

- In 2019, 97.0% (296/305) of new TB cases received treatment. For cases with an onset date recorded, 22.6% started treatment within one month of the onset of symptoms and a further 31.4% started treatment between one and three months.
- For new TB cases with pulmonary disease and a known onset date, 31.8% (41/129 cases) of cases started treatment between one and three months after symptom onset.
- In 2018, 95.9% (284/296) of new TB cases received appropriate treatment and 88.7% (252/284) completed treatment. Thirty-two cases did not complete their treatment; the majority were transferred to overseas medical care (10 cases) or went overseas (5 cases). Nine cases died before their treatment was completed.
- A lower proportion of cases born outside New Zealand received directly observed therapy during the intensive phase of their treatment (56.9%) than those born in New Zealand (72.5%).

Outbreaks and molecular clusters

- One TB outbreak was reported in 2019, involving nine cases from an extended family.
- No new clusters were identified by molecular typing in 2019. Around one third (37.2%) of new TB cases were part of a cluster.
- In the last five years, Māori and Pacific peoples were more likely to be part of a cluster than overseas-born cases.

Drug susceptibility

- Seven (2.6%) culture-positive TB cases reported in 2019 were multidrug-resistant TB (MDR-TB, defined as resistance to at least isoniazid and rifampicin). All seven MDR-TB cases were born overseas.
- Resistance to isoniazid, rifampicin, ethambutol, and streptomycin was higher among isolates from cases born overseas than for New Zealand-born cases, but only isoniazid (p = 0.03) resistance was significantly higher.

INTRODUCTION

Globally, tuberculosis disease (TB) remains one of the top 10 causes of death and the leading cause from a single infectious agent. Infection is usually curable with a combination of specific antibiotics, but relies on full compliance with treatment [1].

The WHO estimates that TB incidence has been falling since 2000 and 54 million lives have been saved between 2000 and 2017 through diagnosis and treatment. However, control of the worldwide epidemic remains a major public health challenge. The burden from TB disease has been sustained by the ongoing HIV/AIDS pandemic and by the continuing prevalence of multi-drug resistant TB. Although TB is more prevalent in low-income countries, it is not confined to these countries and the WHO End TB Strategy recognises that low-incidence countries, such as New Zealand, should work towards eliminating TB within their settings, as well as supporting global control efforts [1,2].

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 [3].

This report provides a description of the epidemiology of TB in New Zealand for 2019 and examines trends from 2010 to 2019 based on notifications, hospital discharges and mortality data. It also includes a summary of TB drug susceptibility and molecular typing.

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

DATA SOURCES

Tuberculosis disease (TB) notification data recorded on EpiSurv, the national notifiable diseases database, is used in this report. Data on species identification, antimicrobial susceptibility and molecular typing is provided by the mycobacteriology laboratories at Auckland City Hospital, Waikato Hospital and Canterbury Health Laboratories. Ministry of Health data on hospitalisations and deaths due to tuberculosis is also included.

Notifications

Clinicians are required to notify all cases of TB to their local medical officer of health under the Health Act 1956. 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.

The case classification for TB, as defined in the Ministry of Health's Communicable Disease Control Manual [4], 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.

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

Tuberculosis disease – new case: active TB in a person who has never previously been treated for TB 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.

Cases diagnosed with latent tuberculosis infection (LTBI) or with old inactive tuberculosis disease are not notifiable under the Health Act 1956*. Only cases of active tuberculosis disease (referred to as TB) are presented in this report.

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

Deaths

Two sources of mortality data are used in this report. Deaths from TB are recorded in EpiSurv and also in the National Mortality Collection which records a classification for the underlying cause of each death registered in New Zealand. Data from the Mortality Collection is only available up to 2018 due to the time taken to complete coronial inquiries and the backlog due to COVID-19 measures. 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 between the two sources.

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 and Canterbury Health Laboratories. These laboratories routinely test susceptibility to isoniazid (at concentrations of 0.1 and 0.4 mg/L), rifampicin, ethambutol, pyrazinamide and streptomycin. LabPlus also tests multidrug-resistant TB (MDR-TB) isolates (ie, isolates resistant to at least isoniazid and rifampicin) for susceptibility to second-line anti-tuberculous agents, including amikacin, capreomycin, moxifloxacin, ethionamide 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:

- Isolates with high-level isoniazid resistance 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 (1) sequencing the *rpoB* gene and/or (2) by using the Hain Lifescience GenoType® MTBDR*plus* version 2.0 assay, that detects the presence of mutations *rpoB*.
- 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 differentiate *M tuberculosis* complex and nontuberculosis mycobacteria (NTM). 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* version 1.0 and MTBDR*sl* version 1.0*,* 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. Alternatively the Hain Lifescience GenoType® MTBDR*plus* version 2.0 and MTBDR*sl* version 2.0 assays may be used, that detect the presence of mutations in the *inhA*, *katG*, *rpoB, gyrA/gyrB, eis* and *rrs* genes that are associated with resistance to low-level isoniazid, high-level isoniazid,

rifampicin, 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.

Dates

Data is presented by the date the case was notified rather than by the date of onset of illness. The report focuses on cases of TB notified in 2019 and trends since 2010 or 2015, depending on the availability of data. Treatment outcomes are presented for cases reported in 2018.

Notification data presented in this report is based on information recorded in EpiSurv as at 20 September 2021. 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.

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 disease rates, except disease rates for ethnic groups and country of birth, has been derived from the 2019 mid-year population estimates published by Statistics New Zealand.

The denominator data used to determine ethnic-specific disease rates is based on the proportion of people in each ethnic group from the estimated resident populations for 2013 (for 2015–2017) and 2018 applied to the corresponding mid-year population estimates.

The denominator used to determine the rates in New Zealand-born children between 2009 and 2018 is based on the proportion of people born in New Zealand from the usually resident 2006 (for 2009–2010), 2013 (for 2011–2014) and 2018 (for 2015–2019) census populations applied to the corresponding mid-year population estimates.

Population data used to determine disease rates for New Zealand-born, overseas-born and each country of birth is derived from the 2018 Census usually resident population count by birthplace.

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.

Ethnicity

Ethnic groups 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

Socioeconomic deprivation is based on the 2013 New Zealand Index of Deprivation (NZDep2013) [5]. 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. Quintiles of NZDep2013, 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.

Country of birth

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

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, was used to determine the significance of any observed differences. The Cochran-Armitage trend test was used to calculate the significance of time trends. A *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 2015 to 2019 is shown in Table 1.

For most variables the level of completeness was more or less stable over the five-year period. Variables with consistently high levels of data completeness (≥95%) were the demographic variables (age, sex, ethnicity), basis of discovery, laboratory confirmation, hospitalisation and survival status, pulmonary or extra pulmonary disease, BCG vaccination, immunosuppressive medication and born outside New Zealand. The completeness of data associated with the treatment variables was also high (≥97%) across the four years analysed (2015–2018).

Date of onset had the lowest levels of completeness, ranging from 68% to 78% (Table 1). However, this is partly explained by the nature of the disease as some cases are asymptomatic.

Table 1. Percentage of data completeness for tuberculosis (new case) notifications by variable and year, 2015–2019

Variable	2015	2016	2017	2018	2019
Basis of discovery	100	100	100	100	100
Laboratory confirmation	100	100	100	100	100
Demographic details					
Age	100	100	100	100	100
Sex	100	100	100	100	100
Ethnicity	100	99	100	98	100
Geocoding accuracy[a]	98	99	97	95	94
Clinical course and outcomes					
Onset date	78	73	68	70	75
Hospitalisation status	100	100	100	100	100
Survival status	100	99	99	99	99
Protective and risk factors					
BCG vaccination[b]	100	100	100	100	100
Has immunosuppressive illness	98	96	94	99	97
On immunosuppressive medication	98	98	96	97	95
Contact with confirmed case of tuberculosis	85	89	78	83	84
Case born outside New Zealand	100	100	100	100	100
Date of arrival[c]	87	89	85	84	84
Current/recent residence with person born outside New Zealand	91	92	94	95	95
Exposure in a healthcare setting	89	95	89	91	92
Current/recent residence in an institution	92	98	91	94	93
Clinical characteristics					
Pulmonary disease	100	100	100	100	100
Extra-pulmonary involvement	100	100	100	100	100
Treatment[d]					
Date treatment started	100	100	100	100	99
Treatment outcome [e]	100	100	100	100	-
Use of directly observed therapy (DOT)[d, e]	97	98	97	97	-

[a] Geocoding accuracy is based on exact and nearest match to Land Information New Zealand addresses.

[b] Cases aged <5 years only.

[c] Cases born outside New Zealand only.

[d] Cases reported as having received treatment only.

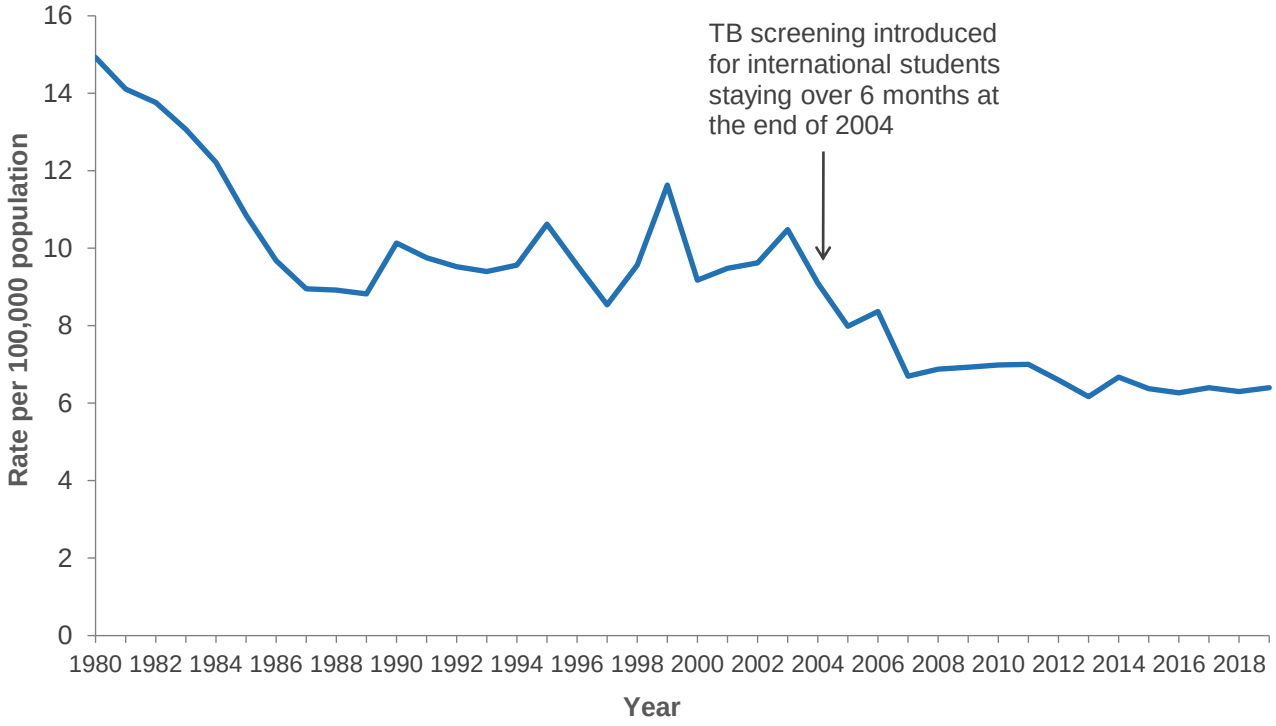
[e] Data is only reported for 2015−2018 due to length of time taken for TB treatment to be completed.

NOTIFICATIONS

There were 317 cases of TB disease notified in 2019, of which 305 (96.2%) were new cases and 12 were relapses or reactivations. The 2019 TB disease notification rate was 6.4 per 100,000 population, similar to the 2018 rate (6.2 per 100,000). The majority of TB cases (92.7%, 294/317) were laboratory confirmed.

Trends in TB disease rates since 1980 are shown in Figure 1. The annual TB rate decreased from 14.9 per 100,000 in 1980 to 8.8 per 100,000 in 1989 and then fluctuated between 8.5 and 11.6 per 100,000 for the next 15 years before decreasing again to 6.7 per 100,000 in 2007. Since 2007, the rate has remained fairly steady, ranging from 6.2 to 7.0 per 100,000 each year.

Figure 1. Tuberculosis notification rates by year, 1980–2019



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 305 new TB cases notified in 2019, giving a notification rate of 6.1 per 100,000 population. This rate was similar to the 2018 rate (6.0 per 100,000, 296 new TB cases). Between 2015 and 2019, the notification rate was ranged between 6.0 and 6.2 per 100,000 (Table 13).

Basis of discovery and diagnosis

Information on how the case was discovered was recorded for all 305 new TB cases. The majority of cases (80.7%, 246/305) were diagnosed when the case presented to a health practitioner with symptoms (Table 2).

Between 2015 and 2019, the proportion of cases discovered by each method ranged from 76.2% to 84.9% for symptomatic cases presenting to a health practitioner, 7.0−13.9% for immigrant/refugee screening, 4.7−7.1% for contact follow-up, and 2.1−5.1% for other means of discovery.

Table 2. Tuberculosis (new case) notification by basis of discovery, 2019

Basis of discovery	Cases	%
Symptomatic case presented to health practitioner	246	80.7
Immigrant/refugee screening	29	9.5
Contact follow-up	18	5.9
Other	12	3.9
Total	**305**	**100**

In 2019, 92.8% (283/305) new TB cases were laboratory confirmed. Of the 283 cases with a method of laboratory confirmation recorded, 94.0% (266 cases) were confirmed by isolation of *M. tuberculosis* (98.9%, 263 cases) or *M. bovis* (1.1%, 3 cases). A further 17 cases were confirmed by the following methods: one case by demonstration of acid-fast bacilli in a clinical specimen, 11 cases by demonstration of *M. tuberculosis* nucleic acid directly from specimens, and five cases by histology strongly suggestive of TB. The remaining 22 new TB cases were classified as probable based on clinical grounds and treatment for presumptive TB, with six of these cases having radiology suggestive of pulmonary TB.

Age and sex

Table 3 shows that notification rates were higher among adults than children (<15 years). This trend was consistent over the last five years (Table 13). Similar to the past four years, the highest notification rate for new TB cases in 2019 for both males and females was in the 15–39 years age group.

Table 3. Numbers and rates for tuberculosis (new case) notifications by age group and sex, 2019

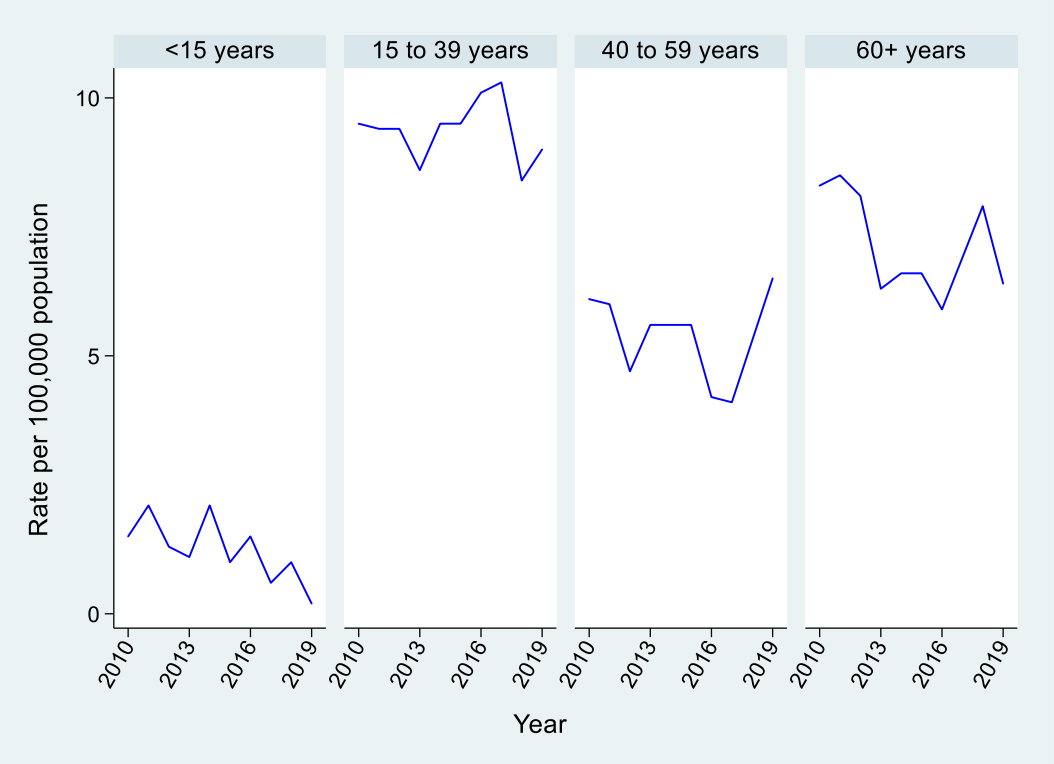
Age group (years)	Male		Female		Total	
	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]
<5	1	-	0	-	1	-
5–14	0	-	1	-	1	-
15–39	86	9.9	67	8.0	153	9.0
40–59	41	6.6	42	6.4	83	6.5
≥60	39	7.9	28	5.1	67	6.4
Total	**167**	**6.8**	**138**	**5.5**	**305**	**6.1**

[a] Rate per 100,000 based on 2019 mid-year population estimates; caution as rates shown for counts with less than five cases.

Males had a higher rate than females for the last five years with the exception of 2017 (Table 13).

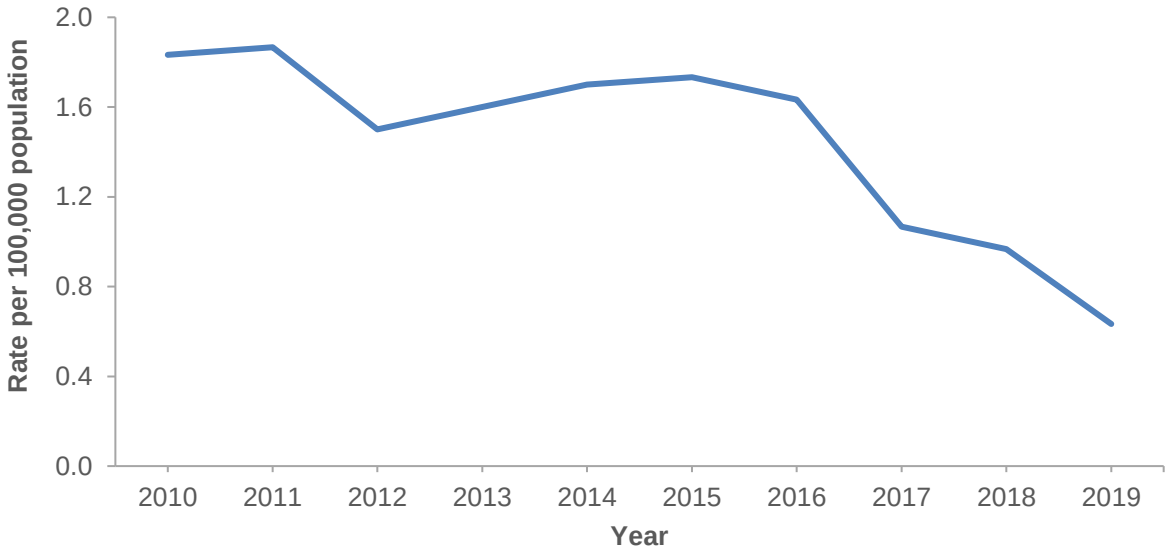
Over the past 10 years (2010–2019), the average annual notification rate was highest in the 15–39 years age group (9.4 per 100,000), followed by the ≥60 years (7.1 per 100,000), and 40–59 years (5.4 per 100,000) age groups (Figure 2).

Figure 2. Tuberculosis (new case) notification rates by age group and year, 2010–2019



In 2019, there were two new TB cases in New Zealand-born children aged less than 15 years, compared with six cases in 2018. Due to the low number of cases, the trend is better assessed by a three-year moving average. The three-year moving average annual rate decreased from 1.8 per 100,000 in 2010 to 0.6 per 100,000 in 2019 (Figure 3).

Figure 3. Three-year moving average rate of tuberculosis (new case) notifications in New Zealand-born children (<15 years old), 2010–2019



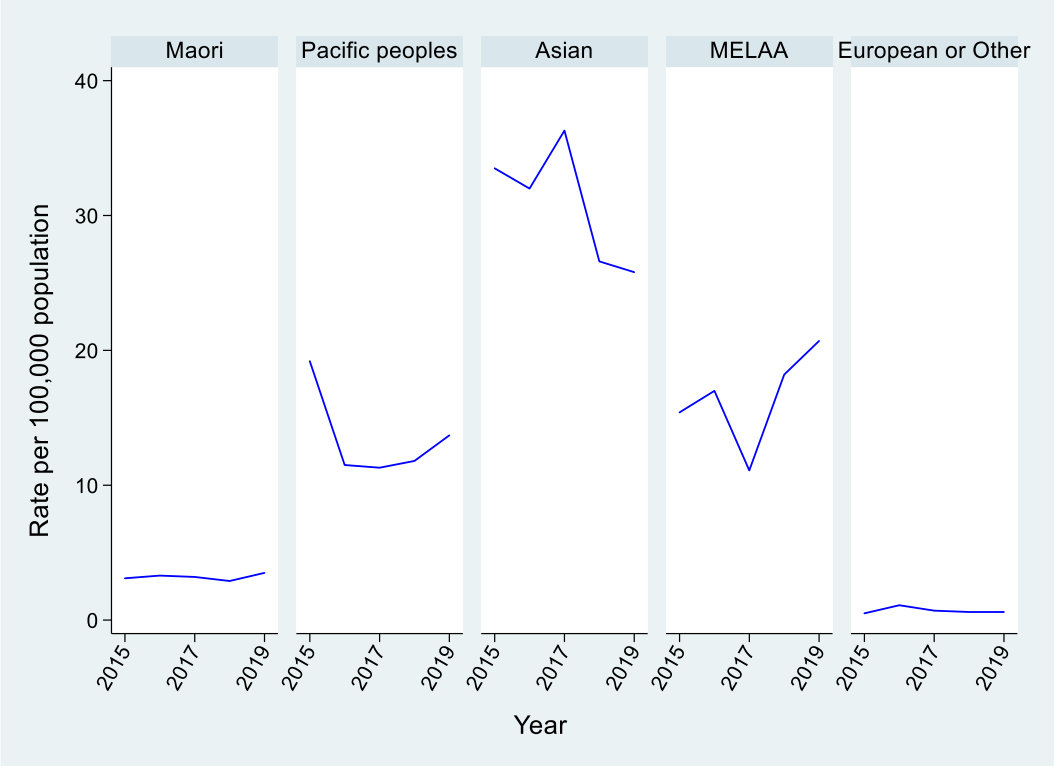
TB in children is an indicator of recent acquisition and a marker of ongoing transmission in the community. The low rates of new TB cases in those under 15 years suggests that transmission within New Zealand is infrequent.

Ethnicity

Ethnicity was recorded for 99.7% (304/305) of the new TB cases notified in 2019. The Asian ethnic group had the highest notification rate (25.8 per 100,000), followed by MELAA (20.7 per 100,000), and Pacific peoples (13.7 per 100,000) (Table 13).

Between 2015 and 2019, the Asian and MELAA had the highest rates, apart from in 2015 where Pacific peoples had a higher rate than MELAA (Figure 4, Table 13). The trend data for the MELAA ethnic group should be interpreted with caution as the number of cases each year was low (6–15 cases annually) and therefore prone to fluctuations in the rate.

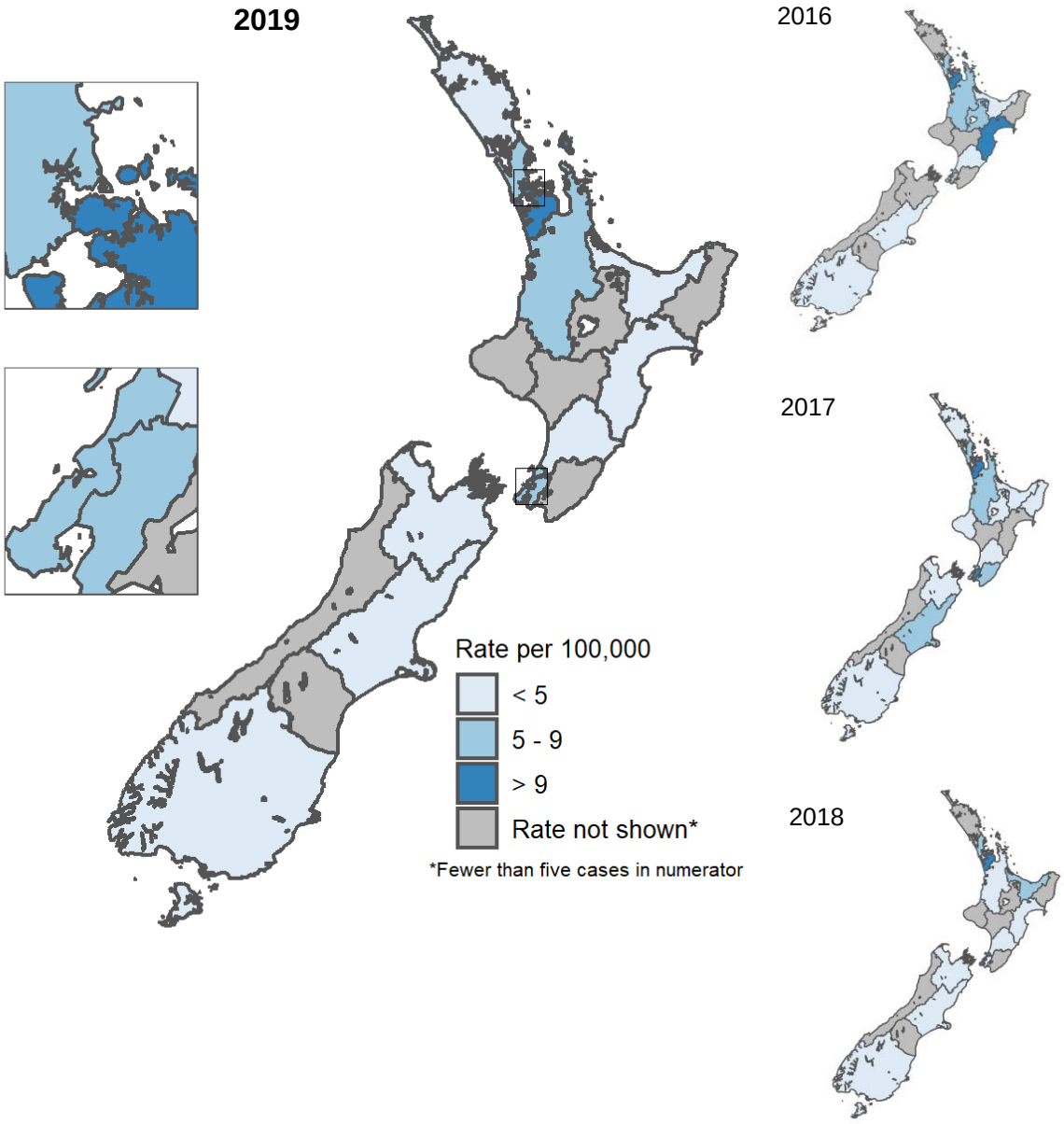
Figure 4. Tuberculosis (new case) notification rates by ethnicity and year, 2015–2019



Geographical distribution

New TB case notification rates by district health board (DHB) for 2015 to 2019 are shown in Figure 5. The highest notification rates in 2019 were recorded for Counties Manukau (13.0 per 100,000, 75 cases), Auckland (9.0 per 100,000, 45 cases) and Waikato (6.8 per 100,000, 29 cases) DHBs (Table 13). Apart from 2018, Auckland and Counties Manukau DHB consistently had the highest rate in 2015−2019 (Table 13).

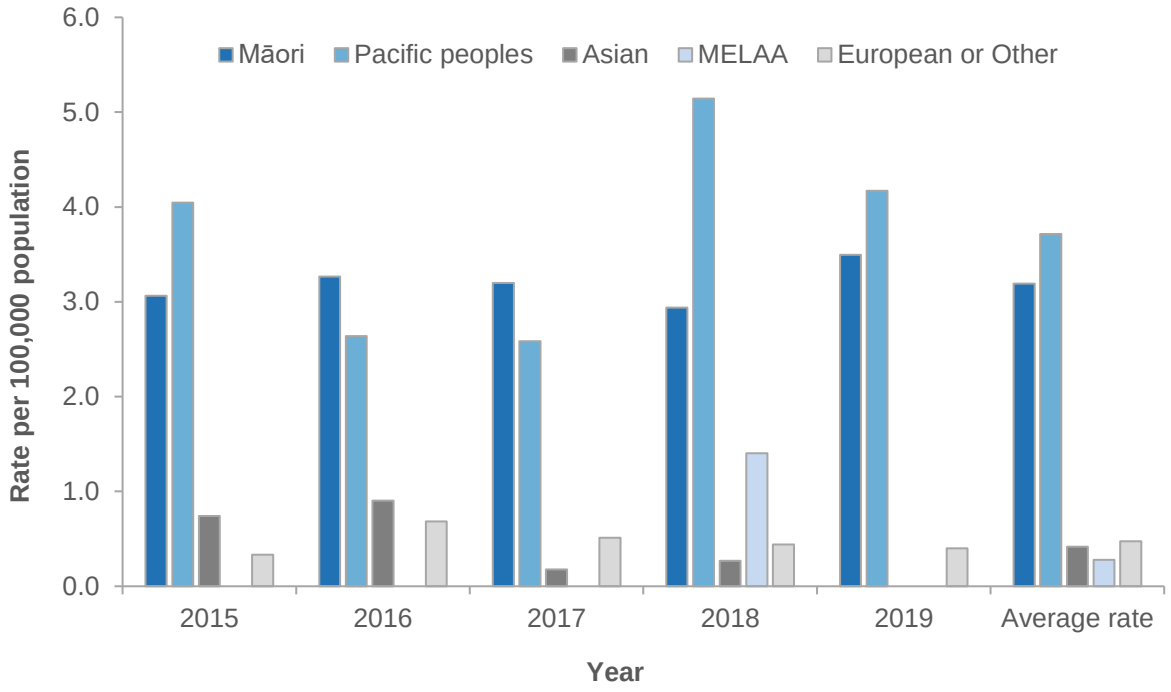
Figure 5. Tuberculosis (new case) notification rates by district health board and year, 2016–2019



Born in New Zealand

There were 55 new TB cases in 2019 who were born in New Zealand, a rate of 1.6 per 100,000. Of these, 29 (52.7%) were Māori, 14 (25.5%) were Pacific peoples, and 12 (21.8%) were European or Other. Incidence rates in 2019 for New Zealand-born new TB cases were highest for Pacific peoples (4.2 per 100,000) and Māori (3.5 per 100,000). In contrast, the rate for European or Other was 0.4 per 100,000. Similarly, for 2015–2019, Pacific peoples (3.7 per 100,000) and Māori (3.2 per 100,000) had higher rates than other ethnic groups (Figure 6).

Figure 6. Tuberculosis (new case) notification rates for New Zealand born cases by ethnicity, 2015–2019



For those 2015–2019 cases born in New Zealand, the burden of disease was highest in Counties Manukau (59 cases) DHB followed by Waikato (34 cases), Auckland (25 cases), Canterbury (24 cases) and Hawke's Bay (22 cases) (Table 14).

Hospitalisations

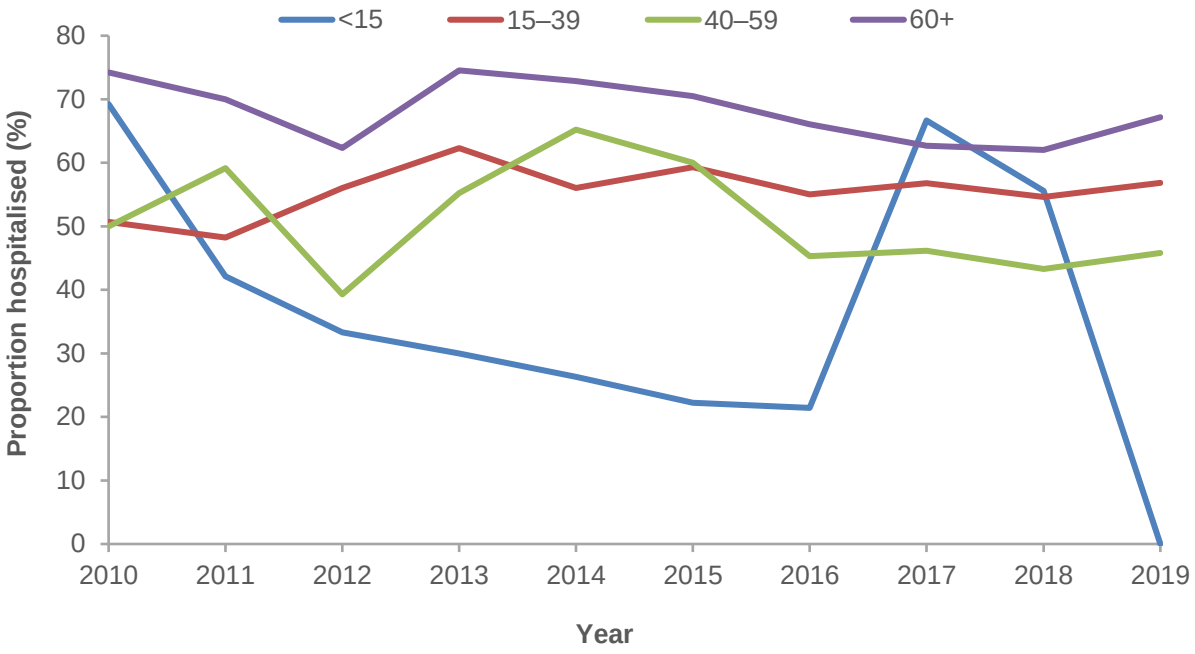
Hospitalisation status was provided for all 305 new TB cases notified in 2019, and just over half (55.7%, 170/305) were hospitalised. Hospitalisation rates were highest in those aged ≥60 years with two-thirds (67.2%) hospitalised (Table 4).

Table 4. Hospitalisations for tuberculosis (new case) by age group, 2019

Age group (years)	Hospitalised		
	Yes	No	Percent (yes)
<5	0	1	0.0
5–14	0	1	0.0
15–39	87	66	56.9
40–59	38	45	45.8
≥60	45	22	67.2

The proportion of cases hospitalised over the past 10 years is highest for those aged ≥60 years followed by those aged 15–39 years. The proportions are more variable for those aged 40-59 and <15 years (Figure 7). Data for the <15 years age group should be interpreted with caution as the number of hospitalisations each year are low (2–9 hospitalisations annually) and, therefore, prone to fluctuations in the proportion.

Figure 7. Hospitalisation rates for tuberculosis (new case) by age group and year, 2010–2019



Deaths

There were two deaths from TB among the 305 new TB cases notified in 2019; one was aged 30–39 years and one was ≥60 years.

Between 2010 and 2018, TB was recorded in the Ministry of Health's Mortality Collection as the underlying cause of death in 56 cases. During this period 0–11 deaths were recorded each year, all aged ≥20 years. The majority of deaths (91.1%, 51 cases) were in people aged ≥50 years.

Risk factors

In 2019, the most common risk factors reported for new TB cases were being born outside New Zealand (82.0%, 250/305) and current or recent residence with person(s) born outside New Zealand (76.6%, 223/291) (Table 5). This follows the same trend as for the previous four years (Figure 8).

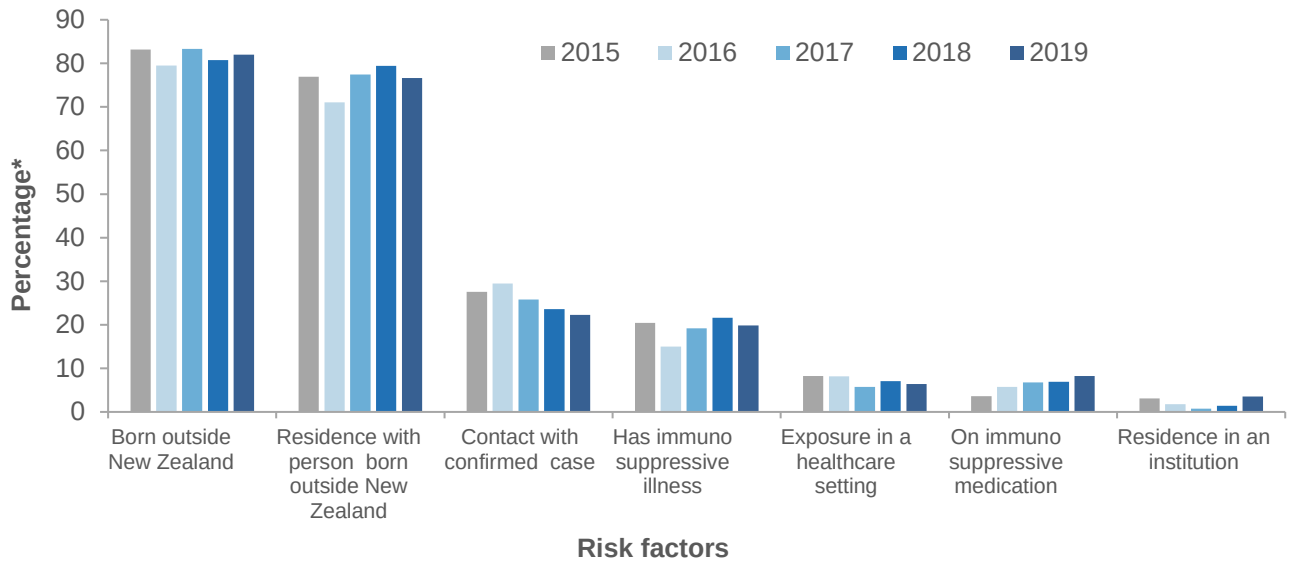
Table 5. Risk factors reported for tuberculosis (new case) notifications, 2019

Risk factor	Cases[a]	Total[b]	%
Born outside New Zealand	250	305	82.0
Current/recent residence with person born outside New Zealand	223	291	76.6
Contact with confirmed case	57	256	22.3
Has immunosuppressive illness	59	297	19.9
Exposure in a healthcare setting	24	291	8.2
On immunosuppressive medication	18	282	6.4
Current/recent residence in an institution	10	284	3.5

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

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

Figure 8. Percentage of tuberculosis (new case) notifications by risk factor and year, 2015–2019



*Percentage refers to the number of cases that answered "yes" out of the total number of cases for which the information was known.

Born outside New Zealand

The majority of new TB cases were born outside New Zealand (81.9 %, 250/305), giving a rate of 19.7 per 100,000. Cases born in the Southern and Central Asia region had the highest notification rate in 2019 (73.5 per 100,000), followed by South-East Asia (37.0 per 100,000) (Table 6). The majority (92.7%, 102/110) of 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 (65.3%, 32/49) and for cases born in North-East Asia it was China (89.3%, 25/28).

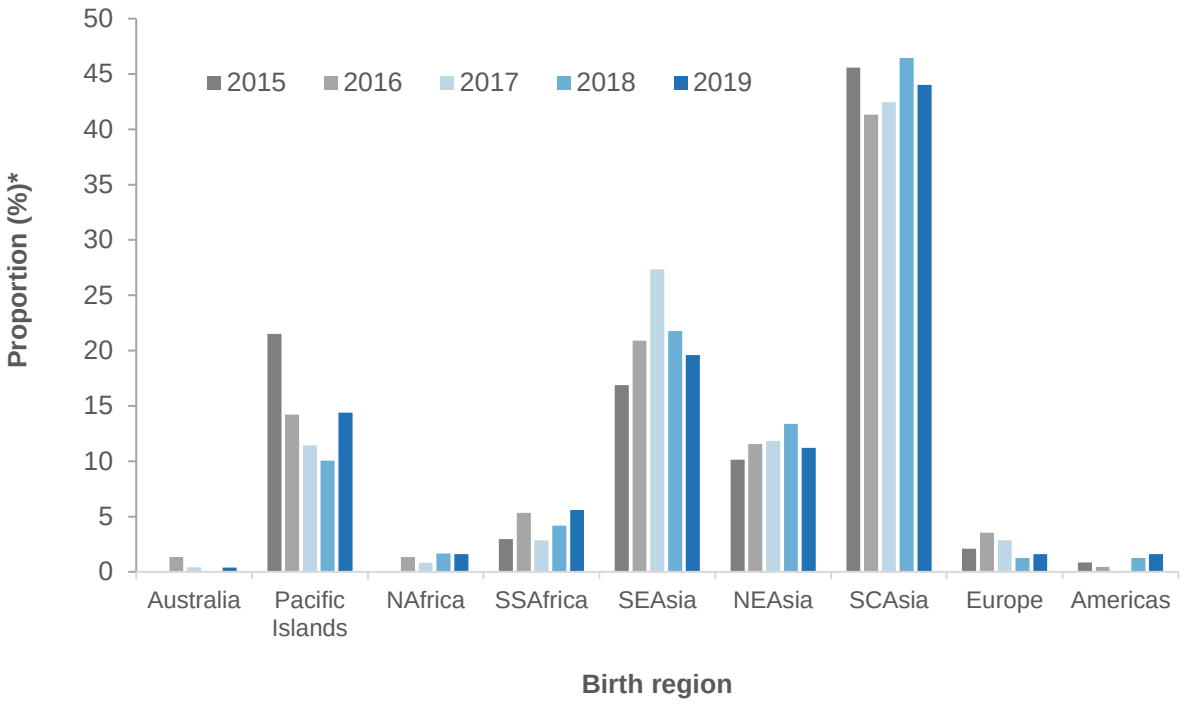
Table 6. Tuberculosis (new case) notifications by region of birth, 2019

Region of birth	Cases	Rate[a]
Born in New Zealand	**55**	**1.6**
Born outside New Zealand	**250**	**19.7**
Southern and Central Asia	110	73.5
South-East Asia	49	37.0
Pacific Islands	36	21.0
North Africa and the Middle East	4	16.8
Sub-Saharan Africa	14	15.3
North-East Asia	28	14.1
The Americas	4	6.3
Australia	1	1.3
Europe	4	1.1
Total	**305**	**6.1**

[a] Rate per 100,000 population. Population data used for the denominator was derived from the 2018 census usually resident population count by birthplace, published by Statistics New Zealand.

The proportion of new TB cases born overseas varied by region between 2015 and 2019 (Figure 9). Although there was a steady decrease in the proportion of new TB cases born in the Pacific Islands between 2015 and 2018, there was an increase in 2019.

Figure 9. Percentage of tuberculosis (new case) notifications born outside New Zealand by birth region and year, 2015–2019



NAfrica – North Africa and the Middle East
SSAfrica – Sub-Saharan Africa
SEAsia – South-East Asia
NEAsia – North-East Asia
SCAsia – Southern and Central Asia

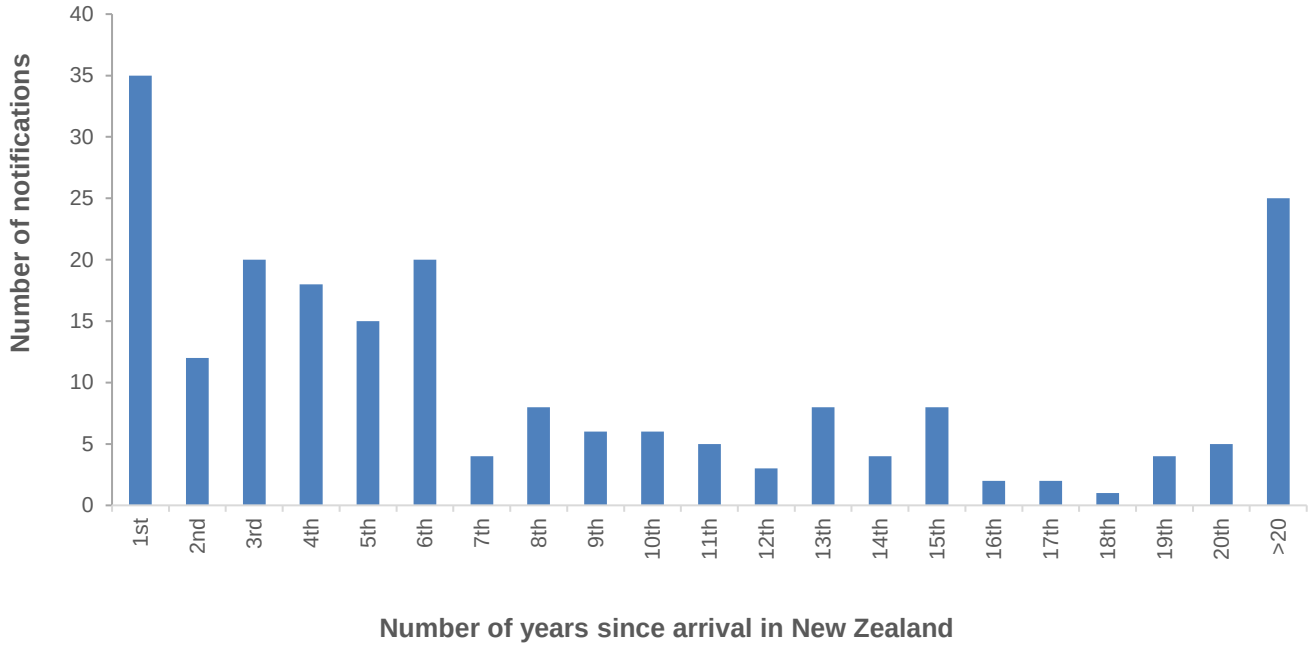
* Number of cases born in a region divided by the total number of cases born outside New Zealand, and for which the country of birth is known.

Time to notification from arrival in New Zealand

The date of arrival in New Zealand was recorded for 84.4% (211/250) of the new TB cases in 2019 who were born outside New Zealand. Thirty-five (16.6%) cases born outside New Zealand were notified with TB in the first year after arrival in New Zealand and just under half (47.4%, 100/211) were notified within the first five years after arrival (Figure 10). The median time between arrival in New Zealand and TB notification was five years (range 0–65 years, mean 8.5 years).

For 2015–2019, the annual median time between arrival in New Zealand and notification was between four and five years (mean 7.7–10.5 years).

Figure 10. Tuberculosis (new case) notifications born outside New Zealand by time since arrival in New Zealand, 2019



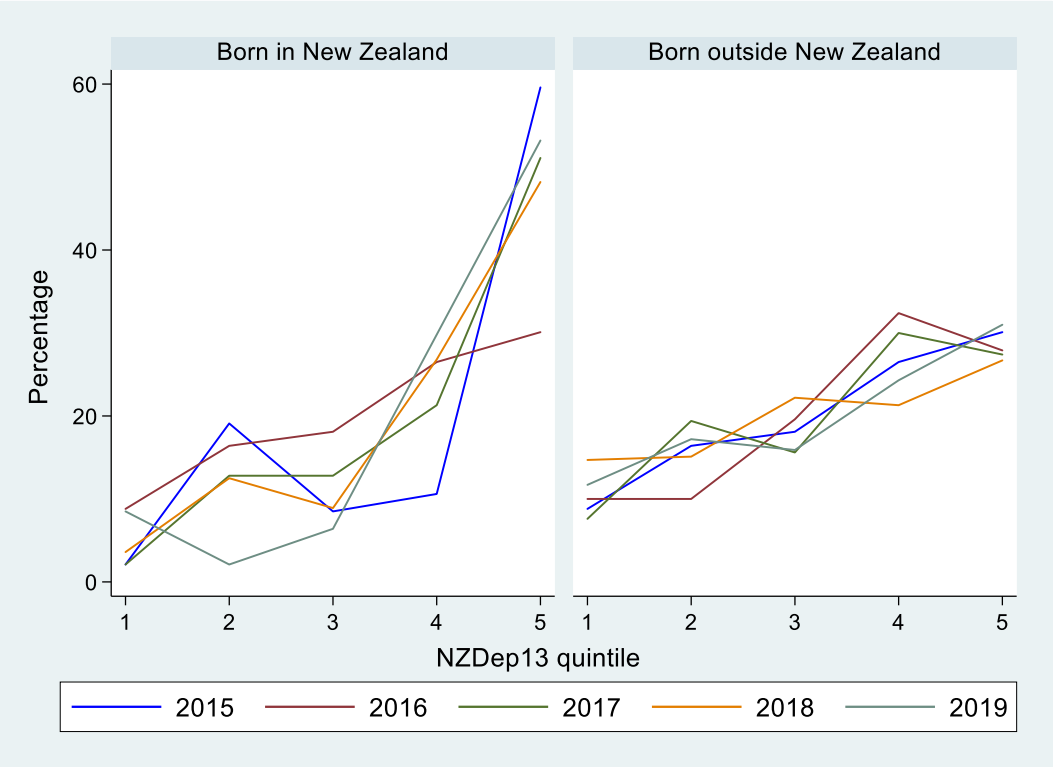
Note: The date of arrival was not recorded for 37 cases. Number of years: 1st: < 1 year after arrival, 2nd: 1–< 2 years after arrival, 3rd: 2–< 3 years after arrival etc.

Socioeconomic deprivation

In 2019, 93.8% (286/305) of new TB cases were assigned a New Zealand Index of Deprivation 2013 (NZDep2013) score. Of the 286 cases, 171 (59.8%) lived in the most deprived areas (NZDep2013 quintile 4 or 5). The rate for new TB cases in the most deprived quintile of the population was three times the rate in the least deprived quintile (11.9 compared with 3.7 per 100,000).

Figure 11 shows the relationship between deprivation and the percentage of new TB cases in the last five years by birthplace (in or outside New Zealand). A higher proportion of new TB cases was reported from more deprived areas irrespective of their place of birth. This trend was more pronounced for cases born in New Zealand.

Figure 11. Percentage of tuberculosis (new case) notifications by birthplace category, NZDep2013 and year, 2015−2019

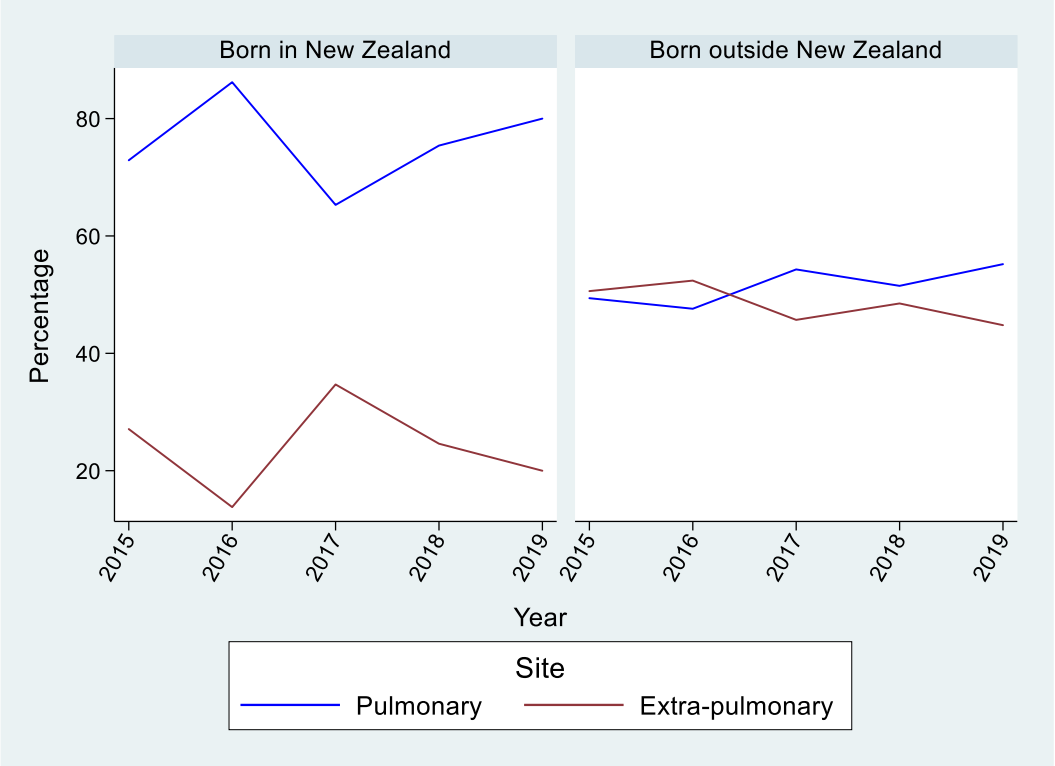


Site of infection

In 2019, 182 (59.7%) new TB cases had pulmonary (including laryngeal) disease. Of these, 130 had pulmonary disease only and 52 had both pulmonary and extra-pulmonary involvement. A further 123 cases (40.3%) had only extra-pulmonary involvement and were therefore unlikely to be infectious.

From 2015 to 2019, cases born in New Zealand were more likely to be reported with pulmonary disease (76.4%) than extra-pulmonary disease only (28.4%). In comparison, new TB cases born outside New Zealand had similar proportions of pulmonary disease (51.7%) and extra-pulmonary disease (48.3%) (Figure 12).

Figure 12. Tuberculosis (new case) notifications by site of infection, birthplace category and year, 2015–2019



Of the 182 new TB cases in 2019 with pulmonary disease, 179 had information on whether acid-fast bacilli were demonstrated in a direct smear of a clinical specimen from a pulmonary or laryngeal site. Of these, 48.6% (87/179) were smear positive, with sputum reported as the specimen site for 82.8% (72/87) of these cases.

Of the 175 cases with extra-pulmonary involvement, 86 (49.1%) had lymph node (excluding abdominal) recorded as a site of infection (Table 15). Fourteen cases of central nervous system TB (CNSTB) were reported in 2019 (all aged ≥20 years). Eight cases of miliary TB were reported, all aged ≥20 years. No miliary TB cases had an underlying immunosuppressive illness.

Between 2015 and 2019, the most common site of infection recorded for cases with extra-pulmonary involvement was lymph node (excluding abdominal) (49.7%), followed by pleural (16.9%) and intra-abdominal (excluding renal) (10.6%) (Table 15).There were 73 cases of central nervous system (CNSTB) (one case of tuberculous meningitis aged 10–14 years and two cases aged 15–19 years). A total of 37 cases of miliary TB were recorded between 2015 and 2019. Of these, one case was aged <5 years and had not received the BCG vaccine.

Immunosuppressive illness and HIV status

In 2019, 59 new TB cases were reported to have an immunosuppressive illness. Of these, 18 cases were on immunosuppressive medication. Information on the illness was provided for 57 cases, with 34 (59.6%) reported as having diabetes.

Information on whether an HIV test was done was available for all 305 new TB cases. Of these, 89.5% (273 cases) were tested for HIV. Two cases were co-infected with HIV in 2019.

Receipt of treatment

In 2019, 97.0% (296/305) of new TB cases received treatment. Onset dates were reported for 226 (76.6%) cases who received treatment, thereby allowing calculation of the time between the onset of symptoms and start of treatment. Of these, 22.6% (51/226) started treatment within one month of the onset of symptoms and a further 31.4% (71/226) started treatment between one and three months. The median interval to the start of treatment was 80 days from the onset of symptoms.

A treatment delay for patients with pulmonary TB represents a risk to public health from disease transmission. In 2019, 96.7% (176/182) of new TB cases with pulmonary disease were reported to have received treatment. The interval between the onset of symptoms and the start of treatment could be calculated for 129 (73.3%) of these cases. Among these, 27.9% (36/129) started treatment within one month of the onset of symptoms and 31.8% (41/129) started treatment between one and three months. The median interval to the start of treatment for patients with pulmonary TB was 59 days from the onset of symptoms. Between 2015 and 2018, the median interval to the start of treatment ranged from 42 days in 2015 to 76 days in 2016.

Treatment outcomes for cases notified in 2018

Due to the length of time taken for TB treatment to be completed, data presented in this section is for the 296 new TB cases notified in 2018. Of these, 95.9% (284/296) were reported to have received appropriate treatment for TB (Table 7). Most cases, 88.7% (252/284), completed treatment to the satisfaction of the prescribing doctor. Of these 252 new TB cases, 57.9% (146/252) received directly observed therapy (DOT) during the intensive phase of their treatment. A lower proportion of cases born outside New Zealand were reported to have received DOT during the intensive phase of their treatment (54.9%) than those born in New Zealand (71.2%). However, those born overseas accounted for 77.4% of the overall usage of intensive phase DOT. For new TB cases with pulmonary disease, 70.9% of cases born outside New Zealand received DOT during the intensive phase of their treatment, which was similar to the 72.2% for cases born in New Zealand.

Table 7: Treatment outcomes for tuberculosis (new cases) notified in 2018

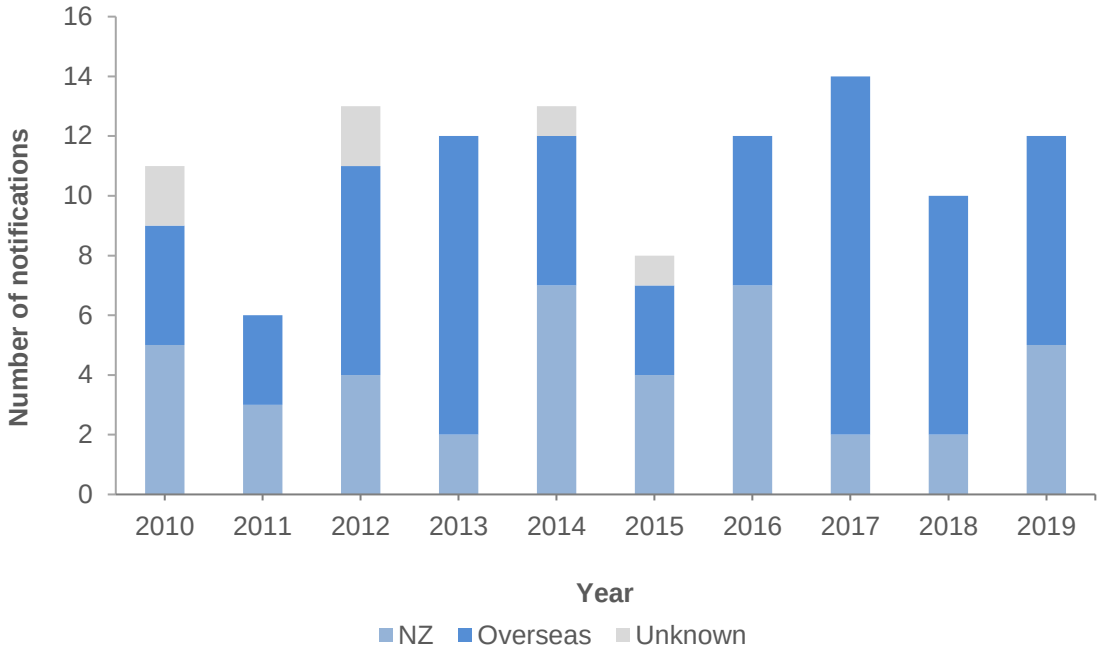
Treatment outcomes for new TB cases	Cases	%
Received treatment	**284**	**95.9**
Treatment completed to satisfaction of doctor	252	88.7
Treatment ended earlier than planned	**32**	**11.3**
Case transferred to overseas medical care	10	3.5
Case died	9	3.2
Case went overseas (medical care not transferred or unknown)	5	1.8
Treatment was stopped because of adverse effects	4	1.4
Case refused to complete treatment	4	1.4

Twelve cases were reported as receiving no treatment: four cases died before treatment, four cases went overseas (medical care not transferred or unknown), two cases transferred to an overseas medical care, one case was lost to follow-up and for one case the reason was unknown.

TUBERCULOSIS DISEASE – RELAPSES OR REACTIVATIONS

Twelve TB relapse/reactivation cases were notified in 2019. This category of disease could also include cases of re-infection. The number of TB relapse/reactivation cases has remained low over the last 10 years (2010–2019) ranging from 6 to 14 cases a year (Figure 13).

Figure 13. Tuberculosis (relapse/reactivation) notifications by place of original diagnosis, 2010−2019



In 2019, TB relapse/reactivation cases were reported from the following five DHBs: Canterbury (4 cases), Waitemata and Counties Manukau (3 cases each), Waikato and Southern (1 case each). The cases were aged 70+ years (5 cases), 20–29 years and 30–39 (2 cases each), 40–49, 50–59 and 60–69 years (1 case each). Eleven relapse/reactivation cases were of Asian ethnicity, and one was MELAA. Six of the relapse/reactivation cases were hospitalised and one death was reported.

Eleven relapse/reactivation cases could be assigned a NZDep2013 score. Six cases (54.5%) lived in the most deprived areas (NZDep2013 quintiles 4 and 5).

Information about the place of birth, place of original diagnosis and whether the case had been previously treated for TB was recorded for 10 (83.3%) cases. All 10 cases were born overseas. Three cases were previously diagnosed in New Zealand and were treated for six months (2 cases) and nine months (1 case), only one case received DOT throughout treatment. Seven cases were previously diagnosed overseas and had received treatment for a period of three months (1 case), four months (1 case), six months (4 cases) and 9 months (1 case).

Information on previous treatment was not recorded for two cases in 2019. One case aged ≥60 years and had a previous diagnosis in 1997, and one case had a previous diagnosis in 1962.

OUTBREAKS

One TB outbreak was reported in 2019 involving nine cases between August 2018 and November 2019. The cases were all part of the same extended family and lived in the Auckland region.

CULTURE CONFIRMATION, SPECIATION AND DRUG SUSCEPTIBILITY

Data presented in this section was collected from the mycobacteriology laboratories at Auckland City Hospital (LabPlus), Waikato Hospital and Canterbury Health Laboratories.

CULTURE CONFIRMATION AND SPECIATION

In 2019, 274 TB cases were culture positive (266 new cases and 8 relapse/reactivations); 271 were due to *M. tuberculosis* and three were due to *M. bovis*. Of the new TB cases with pulmonary disease, 96.2% (175/182) were culture positive and all were due *to M. tuberculosis*.

Fewer than five cases of culture-positive TB due to *M. bovis* were reported each year between 2015 and 2019.

DRUG SUSCEPTIBILITY

Antimicrobial susceptibility data was available for the isolates from 273 culture-positive TB cases in 2019. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 8.

Table 8: Antimicrobial resistance of tuberculosis isolates by species, 2019

Antimicrobial	Resistant[a]					
	M. tuberculosis *n* = 270		*M. bovis* *n* = 3		All isolates *n* = 273	
	No.	%	No.	%	No.	%
Isoniazid (0.1 mg/L)	20	7.4	0	-	20	7.3
Isoniazid (0.4 mg/L)[b]	14	5.2	0	-	14	5.1
Rifampicin	8	3.0	0	-	8	2.9
Ethambutol	2	0.7	0	-	2	0.7
Pyrazinamide	4	1.5	3[c]	100	7	2.6
Streptomycin	12	4.4	0	-	12	4.4

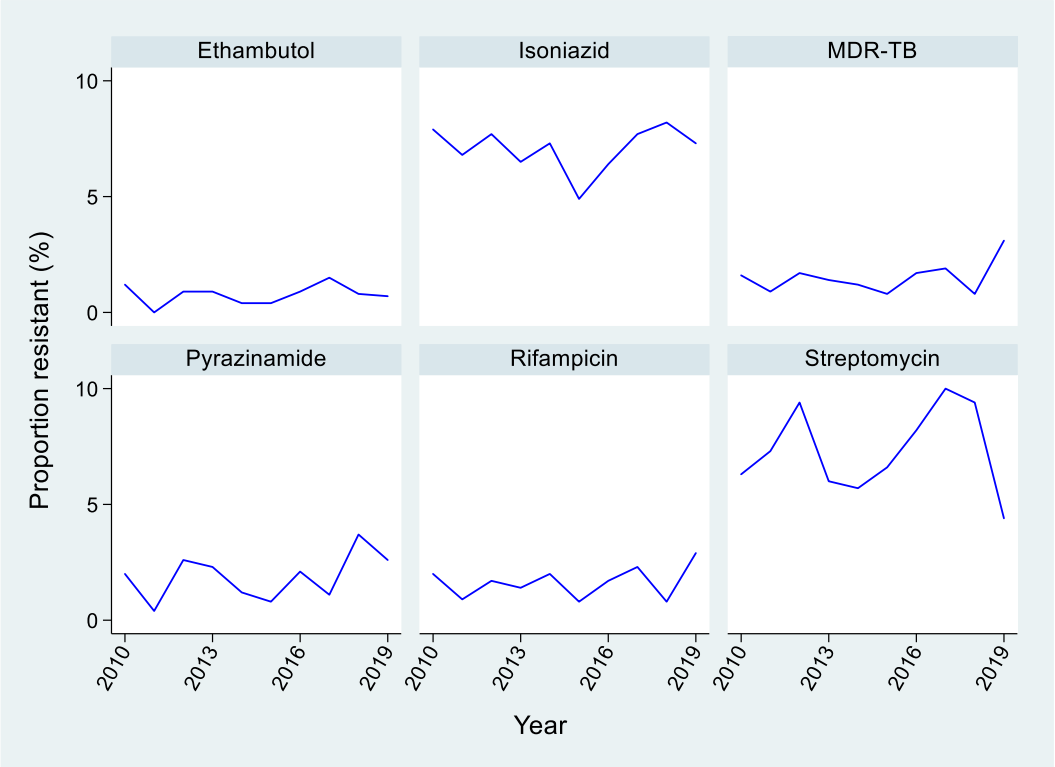
[a] Includes resistance alone or in combination with other antimicrobials.

[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.

From 2010 to 2019, there were no significant trends in pyrazinamide, isoniazid, rifampicin, ethambutol or streptomycin resistance (Figure 14).

Figure 14. Antimicrobial resistance of tuberculosis isolates by antimicrobial and year, 2010−2019



*Isolates resistant to both isoniazid and rifampicin are defined as multidrug-resistant tuberculosis (MDR-TB).

In 2019, 88.6% (242/273) of the isolates were fully susceptible to all five routinely tested antimicrobials. There were seven (2.6%) cases of multidrug-resistant tuberculosis (MDR-TB, defined as resistance to at least isoniazid and rifampicin) (Table 9). All seven of the MDR-TB isolates were from new TB cases. In addition to the seven MDR-TB isolates, four isolates were resistant to isoniazid and streptomycin, but not rifampicin.

Table 9. Antimicrobial resistance patterns for tuberculosis isolates, 2019

	Resistance pattern[a]	% (number) of isolates with each pattern	
Fully susceptible		**88.6**	**(242)**
Resistant to 1 agent		**7.3**	**(20)**
	H	3.3	(9)
	S	2.2	(6)
	Z[b]	1.5	(4)
	R	0.4	(1)
Resistant to 2 agents		**2.6**	**(7)**
	HS	1.5	(4)
	HR[c]	1.1	(3)
Resistant to 3 agents		**0.4**	**(1)**
	HRE[c]	0.4	(1)
Resistant to 4 agents		**1.1**	**(3)**
	HRZS[c]	0.7	(2)
	HREZ[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] Of the four isolates with monoresistance to pyrazinamide: three were *M. bovis* and one was identified as *M. tuberculosis* complex.
[c] MDR-TB, multidrug-resistant tuberculosis, that is, resistant to at least isoniazid and rifampicin.

During the last 10 years there have been a total of 36 cases of MDR-TB, giving an average annual rate of 1.7% of 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 (in 2010).

Table 10 compares antimicrobial resistance among isolates from cases born in New Zealand and cases born overseas. While resistance to all antimicrobials routinely tested was higher among cases born overseas, the difference was only significant for isoniazid (p = 0.030).

Table 10. Antimicrobial resistance of tuberculosis isolates by birthplace category, 2019

	Born in New Zealand (n = 47)		Born overseas (n = 226)		p-value[a]
	No.	%	No.	%	
Fully susceptible					
	44	93.6	198	87.6	0.316
Resistant to:[b]					
Isoniazid[c]	0	-	20	8.9	0.030
Rifampicin	0	-	8	3.5	0.358
Ethambutol	0	-	2	0.9	1.000
Pyrazinamide	2	4.3	5	2.2	0.346
Streptomycin	1	2.1	11	4.9	0.698
MDR-TB[d]					
	0	-	7	3.1	0.608

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

All seven MDR-TB cases identified in 2019 were born overseas. All 36 MDR-TB cases that have occurred in the last 10 years were born overseas and were assumed to have acquired MDR-TB overseas. The majority (83.3%, 30 cases) were born in Asia.

Isoniazid and streptomycin resistance were most frequent among isolates from cases of Asian ethnicity (Table 11). Six MDR-TB cases were of Asian ethnicity, and one was MELAA.

Table 11. Antimicrobial resistance of tuberculosis isolates by ethnicity, 2019

	Māori[a] (*n* = 26)		Pacific peoples (*n* = 38)		Asian (*n* = 179)		MELAA (*n* = 13)		European or Other (*n* = 17)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Fully susceptible										
	25	96.2	36	94.7	156	87.2	9	69.2	16	94.1
Resistant to:[b]										
Isoniazid[c]	0	-	0	-	18	10.1	2	15.4	0	-
Rifampicin	0	-	1	2.6	6	3.4	1	7.7	0	-
Ethambutol	0	-	0	-	1	0.6	1	7.7	0	-
Pyrazinamide	1	3.9	1	2.6	4	2.2	1	7.7	0	-
Streptomycin	0	-	0	-	10	5.6	1	7.7	1	5.9
MDR-TB[d]										
	0	-	0	-	6	3.4	1	7.7	0	-

[a] Middle Eastern/Latin American/African (MELAA

[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.

There were eight culture-positive TB relapses/reactivations in 2019. Because the annual number of TB relapses/reactivations is small, the following analysis of drug resistance among relapses/reactivations is for the five years from 2015 to 2019. During this period, 3.4% (42/1231) of the culture-positive cases for which susceptibility data was available were relapses/reactivations. Information about previous treatment was recorded for 30/42 relapses/reactivations cases and all had received previous anti-tuberculosis drug treatment.

Antimicrobial resistance among new cases of TB and relapses/reactivations is shown in Table 12. Compared with isolates from new TB cases, isolates from relapses/reactivations were more likely to be resistant to isoniazid, although this difference was not significant.

Table 12. Antimicrobial resistance of tuberculosis cases (new cases, relapses/reactivations and previously treated cases), 2015–2019

	New cases (*n* = 1214)	Relapse/reactivation cases			
		All (*n* = 40)		Previously treated[a] (*n* = 29)	
	%	%	*p*-value[b]	%	*p*-value[b]
Fully susceptible					
	86.7	82.5	0.476	82.8	0.577
Resistant to:[c]					
Isoniazid[d]	6.7	15.0	0.053	13.8	0.131
Rifampicin	1.7	2.5	0.513	0.0	1.000
Ethambutol	0.8	2.5	0.301	0.0	1.000
Pyrazinamide	2.1	2.5	0.573	0.0	1.000
Streptomycin	7.7	7.5	1.000	6.9	1.000
MDR-TB[e]					
	1.6	2.5	0.480	0.0	1.000

[a] Information on previous treatment was reported for only 29 of the 40 relapse/reactivation cases, 29 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.

MOLECULAR TYPING

TB molecular typing results were available for all 266 culture-positive new TB cases in 2019. A total of 99 (37.2%) new TB cases had non-unique molecular types and were in 60 separate molecular clusters. No new clusters were identified in 2019.

In the last five years, 1,215 new TB cases had molecular typing results, of which 485 (39.9%) had non-unique molecular types and were in 202 separate molecular clusters. The median cluster size was one case (range 1–37)* and the majority of clusters (90.6%, 183/202) had less than five cases. The remaining 19 clusters were distributed in the following cluster sizes: 5−9 cases (14), 10−19 cases (3) and 20 or more cases (2).

Figure 15 to Figure 20 show the percentage of new TB cases that had non-unique molecular types for subgroups within selected variables between 2015 and 2019, compared with the mean percentage for each variable. Table 16 shows a detailed breakdown of non-unique and unique molecular types for new TB cases for 2015–2019 by age group, sex, ethnicity, DHB, region of birth, NZDep2013 quintiles and clinical manifestation.

In 2015–2019, children aged <15 years (80.0%) were more likely to be part of a TB cluster than other age groups (Figure 15). Three quarters of new TB cases among Pacific peoples (76.2%) and Māori (75.5%) were part of cluster (Figure 16).

Figure 15. Percentage of new TB cases with non-unique molecular types by age group and sex, 2015–2019

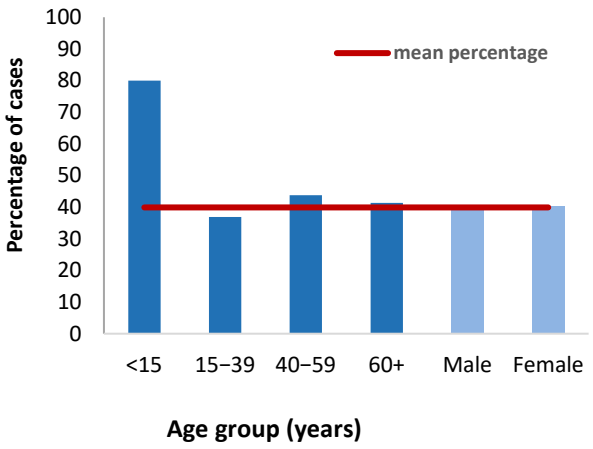
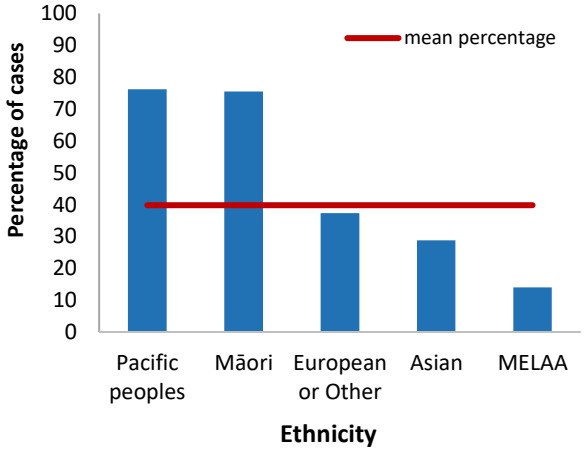


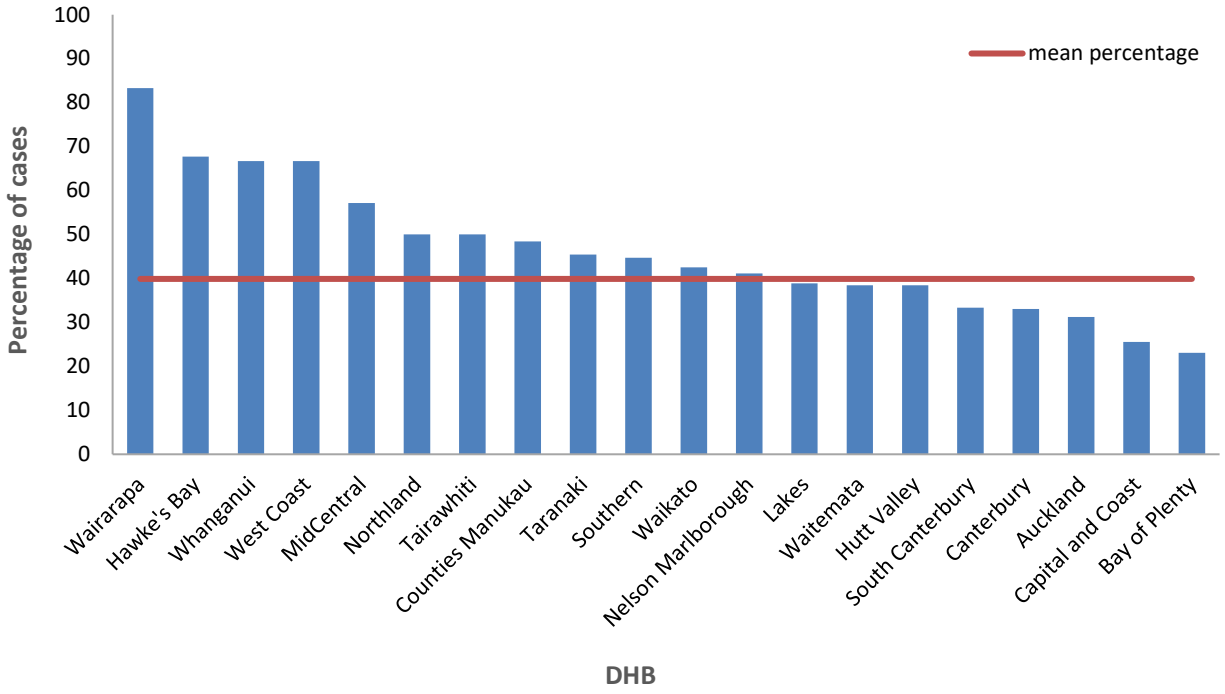
Figure 16. Percentage of new TB cases with non-unique molecular types by ethnicity, 2015–2019



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

Wairarapa (83.3%), Hawke's Bay (67.7%), Whanganui and West Coast (66.7% each) DHBs had the highest proportions of cases with non-unique molecular types. Whereas Bay of Plenty (23.1%) and Capital & Coast (25.6%) DHBs had the lowest proportions of cases with non-unique molecular types (Figure 17).

Figure 17. Percentage of new TB cases with non-unique molecular types by DHB, 2015–2019



Cases born in the Pacific Islands (70.7%) and New Zealand (70.4%) had a higher proportion of non-unique molecular types than the mean, whereas for other overseas-born cases the proportion was well below the mean (Figure 18).

A high proportion of cases with non-unique molecular types lived in NZDep2013 quintile 5 (more socioeconomically deprived) areas (48.9%) (Figure 19).

Figure 18. Percentage of new TB cases with non-unique molecular types by region of birth, 2015–2019

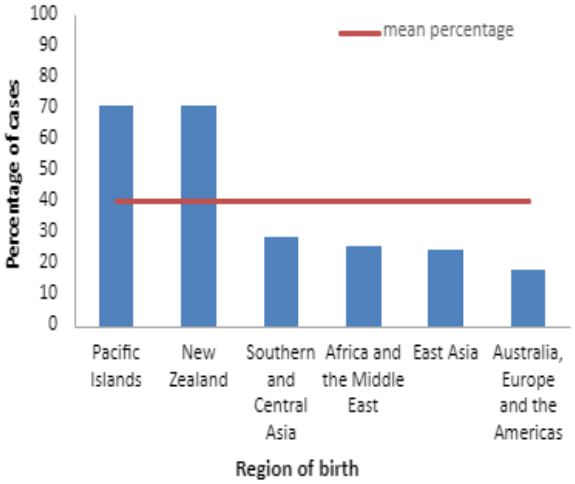
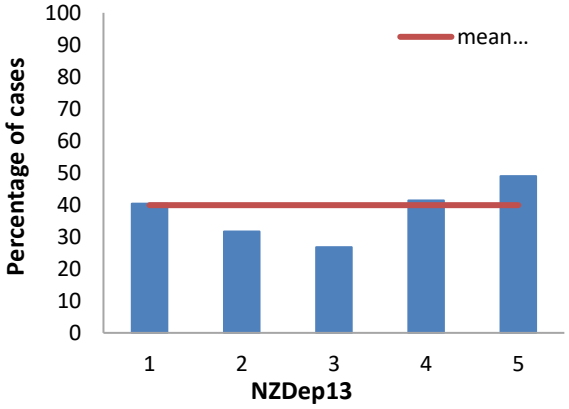
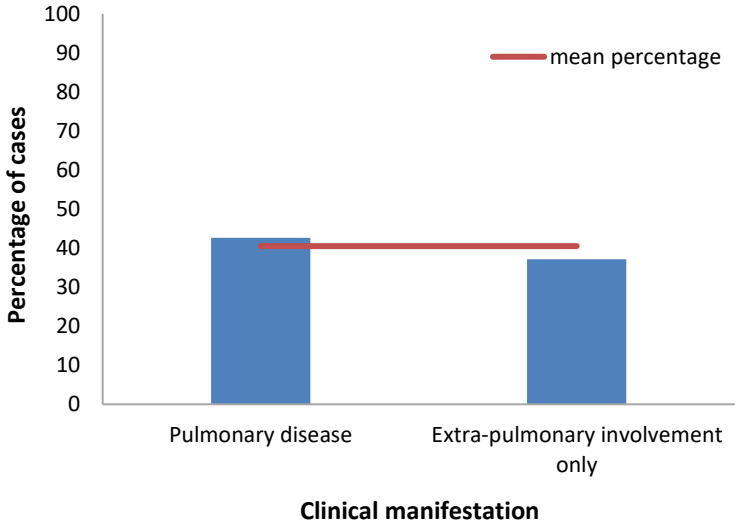


Figure 19. Percentage of new TB cases with non-unique molecular types by NZDep13, 2015–2019



New TB cases with pulmonary disease (41.2 %) had a similar proportion of non-unique molecular types to cases with extra-pulmonary involvement only (37.9%) (Figure 20).

Figure 20. Percentage of new TB cases with non-unique molecular types by clinical manifestation, 2015–2019



DISCUSSION

New Zealand continues to meet the World Health Organization (WHO) definition of a low TB incidence country (defined as a TB notification rate of ≤10 cases per 100,000 population a year). In 2019 the notification rate was 6.4 per 100,000 population. Since 2007, the notification rate has been stable, ranging from 6.2 (in 2013) to 7.0 (in 2011) per 100,000. The WHO's global TB strategy emphasises the need for low-incidence countries, like New Zealand, to progress towards elimination. A common pattern seen in low endemicity countries, however, is that the rate of decline slows once incidence falls below 10 per 100,000 [6].

CLINICAL PRESENTATION AND TREATMENT

Nearly all (96%) the TB cases notified in 2019 were "new disease", meaning there was no history of prior treatment. Information about previous diagnosis and treatment was recorded for 10/12 relapse/reactivation cases. For all 10 cases with information available, treatment periods for their previous illness were recorded as being between 3 and 9 months. All were born overseas. Five were diagnosed and treated in New Zealand for their first illness and only one receive DOT throughout treatment for their original illness. The low percentage of relapse/reactivation cases, particularly where the original illness was diagnosed and treated in New Zealand, reflects the low incidence of TB in New Zealand and suggests effective treatment and high treatment compliance.

Pulmonary disease was reported in 60% of new TB cases in 2019. One new TB case aged <5 years was reported in 2019. The case was born in New Zealand and had pulmonary disease.

For cases notified in 2018, 96% were reported to have completed treatment. There were 32 cases who did not complete treatment, the majority of which (15 cases) went overseas. Nine cases died before they were able to finish their treatment.

COUNTRY OF BIRTH

The majority of cases continue to occur in people born outside New Zealand and accounted for 82.0% of notifications of new TB cases in 2019. During the past five years, an average of 81.7% (range: 80–83%) of TB cases notified were born outside of New Zealand, an increase from earlier periods (61% for 1995–1999 and 68% for 2000–2004). The rate of TB among this population group was 12 times higher than the rate in those born in New Zealand. The most frequently reported countries of birth were India and the Philippines. This can be explained by the fact that both of these countries have high endemicity and there is a high proportion of people from these ethnic groups in New Zealand.

Māori continue to be disproportionately represented in TB new cases who are born in New Zealand. In 2019, approximately half of New Zealand-born cases occurred in Māori people. New Zealand-born cases were also more likely to be part of a cluster than cases who were born overseas.

DRUG SUSCEPTIBILITIES AND MDR-TB

Over the last 10 years from 2010 to 2019, there has been no overall change in the prevalence of pyrazinamide, isoniazid, rifampicin, ethambutol or streptomycin resistance.

There were seven MDR-TB cases in 2019, all from individuals born overseas. All 36 MDR-TB cases reported in New Zealand in the past 10 years were born overseas, the majority in Asian countries, and assumed to have acquired their resistant organisms overseas.

TRANSMISSION AND CONTROL

Recent transmission in low endemicity countries, such as New Zealand, can be assessed by using the rate of TB in children age <15 years born within the country as an indicator [7]. The 2019 rate of TB in New Zealand-born children aged <15 years was 0.3 per 100,000. As case numbers in New Zealand are low, the three-year moving annual average gives a better indication of trends in local transmission. The 2019 three-year moving annual average rate of TB in New Zealand-born children in the <15 years age group was 0.6 per 100,000, a decrease from 3.0 per 100,000 in 2008.

Between 2015 and 2019, 40% of strain-typed TB cases in New Zealand were part of a cluster and 91% of these clusters had fewer than five cases. A high proportion (80%) of children under 15 years were part of a TB cluster, as were Māori and Pacific cases (76% each)

These indicators suggest relatively low and likely decreasing transmission of TB infection within New Zealand, at least partly as a consequence of high-quality contact tracing and rigorous management of cases and contacts. However, it is also noteworthy that cases born in New Zealand and in the Pacific Islands are more likely to be part of a cluster compared with cases born in other overseas regions.

REFERENCES

1. WHO, *Global Tuberculosis Report 2018*. 2018, World Health Organization: Geneva.
2. WHO, *The End TB Strategy*. 2015, World Health Organization: Geneva.
3. Baker, M.G., et al., *Increasing incidence of serious infectious diseases and inequalities in New Zealand: a national epidemiological study.* The Lancet, 2012. **379**(9821): p. 1112-1119.
4. https://www.health.govt.nz/our-work/diseases-and-conditions/communicable-disease-control-manual/tuberculosis.
5. Atkinson J, Salmond C, and Crampton P, NZDep2013 Index of Deprivation. 2014, University of Otago: Wellington.
6. World Health Organization, *Tuberculosis surveillance and monitoring in Europe 2020: 2018 data.* 2020.
7. Public Health England, *Tuberculosis in England: 2018 report, presenting data to end of 2017. 2018*, Public Health England: London.

APPENDIX

Table 13. Numbers and rates of tuberculosis (new cases) notifications by age group, sex, ethnicity, district health board and year, 2015−2019

Category	2015		2016		2017		2018		2019	
	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]
Age group (years)										
<5	3	-	6	2.0	3	-	1	-	1	-
5−14	6	1.0	8	1.3	3	-	8	1.2	1	-
15−39	145	9.5	160	10.1	169	10.3	141	8.4	153	9.0
40−59	70	5.6	53	4.2	52	4.1	67	5.3	83	6.5
≥60	61	6.6	56	5.9	67	6.9	79	7.9	67	6.4
Sex										
Male	155	6.8	149	6.4	143	6.0	150	6.2	167	6.8
Female	130	5.6	134	5.6	151	6.2	146	5.9	138	5.5
Ethnic group										
Māori	22	3.1	24	3.3	24	3.2	24	2.9	25	3.5
Pacific peoples	57	19.2	35	11.5	35	11.3	39	11.8	46	13.7
Asian	181	33.5	177	32.0	205	36.3	198	26.6	195	25.8
MELAA	8	15.4	9	17.0	6	11.1	13	18.2	15	20.7
European or Other	16	0.5	34	1.1	23	0.7	17	0.6	19	0.6
Unknown	1	-	4	-	1	-	5	-	1	-
District health board										
Northland	2	-	2	-	3	-	3	-	6	3.2
Waitemata	38	6.6	34	5.8	35	5.8	51	8.3	37	5.9
Auckland	62	13.1	54	11.2	58	11.9	35	7.1	45	9.0
Counties Manukau	64	12.2	63	11.7	55	9.9	67	11.8	75	13.0
Waikato	23	5.9	21	5.2	28	6.8	18	4.3	29	6.8
Lakes	7	6.6	6	5.5	2	-	4	-	3	-
Bay of Plenty	6	2.7	10	4.3	9	3.7	14	5.6	7	2.7
Tairawhiti	1	-	1	-	1	-	0	-	4	-
Taranaki	2	-	3	-	4	-	3	-	4	-
Hawke's Bay	9	5.5	16	9.6	12	7.1	6	3.5	7	4.0
Whanganui	3	-	2	-	0	-	2	-	0	-
MidCentral	7	4.0	6	3.4	6	3.4	9	5.0	5	2.7
Hutt Valley	4	-	4	-	15	9.9	7	4.5	10	6.4
Capital & Coast	21	6.9	19	6.2	17	5.5	31	9.8	20	6.3
Wairarapa	0	-	2	-	4	-	2	-	0	-
Nelson	3	-	4	-	4	-	5	3.2	7	4.4
West Coast	1	-	1	-	0	-	0	-	2	-
Canterbury	26	4.9	26	4.8	33	6.0	27	4.8	27	4.7
South Canterbury	0	-	2	-	0	-	3	-	3	-
Southern	6	1.9	7	2.2	8	2.4	9	2.7	14	4.1
Total	**285**	**6.2**	**283**	**6.0**	**294**	**6.1**	**296**	**6.0**	**305**	**6.1**

[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 and 2018 census populations 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).

Table 14. Tuberculosis (new case) notifications for cases born in New Zealand by DHB and year, 2015–2019

District health board	2015	2016	2017	2018	2019	Total
Northland	2	0	1	1	2	**6**
Waitemata	2	2	3	5	3	**15**
Auckland	5	4	3	3	10	**25**
Counties Manukau	9	12	8	18	12	**59**
Waikato	7	7	9	3	8	**34**
Lakes	2	1	1	2	0	**6**
Bay of Plenty	0	1	3	4	2	**10**
Tairawhiti	1	1	1	0	0	**3**
Taranaki	1	2	1	0	0	**4**
Hawke's Bay	6	7	5	3	1	**22**
Whanganui	0	1	0	2	0	**3**
MidCentral	2	1	2	3	2	**10**
Hutt Valley	0	1	2	3	2	**8**
Capital & Coast	5	4	2	4	0	**15**
Wairarapa	0	2	1	1	0	**4**
Nelson Marlborough	1	1	0	0	4	**6**
West Coast	0	1	0	0	1	**2**
Canterbury	3	5	5	3	8	**24**
South Canterbury	0	0	0	0	0	**0**
Southern	2	5	2	2	0	**11**
Total	**48**	**58**	**49**	**57**	**55**	**267**

Table 15. Tuberculosis (new case) notifications with extra-pulmonary involvement by site of infection and year, 2015–2019

Site of infection	2015		2016		2017		2018		2019		Total (2015–2019)	
	Cases[b]	%	Cases[b]	%	Cases[b]	%	Cases[b]	%	Cases[b]	%	Cases[b]	%
Lymph node (excl. abdominal)	87	47.5	87	51.2	84	50.3	87	50.3	86	49.1	431	49.7
Pleural	34	18.6	25	14.7	33	19.8	22	12.7	33	18.9	147	16.9
Intra-abdominal (excl. renal)	17	9.3	16	9.4	20	12.0	21	12.1	18	10.3	92	10.6
Bone/joint	12	6.6	8	4.7	12	7.2	19	11.0	12	6.9	63	7.3
Renal/genitourinary tract	14	7.7	4	2.4	7	4.2	4	2.3	10	5.7	39	4.5
Soft tissue/skin	16	8.7	14	8.2	11	6.6	6	3.5	3	1.7	50	5.8
Miliary tuberculosis	10	5.5	5	2.9	6	3.6	8	4.6	8	4.6	37	4.3
Central nervous system TB (CNS TB)[C]	10	5.5	11	6.5	16	9.6	22	12.7	14	8.0	73	8.4
Other	14	7.7	16	9.4	6	3.6	4	2.3	5	2.9	45	5.2
Total[a]	**183**	**100**	**170**	**100**	**167**	**100**	**173**	**100**	**175**	**100**	**868**	**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.
[C] Includes meningitis.

Table 16. Numbers and percentages of non-unique and unique strains for tuberculosis (new case) notifications for selected variables, 2015−2019

Variable[a]	Non-unique		Unique	
	Cases	%[b]	Cases	%[b]
Age group (years)	**485**	**39.9**	**730**	**60.1**
<15 years	12	80.0	3	20.0
15 to 39 years	242	36.9	414	63.1
40 to 59 years	113	43.8	145	56.2
60+ years	118	41.3	168	58.7
Sex	**485**	**39.9**	**730**	**60.1**
Male	252	39.7	383	60.3
Female	233	40.2	347	59.8
Ethnic group	**480**	**39.8**	**726**	**60.2**
Māori	71	75.5	23	24.5
Pacific Peoples	141	76.2	44	23.8
Asian	231	28.8	570	71.2
MELAA	6	14.0	37	86.0
European or Other	31	37.3	52	62.7
District Health Board	**485**	**39.9**	**730**	**60.1**
Northland	7	50.0	7	50.0
Waitemata	65	38.5	104	61.5
Auckland	70	31.3	154	68.8
Counties Manukau	137	48.4	146	51.6
Waikato	40	42.6	54	57.4
Lakes	7	38.9	11	61.1
Bay of Plenty	9	23.1	30	76.9
Tairawhiti	2	50.0	2	50.0
Taranaki	5	45.5	6	54.5
Hawke's Bay	21	67.7	10	32.3
Whanganui	4	66.7	2	33.3
MidCentral	16	57.1	12	42.9
Hutt Valley	10	38.5	16	61.5
Capital & Coast	22	25.6	64	74.4
Wairarapa	5	83.3	1	16.7
Nelson Marlborough	7	41.2	10	58.8
West Coast	2	66.7	1	33.3
Canterbury	37	33.0	75	67.0
South Canterbury	2	33.3	4	66.7
Southern	17	44.7	21	55.3
Region of birth	**485**	**39.9**	**730**	**60.1**
New Zealand	143	70.4	60	29.6
Southern and Central Asia	189	28.5	473	71.5
East Asia	28	24.3	87	75.7
Pacific Islands	106	70.7	44	29.3
Africa and the Middle East	13	25.5	38	74.5
Australia, Europe and the Americas	6	17.6	28	82.4
NZ Deprivation Index (2013) quintile	**465**	**39.9**	**701**	**60.1**
1	46	40.4	68	59.6
2	56	31.6	121	68.4
3	50	26.7	137	73.3
4	130	41.4	184	58.6
5	183	48.9	191	51.1
Clinical manifestation	**485**	**39.9**	**730**	**60.1**
Pulmonary disease	307	41.2	438	58.8
Extra-pulmonary involvement only	178	37.9	292	62.1

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

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

ESR
Science for Communities
He Pūtaiao, He Tāngata

INSTITUTE OF ENVIRONMENTAL
SCIENCE AND RESEARCH LIMITED

Kenepuru Science Centre
34 Kenepuru Drive, Kenepuru, Porirua 5022
PO Box 50348, Porirua 5240
New Zealand
T: +64 4 914 0700 **F:** +64 4 914 0770

Mt Albert Science Centre
120 Mt Albert Road, Sandringham, Auckland 1025
Private Bag 92021, Auckland 1142
New Zealand
T: +64 9 815 3670 **F:** +64 9 849 6046

NCBID – Wallaceville
66 Ward Street, Wallaceville, Upper Hutt 5018
PO Box 40158, Upper Hutt 5140
New Zealand
T: +64 4 529 0600 **F:** +64 4 529 0601

Christchurch Science Centre
27 Creyke Road, Ilam, Christchurch 8041
PO Box 29181, Christchurch 8540
New Zealand
T: +64 3 351 6019 **F:** +64 3 351 0010

www.esr.cri.nz