Science for Communities
He Pūtaiao, He Tāngata

# TUBERCULOSIS IN NEW ZEALAND ANNUAL REPORT 2020


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## Disclaimer

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# 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 2020, 320 cases of tuberculosis disease (TB) were notified in New Zealand, of which 311 (97.2%) were new cases.
- The incidence rate for TB in 2020 was 6.3 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.
- The incidence of TB in 2020 in New Zealand was higher than the 2020 rates in other developed countries such as USA (2.2 per 100.000) [1] and Canada (4.7 per 100,000) [2], but lower than in Australia and UK (both 7.3 per 100,000) [3, 4].
- Geographically the highest notification rates for new TB cases in 2020 were reported from Counties Manukau (11.6 per 100,000), Hutt Valley (11.3 per 100,000) and Auckland (9.5 per 100,000) DHBs.
- Males had a notification higher rate for new TB cases in 2020 (6.4 per 100,000) than females (5.9 per 100,000).
- By age group, the highest notification rate for new TB cases in 2020 was in the 15–39 years age group (9.4 per 100,000).
- The highest ethnic-specific rates were reported in the Asian ethnic group (27.3 per 100,000), followed by Pacific peoples (11.1 per 100,000) and MELAA (9.5 per 100,000).

## Place of birth and trends by country of birth

- People born outside New Zealand accounted for 82.0% (255/311 cases) of new TB cases in 2020. The most common regions for overseas-born cases were Southern and Central Asia region (particularly India), and South-East Asia (particularly the Philippines).
- For people born outside New Zealand, 11.9% of new TB cases occurred in the first year after arrival in New Zealand and 41.1% occurred within five years.
- Over half of New Zealand-born new TB cases were Māori, and a fifth were Pacific peoples. Rates for New Zealand-born new TB cases were highest for Māori (3.7 per 100,000) and Pacific peoples (3.2 per 100,000).
- In 2020, the three-year moving average rate for new TB cases in New Zealand-born children aged <15 years (a proxy for recent transmission within the country) [5] was 0.7 per 100,000; the same rate as in 2019.

## Socioeconomic deprivation

- Around 55% 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 over twice the rate in the least deprived quintile.

## Diagnosis

- The majority (81.7%) of new TB cases present symptomatically to their health practitioner. A further 5.5% were identified through immigrant/refugee screening and 5.5% through contact follow-up.

## Receipt of treatment

- In 2020, 98.7% (307/311) of new TB cases received treatment. For cases with an onset date recorded, 19.3% started treatment within one month of the onset of symptoms and a further 36.3% started treatment between one and three months.
- For new TB cases with pulmonary disease and a known onset date, 21.2% started treatment within one month of the onset of symptoms and 43.3% of cases started treatment between one and three months after symptom onset. This treatment delay represents a risk to public health from disease transmission.
- In 2019, 97.0% (296/305) of new TB cases received appropriate treatment and 86.8% (257/296) completed treatment. Thirty-nine cases started but did not complete their treatment; the majority were transferred to overseas medical care (17 cases) or went overseas (7 cases). Eleven cases died before their treatment was completed. Nine cases did not receive any treatment.
- In 2019, a lower proportion of new TB cases born outside New Zealand received directly observed therapy during the intensive phase of their treatment (57.1%) than those born in New Zealand (72.5%).

## Outbreaks and molecular clusters

- Four TB outbreaks were reported in New Zealand in 2020, involving 22 cases.
- No new clusters were identified by molecular typing in 2020. Around one third (39.8%) 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 other ethnic groups. Cases born in the Pacific Islands and New Zealand were more likely to be part of a cluster than other overseas-born cases.

## Drug susceptibilities

- Four culture-positive TB cases reported in 2020 were multidrug-resistant TB (MDR-TB, defined as resistance to at least isoniazid and rifampicin). All four MDR-TB cases were born outside New Zealand.
- Resistance to isoniazid, rifampicin, ethambutol, pyrazinamide and streptomycin was higher among isolates from cases born outside New Zealand than for New Zealand-born cases, but only isoniazid ($p$ = 0.030) 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 [6].

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 [6, 7].

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 [8].

This report provides a description of the epidemiology of TB in New Zealand for 2020 and examines trends from 2011 to 2020 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 by the Ministry of Health's Communicable Disease Control Manual [9], 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:<br>• there are symptoms or signs compatible with active tuberculosis, such as compatible radiology or clinical evidence of current disease; and<br>• 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:<br>• positive culture for *Mycobacterium tuberculosis* complex<br>• positive microscopic examination for acid-fast bacilli when a culture has not been or cannot be obtained<br>• demonstration of *M. tuberculosis* complex nucleic acid directly from specimens<br>• 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 1956i. Only cases of active tuberculosis disease (referred to as TB) are presented in this report.

[i] 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.

## Drug susceptibility and resistance gene testing

First-line drug susceptibility testing (DST) is undertaken by the mycobacteriology laboratories at Auckland City Hospital (LabPlus), Waikato 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. Multidrug-resistant TB (MDR-TB) isolates (ie, isolates resistant to at least isoniazid and rifampicin) are tested at LabPlus 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

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 2020 and trends since 2011 or 2016, depending on the availability of data. In this report, treatment outcomes are presented for cases reported in 2019.

Notification data presented in this report is based on information recorded in EpiSurv as at 7 October, 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 all disease rates, except that used to determine disease rates for ethnic groups and country of birth, has been derived from the 2020 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 2016-2017) and 2018 applied to the corresponding mid-year population estimates.

The denominator used to determine rates in New Zealand-born children between 2011 and 2020 is based on the proportion of people born in New Zealand from the usually resident 2013 (for 2011–2014) and 2018 (for 2015–2020) census population 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 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

Socioeconomic deprivation is based on the 2013 New Zealand Index of Deprivation (NZDep2013) [10]. 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 [10]. 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 2016 to 2020 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 (≥99%) across the four years analysed (2016–2019).

Date of onset of illness had the lowest levels of completeness, ranging from 68% to 75%. 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, 2016–2020**

| Variable | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| **Basis of diagnosis** | | | | | |
| 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 | 99 | 100 | 98 | 100 | 99 |
| Geocoding accuracy[a] | 99 | 97 | 95 | 94 | 94 |
| **Clinical course and outcomes** | | | | | |
| Onset date | 73 | 68 | 70 | 75 | 73 |
| Hospitalisation status | 100 | 100 | 100 | 100 | 100 |
| Survival status | 99 | 99 | 99 | 99 | 100 |
| **Protective and risk factors** | | | | | |
| BCG vaccination[b] | 100 | 100 | 100 | 100 | 100 |
| Has immunosuppressive illness | 96 | 94 | 99 | 97 | 97 |
| On immunosuppressive medication | 98 | 96 | 97 | 95 | 97 |
| Contact with confirmed case of tuberculosis | 89 | 78 | 83 | 84 | 80 |
| Case born outside New Zealand | 100 | 100 | 100 | 100 | 100 |
| Date of arrival[c] | 89 | 85 | 84 | 84 | 85 |
| Current/recent residence with person born outside New Zealand | 92 | 94 | 95 | 95 | 88 |
| Exposure in a healthcare setting | 95 | 89 | 91 | 92 | 88 |
| Current/recent residence in an institution | 98 | 91 | 94 | 93 | 92 |
| **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 | 99 | 98 |
| Treatment outcome[e] | 100 | 100 | 100 | 100 | - |
| Use of directly observed therapy (DOT)[d, e] | 98 | 97 | 97 | 96 | - |

[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.

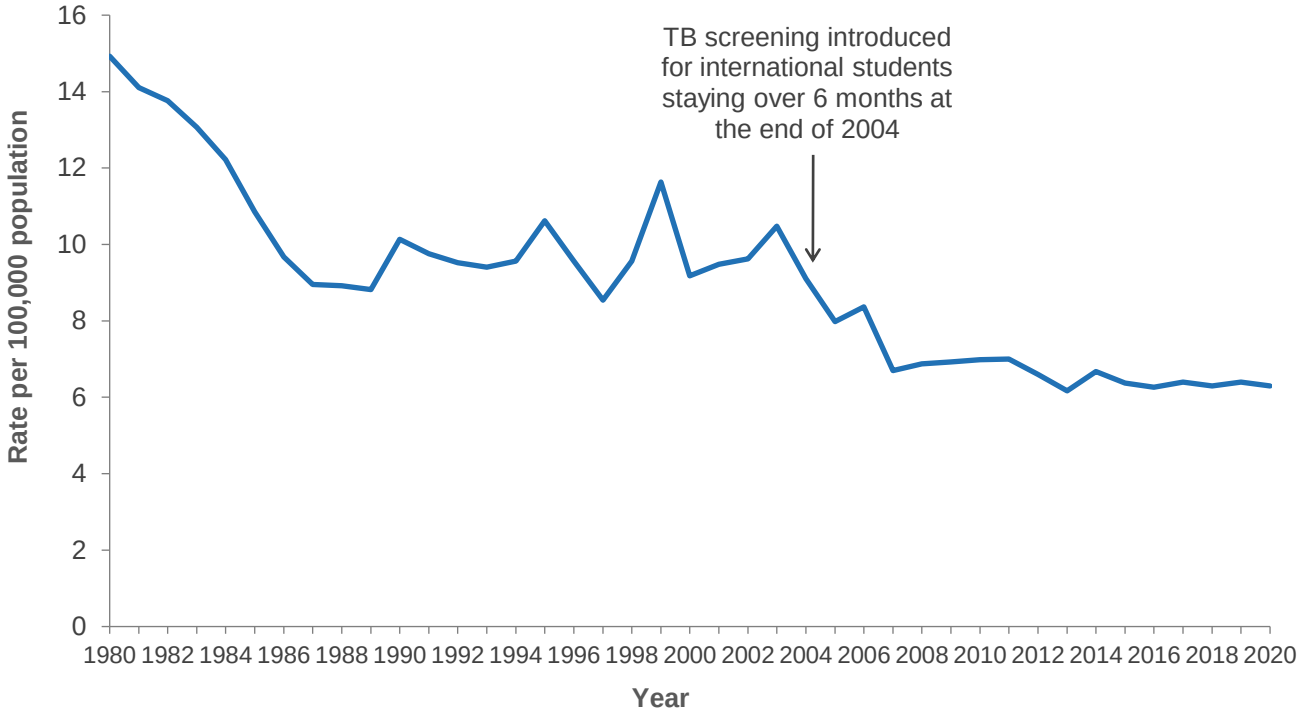
[e] Data is only reported for 2016−2019 due to length of time taken for TB treatment to be completed.

# NOTIFICATIONS

There were 320 cases of TB disease notified in 2020, of which 311 (97.2%) were new cases and nine were relapses or reactivations. The 2020 TB disease notification rate was 6.3 per 100,000 population, similar to the 2019 rate (6.4 per 100,000). The majority of TB cases (91.3%, 292/320) 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, 1980−2020**




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 311 new TB cases notified in 2020, giving a notification rate of 6.1 per 100,000 population. The rate was the same as in 2019 (305 new TB cases). Between 2016 and 2020, the notification rate was stable (between 6.0 and 6.1 per 100,000) (Table 13).

## Basis of discovery and diagnosis

Information on how the case was discovered was recorded for all 311 new TB cases. The majority of cases (81.7%, 254/311) were diagnosed when the case presented to a health practitioner with symptoms (Table 2).

Between 2016 and 2020, the proportion of cases discovered by each method ranged from 76.2 to 81.7% for symptomatic presenting to a health practitioner, 5.5−13.9 % for immigrant/refugee screening, 4.7−7.1% for contact follow-up, and 3.9−7.4% for other means of discovery.

**Table 2. Tuberculosis (new case) notification by basis of discovery, 2020**

| Basis of discovery | Cases | % |
|---|---|---|
| Symptomatic case presented to health practitioner | 254 | 81.7 |
| Immigrant/refugee screening | 17 | 5.5 |
| Contact follow-up | 17 | 5.5 |
| Other | 23 | 7.4 |
| **Total** | **311** | **100.0** |

In 2020, 91.0% (283/311) new TB cases were laboratory confirmed. Of the 283 laboratory-confirmed cases, 93.6% (265 cases) were confirmed by culture of *Mycobacterium tuberculosis*. No cases of *M. bovis* were identified. A further 18 cases were confirmed by the following methods: 10 cases by demonstration of *M. tuberculosis* complex nucleic acid directly from specimens, four cases by demonstration of acid-fast bacilli in a clinical specimen and four cases by histology strongly suggestive of TB. The remaining 28 new TB cases were classified as probable based on clinical grounds and treatment for presumptive TB, with six of these cases recorded as having radiology suggestive of pulmonary TB.

## Age and sex

Table 3 shows that notification rates for new TB cases were higher among adults than children aged <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 2020 for both males and females was in the 15–39 years age group.

**Table 3. Numbers and rates of tuberculosis notifications (new case) by age group and sex, 2020**

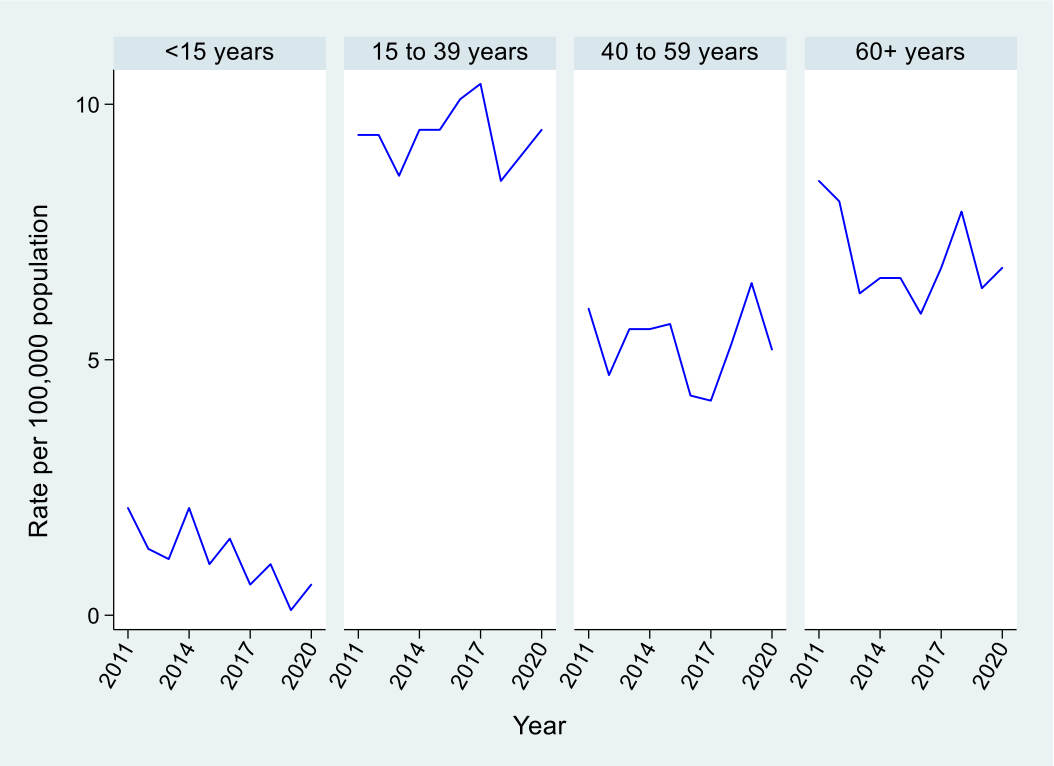
| Age group (years) | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | Cases | Rate[a] | Cases | Rate[a] | Cases | Rate[a] |
| <5 | 2 | - | 2 | - | 4 | - |
| 5–14 | 1 | - | 1 | - | 2 | - |
| 15–39 | 93 | 10.5 | 72 | 8.4 | 165 | 9.4 |
| 40–59 | 30 | 4.7 | 37 | 5.6 | 67 | 5.2 |
| ≥60 | 38 | 7.4 | 35 | 6.1 | 73 | 6.7 |
| Total | 164 | 6.5 | 147 | 5.7 | 311 | 6.1 |

[a] Rate per 100,000 based on 2018 mid-year population estimates; caution as rates shown for counts with less than five cases.

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

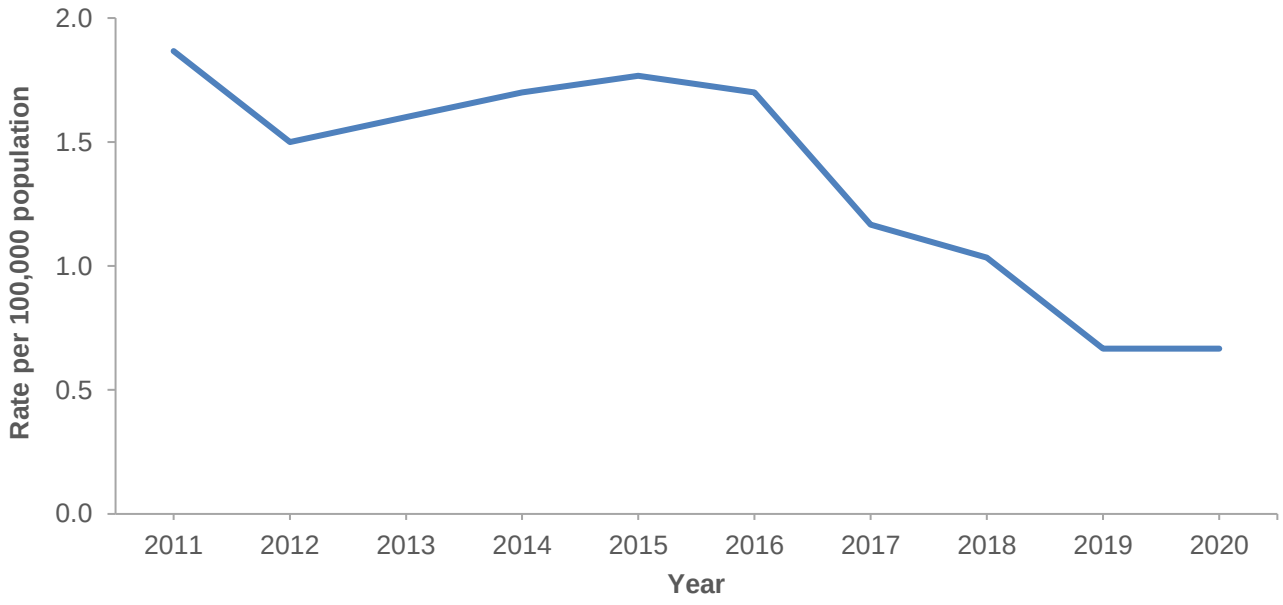
Over the past 10 years (2011–2020), the average annual notification rate was highest in the 15–39 years age group (9.4 per 100,000), followed by the ≥60 years (7.0 per 100,000), and 40–59 years (5.3 per 100,000) age groups (Figure 2).

**Figure 2. Tuberculosis (new case) notification rates by age group and year, 2011–2020**




In 2020, there were five new TB cases in New Zealand-born children aged <15 years, compared with two cases in 2019. Due to the low number of cases the trend is better assessed by a three-year moving average. The three-year moving average rate decreased from 1.9 per 100,000 in 2011 to 0.7 per 100,000 in both 2019 and 2020 (Figure 3).

**Figure 3. Three-year moving average rates of tuberculosis (new cases) in the New Zealand-born children (<15 years old), 2011–2020**



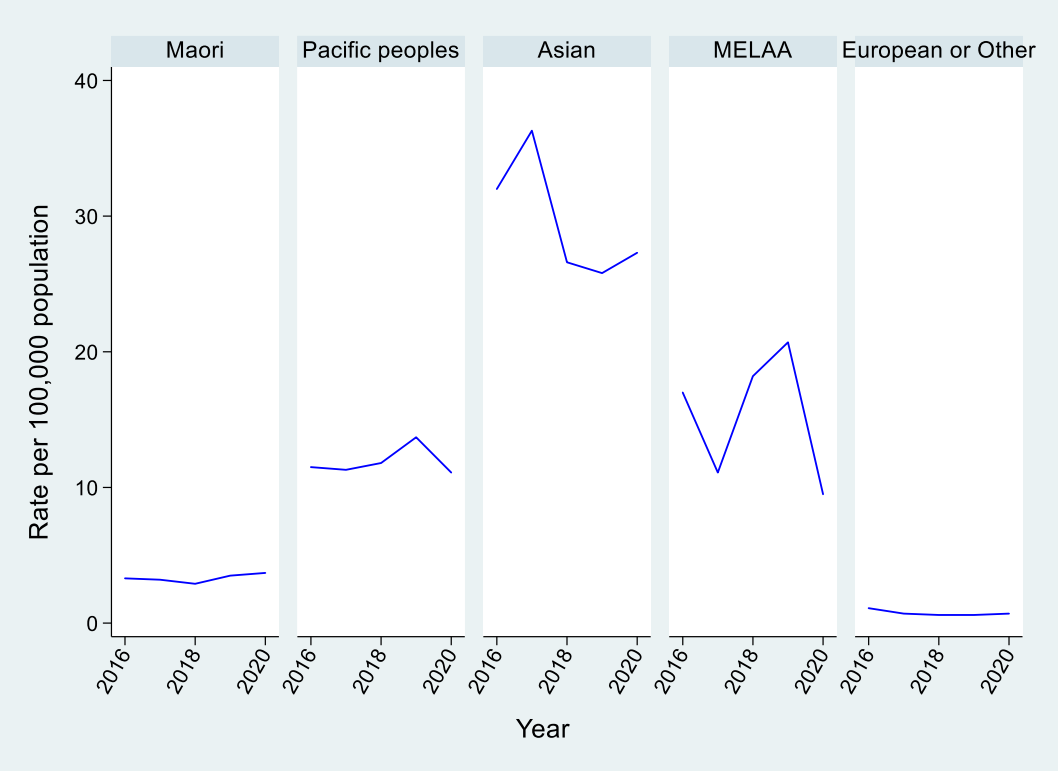
TB in children is an indicator of recent acquisition and a marker of ongoing transmission in the community. The low rates of new TB cases in those under 15 years suggest that transmission within New Zealand is infrequent.

## Ethnicity

Ethnicity was recorded for 99.4% (309/311) new TB cases notified in 2020. The Asian ethnic group had the highest notification rate (27.3 per 100,000), followed by Pacific peoples (11.1 per 100,000), and MELAA (9.5 per 100,000) (Table 13).

Between 2016 and 2020, the Asian and MELAA ethnic groups had the highest rates, apart from in 2020 when 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.

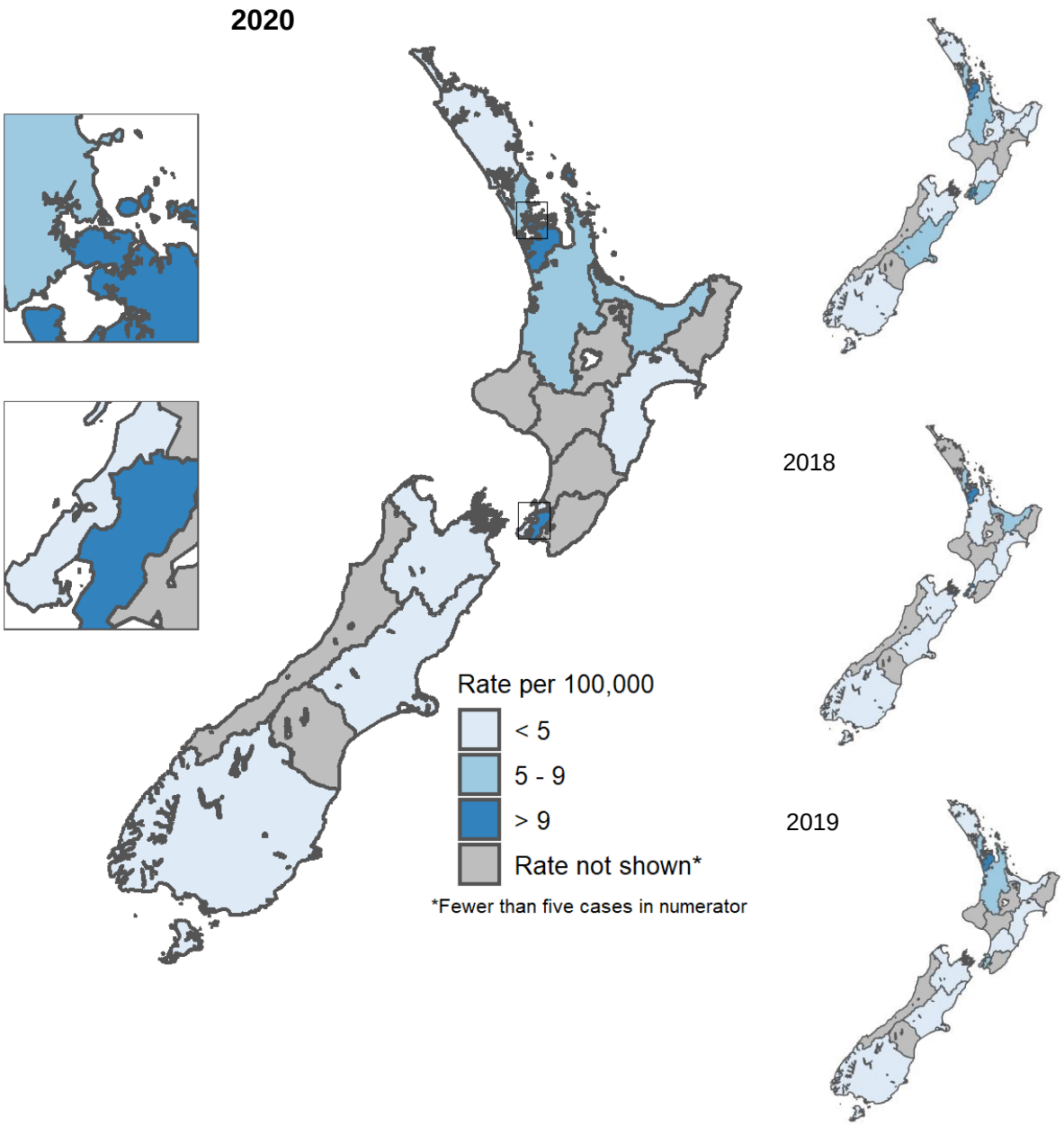
**Figure 4. Tuberculosis (new case) notification rates by ethnicity and year, 2016–2020**




## Geographical distribution

New TB case notification rates by district health board (DHB) for 2016 to 2020 are shown in Figure 5 and Table 13. The highest notification rates in 2020 were recorded for Counties Manukau (11.6 per 100,000, 69 cases), Hutt Valley (11.3 per 100,000, 18 cases) and Auckland (9.5 per 100,000, 48 cases) DHBs. Apart from 2017, Counties Manukau DHB consistently had the highest rate in 2016−2020.

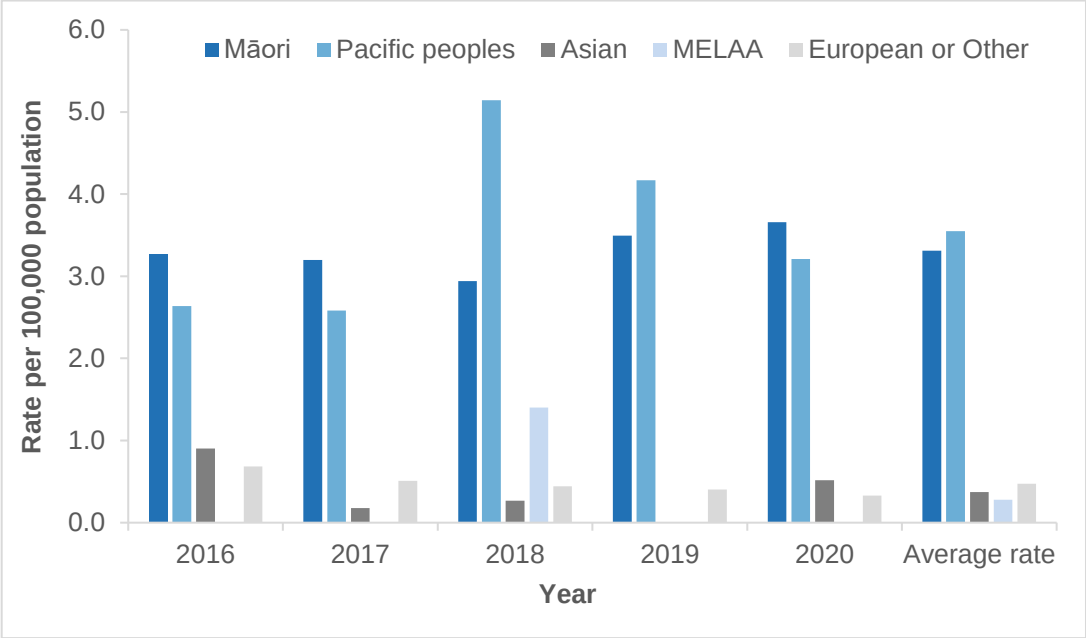
**Figure 5. Tuberculosis (new case) notification rates by district health board and year, 2017–2020**




## Born in New Zealand

There were 56 new TB cases in 2020 who were born in New Zealand, a rate of 1.5 per 100,000. Of these, 31 (55.4%) were Māori, 11 (19.6%) were Pacific peoples, 10 (17.9%) were European or Other and four (7.1%) were Asian. Incidence rates in 2020 for New Zealand-born new TB cases were highest for Māori and Pacific peoples (3.7 and 3.2 per 100,000 respectively). In contrast, the rate for European or Other was 0.3 per 100,000. Similarly, for 2016–2019, Pacific peoples (3.5 per 100,000) and Māori (3.3 per 100,000) had higher rates among New Zealand-born cases than other ethnic groups (Figure 6).

**Figure 6. Tuberculosis (new case) notification rates for New Zealand born cases by ethnicity, 2016–2020**




For those 2016–2020 cases born in New Zealand, the burden of disease was highest in Counties Manukau (59 cases) DHB followed by Waikato (36 cases), Canterbury (25 cases), Auckland (24 cases) and Waitemata (22 cases) (Table 14).

## Hospitalisations

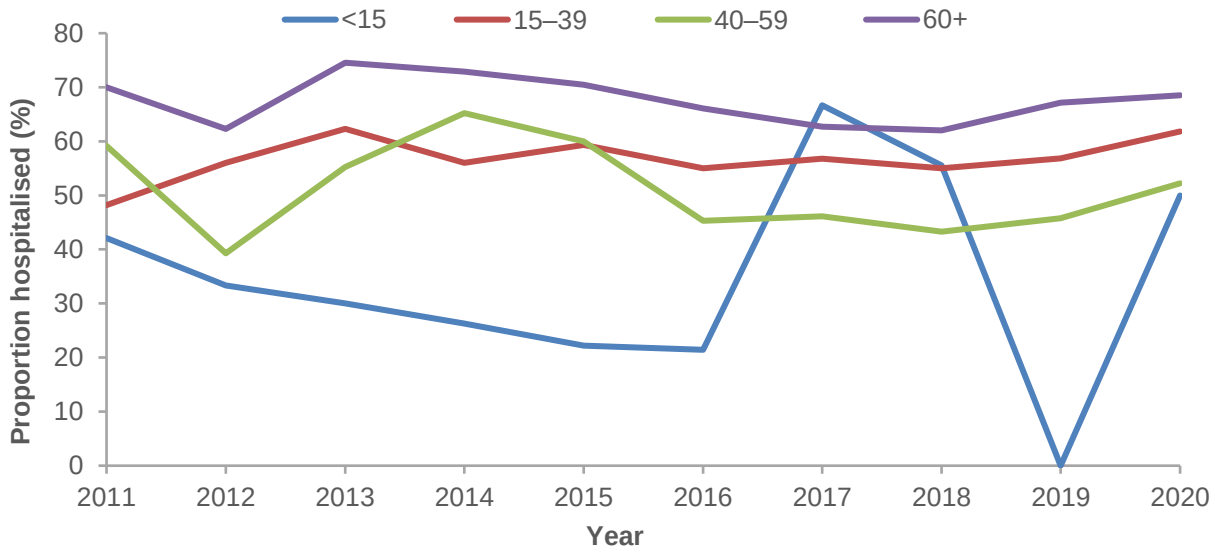
Hospitalisation status was provided for all the 311 new TB cases notified in 2020, and over half (61.1%, 190/311) were hospitalised. Among adults, hospitalisation rates were highest in those aged ≥60 years, with two-thirds (68.5%) hospitalised (Table 4).

**Table 4. Hospitalisations for tuberculosis (new case) by age group, 2020**

| Age group (years) | Hospitalised | | |
|---|---|---|---|
| | Yes | No | Percent (yes) |
| <5 | 1 | 3 | 25.0 |
| 5–14 | 2 | 0 | 100.0 |
| 15–39 | 102 | 63 | 61.8 |
| 40–59 | 35 | 32 | 52.2 |
| ≥60 | 50 | 23 | 68.5 |

The proportion of cases hospitalised over the past 10 years was 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 (0-8 hospitalisations annually) and, therefore, prone to fluctuations in the proportion.

**Figure 7. Hospitalisation rates for tuberculosis (new case) by age group and year, 2011–2020**




## Deaths

There were five deaths from TB among the 311 new TB cases notified in 2020. The deaths were all in adults aged ≥60 years.

Between 2010 and 2018, TB was recorded in the Ministry of Health's Mortality Collections dataset 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 2020, the most common risk factors reported for new TB cases were being born outside New Zealand (82.0%) and current/recent residence with a person born outside New Zealand (79.6%) (Table 5). This follows the same trend over the previous four years (Figure 8).

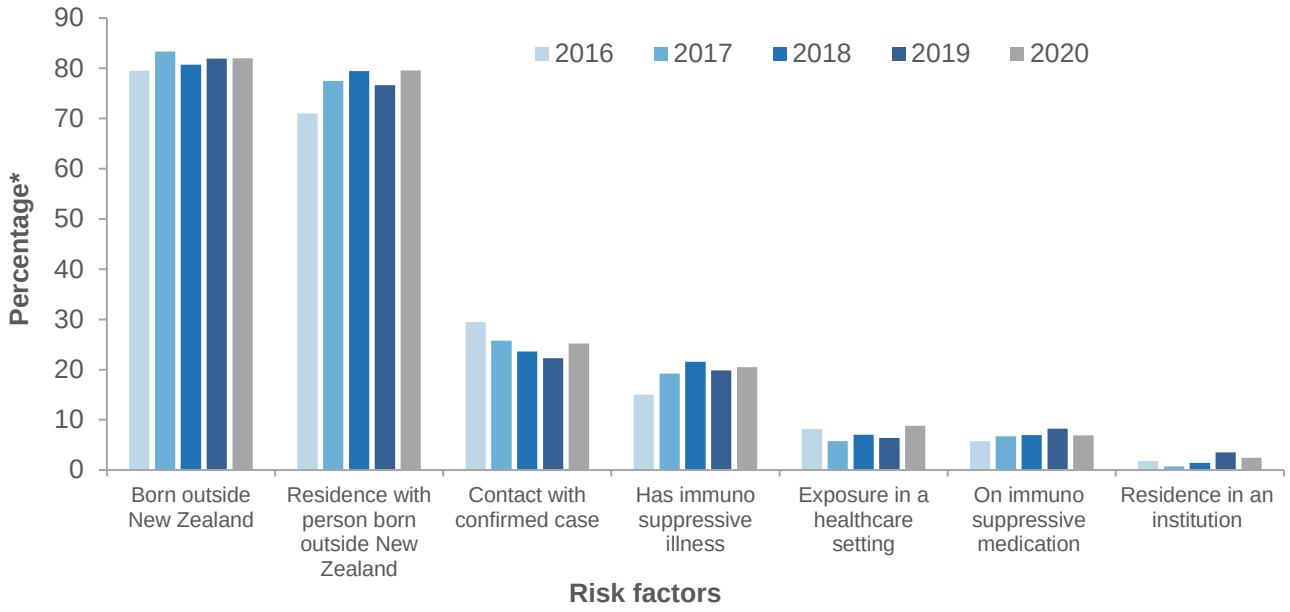
**Table 5. Risk factors reported for tuberculosis (new case) notifications, 2020**

| Risk factor | Cases[a] | Total[b] | % |
|---|---|---|---|
| Born outside New Zealand | 255 | 311 | 82.0 |
| Current/recent residence with person born outside New Zealand | 218 | 274 | 79.6 |
| Contact with confirmed case | 63 | 250 | 25.2 |
| Has immunosuppressive illness | 62 | 303 | 20.5 |
| Exposure in a healthcare setting | 24 | 273 | 8.8 |
| On immunosuppressive medication | 21 | 303 | 6.9 |
| Current/recent residence in an institution | 7 | 286 | 2.4 |

[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, 2016–2020**




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

### Born outside New Zealand

The majority (82.0 %, 255/311) of new TB cases were born outside New Zealand, giving a rate of 20.1 per 100,000. Cases born in the Southern and Central Asia region had the highest notification rate (141.4 per 100,000), followed by South-East Asia (68.4 per 100,000, 60 cases) (Table 6). The majority (92.6%, 113/122) 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 (71.7%, 43/60) and for cases born in North-East Asia it was China (77.3%, 17/22).

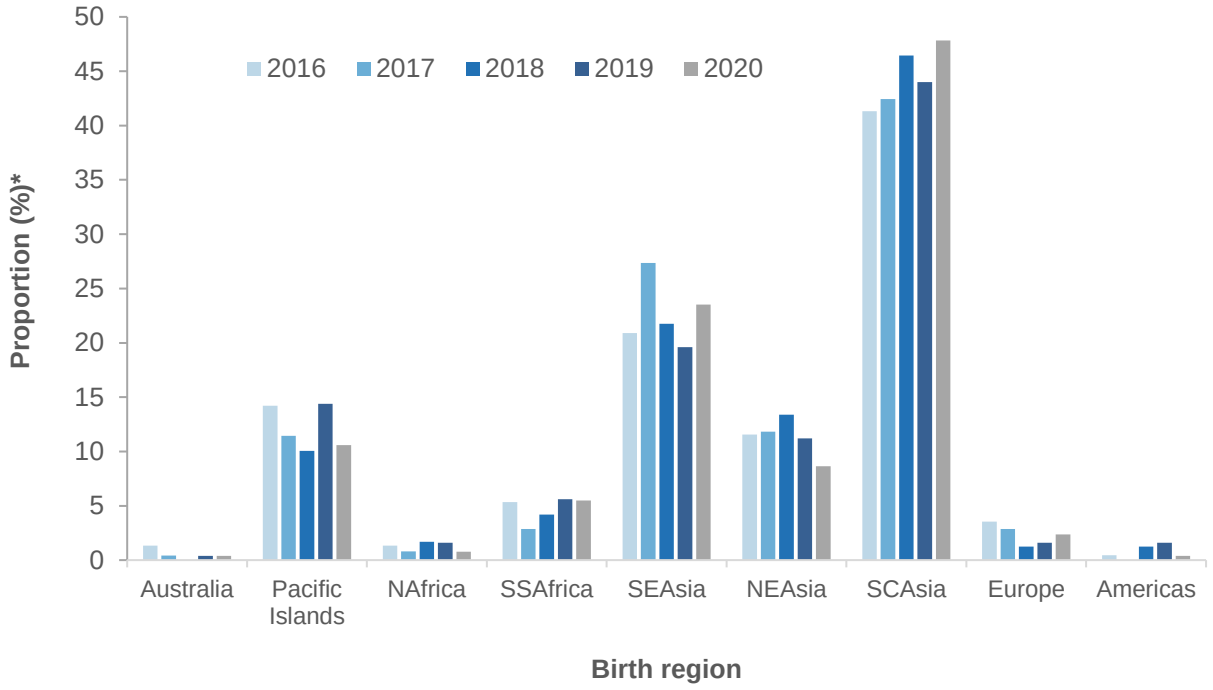
**Table 6. Tuberculosis notifications (new case) by region of birth, 2020**

| Region of birth | Cases | Rate[a] |
|---|---|---|
| **Born in New Zealand** | **56** | **1.9** |
| **Born outside New Zealand** | **255** | **20.1** |
| Southern and Central Asia | 122 | 141.4 |
| South-East Asia | 60 | 68.4 |
| Pacific Islands | 27 | 17.8 |
| North-East Asia | 22 | 15.4 |
| Sub-Saharan Africa | 14 | 19.4 |
| Europe | 6 | 1.0 |
| North Africa and the Middle East | 2 | - |
| Australia | 1 | - |
| The Americas | 1 | - |
| **Total** | **311** | **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 outside New Zealand varied by region between 2016 and 2020 (Figure 9). There was an overall increasing trend in the proportion of new TB cases born in Southern and Central Asia and a decrease in the proportion born in North East Asia.

**Figure 9. Percentage of tuberculosis (new case) notifications born outside New Zealand by birth region and year, 2016–2020**




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

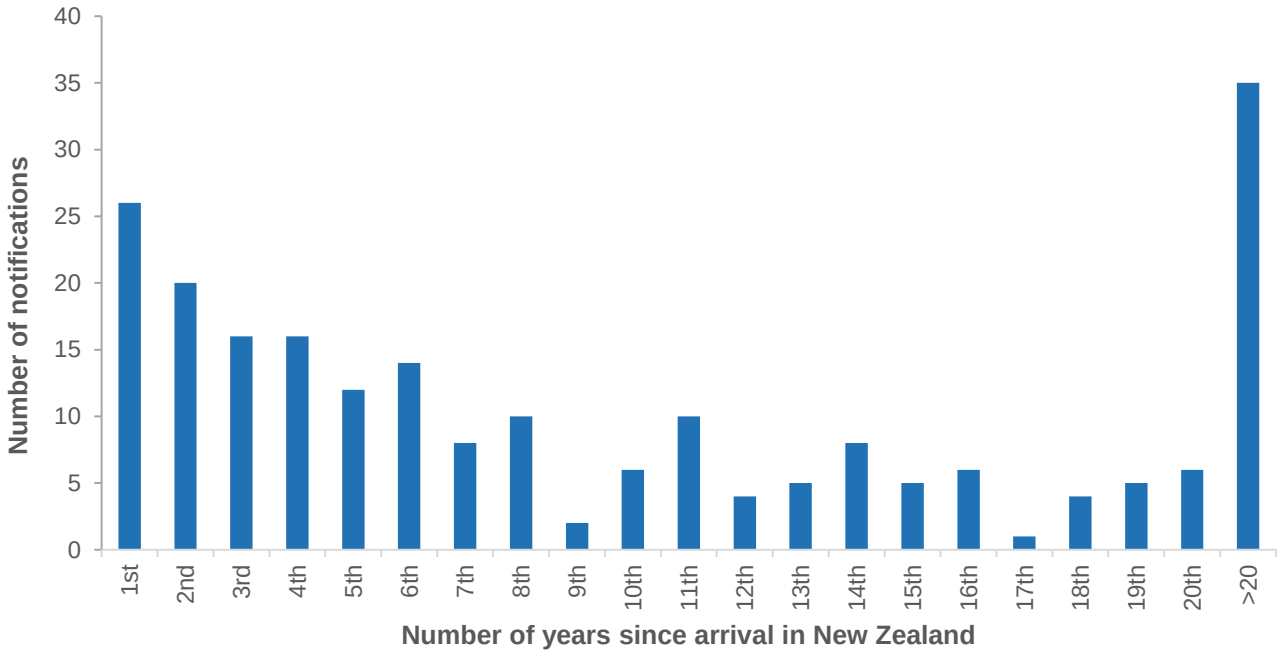
* Number of cases born in a region divided by the total number of cases born outside New Zealand, and for which the country of birth is known.

### Time to notification from arrival in New Zealand

The date of arrival in New Zealand was recorded for 86.9% (219/255) of the new TB cases in 2020 who were born outside New Zealand. Twenty-six (11.9%) cases born outside New Zealand were notified with TB in the first year after arrival in New Zealand and 90 cases (41.1%) were notified within the first five years after arrival (Figure 10).The median time between the date of arrival in New Zealand and TB notification was six years (range 0–60 years, mean 10.0 years).

Between 2016 and 2020, the annual median time between arrival in New Zealand and the date of TB notification was between four and six years. The annual mean ranged between 7.7 and 10.5 years.

**Figure 10. Tuberculosis (new case) notifications born outside New Zealand by time since arrival in New Zealand, 2020**



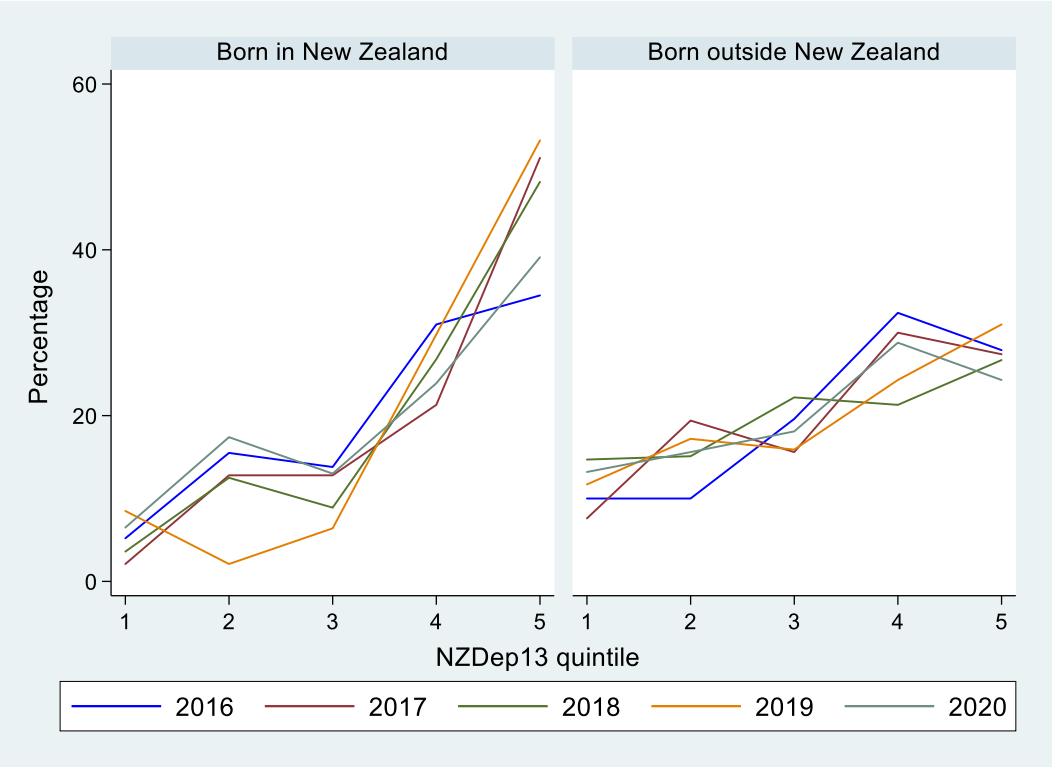

Note: The date of arrival was not recorded for 37 cases. Number of years: 1st: < 1 year after arrival, 2nd: 1–< 2 years after arrival, 3rd: 2–< 3 years after arrival etc.

### Socioeconomic deprivation

In 2020, 92.9% (289/311) of new TB cases were assigned a New Zealand Index of Deprivation 2013 (NZDep2013) score. Over half of the cases (54.7%, 158/289) lived in the most deprived areas (NZDep2013 quintile 4 or 5). The rate for new TB cases in the most deprived NZDep2013 quintile was over twice the rate in the least deprived quintile (9.2 compared with 4.0 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, 2016–2020**




## Site of infection

In 2020, 154 (49.5%) new TB cases had pulmonary (including laryngeal) disease. Of these, 109 had pulmonary disease only and 45 had both pulmonary and extra-pulmonary involvement. A further 157 (50.5%) cases had only extra-pulmonary involvement and were therefore unlikely to be infectious.

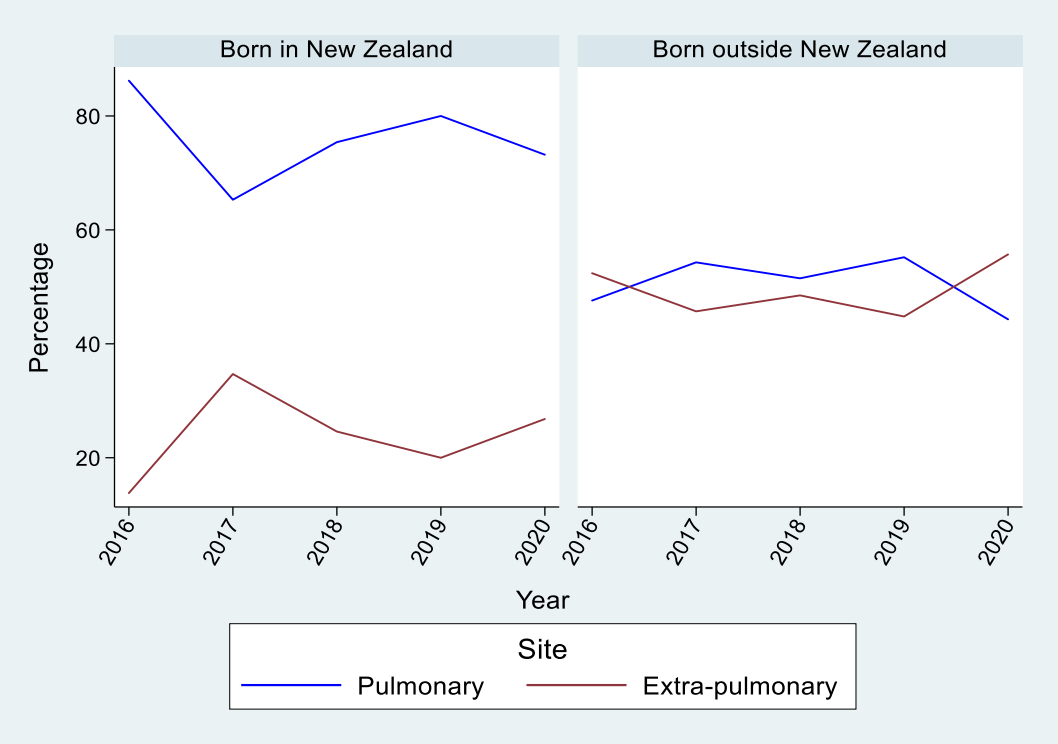
From 2016 to 2020, cases born in New Zealand were more likely to have pulmonary disease (76.4%) than extra-pulmonary disease only (23.6%). In comparison, new TB cases born outside New Zealand had similar proportions of pulmonary disease (50.6%) and extra-pulmonary disease (49.4%) (Figure 12).

Of the 154 new TB cases in 2020 with pulmonary disease, 148 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, 90 (60.8%) were smear positive, with sputum reported as the specimen site for 82.2% (74/90) of these cases.

Of the 202 cases with extra-pulmonary involvement, 95 (47.0%) had lymph node (excluding abdominal) recorded as a site of infection (Table 15). Twenty-three cases of central nervous system (CNS) TB were reported in 2020 (none in children aged <15 years). Twelve cases of miliary TB were reported (none aged <15 years), of which six had an underlying immunosuppressive illness.

Between 2016 and 2020, the most common site of infection recorded for cases with extra-pulmonary involvement was lymph node (excluding abdominal) (49.5%), followed by pleural (16.8%) and intra-abdominal (excluding renal) (11.4%) (Table 15). There were 87 cases of CNS TB. The number of cases of reported with CNS as a site of infection increased from 11 in 2016 to 23 in 2020. A total of 40 cases of miliary TB were recorded between 2016 and 2020. No cases were aged <5 years.

**Figure 12. Tuberculosis (new case) notifications by site of infection, birthplace category and year, 2016−2020**




## Immunosuppressive illness and HIV status

In 2020, 62 new TB cases were reported to have an immunosuppressive illness. Of these, 12 cases were on immunosuppressive medication. Information on the illness was provided for 60 cases, with 34 (56.7%) reported as having diabetes.

Information on whether an HIV test was done was available for all 311 new TB cases. Of these, 93.2% (290 cases) were tested for HIV. Two cases were co-infected with HIV in 2020.

## Receipt of treatment

In 2020, 98.7% (307/311) of new TB cases received treatment. Onset dates were reported for 223 (72.6%) cases who received treatment, thereby allowing calculation of the time between the onset of symptoms and start of treatment. Of these, 19.3% (43/223) started treatment within one month of the onset of symptoms and a further 36.3% (81/223) started treatment between one and three months. The median interval to the start of treatment was 72 days from the onset of symptoms.

A treatment delay for patients with pulmonary TB represents a risk to public health from disease transmission. In 2020, 98.1% (151/154) of new TB cases with pulmonary disease were reported to have received treatment. The date of onset of symptoms was available for 104 (68.9%) new TB cases with pulmonary disease who had received treatment. Of these, 21.2% (22/104) started treatment within one month of the onset of symptoms and a further 43.3% (45/104) started treatment between one and three months. The median interval to the start of treatment for patients with pulmonary TB was 59.5 days from the onset of symptoms. Between 2016 and 2019, the median interval to the start of treatment ranged from 59 days in 2019 to 76 days in 2016.

## Treatment outcomes for cases notified in 2019

Due to the length of time taken for TB treatment to be completed, data presented in this section is for the 305 new TB cases notified in 2019. The majority of these, 97.0% (296/305), were reported to have received treatment for TB (Table 7) and most cases, 86.8% (257/296), completed treatment to the satisfaction of the prescribing doctor. Receipt of directly observed therapy (DOT) was recorded for 98.8% (254/257) new TB cases, of which 60.2% (153/254) received DOT during the intensive phase of their treatment. A lower proportion of cases born outside New Zealand were reported to have received intensive phase DOT (57.1%) than those born in New Zealand (72.5%). However, those born outside New Zealand accounted for 79.9% of the overall usage of intensive phase DOT. For new TB cases with pulmonary disease, 68.0% of cases born outside New Zealand received intensive phase DOT, compared with 78.0% for cases born in New Zealand.

**Table 7: Treatment outcomes for tuberculosis (new cases) notified in 2019**

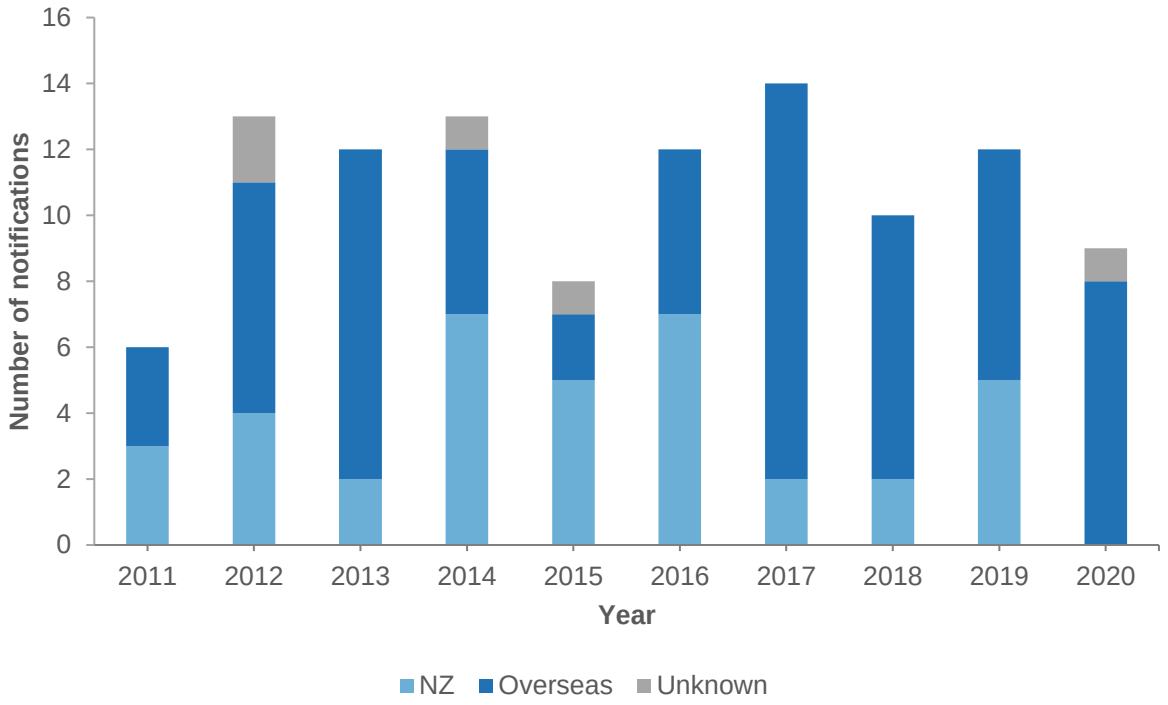
| Treatment outcomes for new TB cases | Cases | % |
|---|---|---|
| **Received treatment** | **296** | **97.0** |
| Treatment completed to satisfaction of doctor | 257 | 86.8 |
| **Treatment ended earlier than planned** | **39** | **13.2** |
| Case transferred to overseas medical care | 17 | 5.7 |
| Case died | 11 | 3.7 |
| Case went overseas (medical care not transferred or unknown) | 7 | 2.4 |
| Case refused to complete treatment | 2 | 0.7 |
| Treatment was stopped because of adverse effects | 1 | 0.3 |
| Case was lost to follow up | 1 | 0.3 |

Nine cases were reported as having received no treatment: six cases went overseas, two cases died before treatment was initiated and/or the diagnosis was post-mortem, and one case declined treatment.

## TUBERCULOSIS DISEASE – RELAPSES OR REACTIVATIONS

Nine TB relapse/reactivation cases were notified in 2020. 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 (2011–2020) ranging from 6 to 14 cases a year (Figure 13).

**Figure 13. Tuberculosis (relapse/reactivation) notifications by place of original diagnosis, 2011−2020**




In 2020, TB relapse/reactivation cases were reported from the following five DHBs: Waitemata and Auckland (3 cases each), Counties Manukau, Capital and Coast, and South Canterbury (1 case each). The cases were aged 70+ years (5 cases), 60–69 years (2 cases), 40–49 and 50–59 years (1 case each). Seven relapse/reactivation cases were of Asian ethnicity, one was European or Other and one was MELAA. Four of the relapse/reactivation cases were hospitalised and no deaths were reported.

Eight relapse/reactivation cases could be assigned a NZDep2013 score. Three cases (37.5%) lived in the most deprived areas (NZDep2013 quintiles 4 and 5).

All nine relapse/reactivation cases were born outside New Zealand. Information on the place of original diagnosis was reported for eight cases and all were previously diagnosed overseas. Details of previous treatment was recorded for six of these eight cases. All six had previous pulmonary disease and were treated for three months (1 case), six months (3 cases), and nine months (2 cases).

## OUTBREAKS

Four TB outbreaks were reported in 2020 involving 22 cases. The outbreaks were reported from Waitemata (14 cases), Counties Manukau (4 cases), Auckland (2 cases) and Nelson Marlborough (2 cases). All four outbreaks were in family or close social settings.

# 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 2020, 265 new TB cases and eight relapse/reactivation cases were culture positive. All 273 isolates were identified as belonging to the *M. tuberculosis* complex. None were identified as *M. bovis.* Of the new TB cases with pulmonary disease, 94.7% (144/152) were culture positive.

Fewer than five cases of culture-positive TB due to *M. bovis* were reported each year between 2016 and 2020.

## DRUG SUSCEPTIBILITY

Antimicrobial susceptibility data was available for the isolates from 272 culture-positive TB cases in 2020. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 8.

**Table 8: Antimicrobial resistance of *M. tuberculosis* complex isolates, 2020**

| Antimicrobial | No. resistant[a] | Percent |
|---|---|---|
| Isoniazid (0.1 mg/L) | 19 | 7.0 |
| Isoniazid (0.4 mg/L)[b] | 15 | 5.5 |
| Rifampicin | 6 | 2.2 |
| Ethambutol[c] | 1 | 0.4 |
| Pyrazinamide | 1 | 1.4 |
| Streptomycin[c] | 14 | 5.2 |

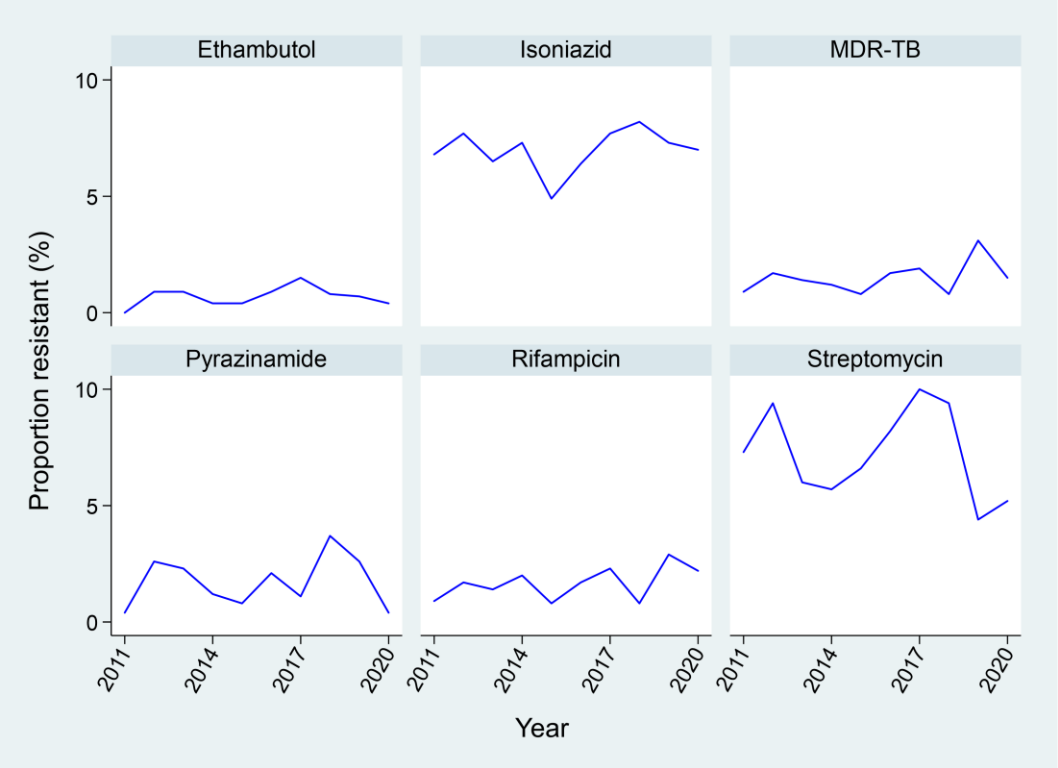
[a] Includes resistance alone or in combination with other antimicrobials.

[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] One isolate has data missing for ethambutol and streptomycin, as it failed to grow for phenotypic testing.

From 2011 to 2020, 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, 2011−2020**




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

In 2020, 88.6% (241/272) of isolates were fully susceptible to all five routinely tested antimicrobials. There were four (1.5%) cases of multidrug-resistant tuberculosis (MDR-TB, defined as resistance to at least isoniazid and rifampicin) (Table 9). Three MDR-TB isolates were from new TB cases.

**Table 9. Antimicrobial resistance patterns for tuberculosis isolates, 2020**

| | Resistance pattern[a] | Number | Percent |
|---|---|---|---|
| **Fully susceptible** | | **241** | **88.6** |
| **Resistant to 1 agent** | | **25** | **9.2** |
| | H | 13 | 4.8 |
| | S | 9 | 3.3 |
| | R | 2 | 0.7 |
| | E | 1 | 0.4 |
| **Resistant to 2 agents** | | **3** | **1.1** |
| | HS | 2 | 0.7 |
| | HR[b] | 1 | 0.4 |
| **Resistant to 3 agents** | | **2** | **0.7** |
| | HRS[b] | 2 | 0.7 |
| **Resistant to 4 agents** | | **1** | **0.4** |
| | HRZS[b] | 1 | 0.4 |

[a] H, isoniazid resistance at the standard concentration of 0.1 mg/L; R, rifampicin; E, ethambutol; Z, pyrazinamide; S, streptomycin.
[b] MDR-TB, multidrug-resistant tuberculosis – resistant to at least isoniazid and rifampicin.

During the last 10 years there have been 36 cases of MDR-TB, giving an average annual proportion of 1.5% 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).

### Country of birth

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

**Table 10. Antimicrobial resistance of tuberculosis isolates by birthplace category, 2020**

| | Born in New Zealand ($n$ = 48) | | Born outside New Zealand ($n$ = 224) | | $p$-value[a] |
|---|---|---|---|---|---|
| | No. | % | No. | % | |
| **Fully susceptible** | | | | | |
| | 48 | 100.0 | 193 | 86.2 | 0.002 |
| **Resistant to:**[b] | | | | | |
| Isoniazid[c] | 0 | - | 19 | 8.5 | 0.030 |
| Rifampicin | 0 | - | 6 | 2.7 | 0.595 |
| Ethambutol[d] | 0 | - | 1 | 0.5 | 1.000 |
| Pyrazinamide | 0 | - | 1 | 0.5 | 1.000 |
| Streptomycin[d] | 0 | - | 14 | 6.3 | 0.141 |
| **MDR-TB**[e] | | | | | |
| | 0 | - | 4 | 1.8 | 1.000 |

[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.
[e] For ethambutol and streptomycin, the number of cases born outside New Zealand was 223.
[d] Multidrug-resistant tuberculosis – resistant to at least isoniazid and rifampicin.

All MDR-TB cases identified in 2020 were born outside New Zealand. All 36 MDR-TB cases that have occurred in the last 10 years were born outside New Zealand and assumed to have acquired MDR-TB overseas. The majority (86.1%, 31 cases) were born in Asia.

### Ethnicity

Resistance was most frequent among isolates from cases of Asian ethnicity (Table 11). All four MDR-TB cases were of Asian ethnicity.

**Table 11. Antimicrobial resistance of tuberculosis isolates by ethnicity, 2020**

| | Māori (*n* = 28) | | Pacific peoples (*n* = 34) | | Asian (*n* = 186) | | MELAA[a] (*n* = 7) | | European or Other (*n* = 17) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Fully susceptible** | | | | | | | | | | |
| | 28 | 100.0 | 32 | 94.1 | 157 | 84.4 | 7 | 100.0 | 17 | 100.0 |
| **Resistant to:**[b] | | | | | | | | | | |
| Isoniazid[c] | 0 | - | 0 | - | 19 | 10.2 | 0 | - | 0 | - |
| Rifampicin | 0 | - | 0 | - | 6 | 3.2 | 0 | - | 0 | - |
| Ethambutol[d] | 0 | - | 0 | - | 1 | 0.5 | 0 | - | 0 | - |
| Pyrazinamide | 0 | - | 0 | - | 1 | 0.5 | 0 | - | 0 | - |
| Streptomycin[d] | 0 | - | 2 | 5.9 | 12 | 6.5 | 0 | - | 0 | - |
| **MDR-TB**[e] | | | | | | | | | | |
| | 0 | - | 0 | - | 4 | 2.2 | 0 | 0.0 | 0 | - |

[a] Middle Eastern/Latin American/African.
[b] Includes resistance alone or in combination with other antimicrobials.
[c] Isoniazid resistance at the standard concentration of 0.1 mg/L.
[d] For ethambutol and streptomycin, the number of cases of Asian ethnicity was 185.
[e] Multidrug-resistant tuberculosis – resistant to at least isoniazid and rifampicin.

### Relapse/reactivation cases

There were eight culture-positive TB relapse/reactivation cases in 2020. Because the annual number of TB relapse/reactivation cases is small, the following analysis of drug resistance among relapse/reactivation cases is for the five years from 2016 to 2020. During this period, 3.4% (44/1284) of the culture-positive cases for which susceptibility data was available were relapse/reactivation cases. Information about previous treatment was recorded for 30/44 relapse/reactivation cases and all had received previous anti-tuberculosis drug treatment.

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

## Table 12. Antimicrobial resistance of tuberculosis cases (new TB cases and relapse/reactivation cases), 2016–2020

| | New cases (*n* = 1240) | Relapse/reactivation cases | | | |
|---|---|---|---|---|---|
| | | All (*n* = 44) | | Previously treated[a] (*n* = 30) | |
| | % | % | *p*-value[b] | % | *p*-value[b] |
| **Fully susceptible** | | | | | |
| | 86.8 | 77.3 | 0.075 | 80.0 | 0.277 |
| **Resistant to:**[c] | | | | | |
| Isoniazid[d] | 7.0 | 18.2 | 0.012 | 16.7 | 0.058 |
| Rifampicin | 1.9 | 6.8 | 0.056 | 3.3 | 0.440 |
| Ethambutol | 0.8 | 2.3 | 0.320 | 0.0 | 1.000 |
| Pyrazinamide | 1.9 | 2.3 | 0.585 | 0.0 | 1.000 |
| Streptomycin | 7.2 | 11.4 | 0.249 | 10.0 | 0.474 |
| **MDR-TB**[e] | | | | | |
| | 1.6 | 4.6 | 0.172 | 3.3 | 0.397 |

[a] Information on previous treatment was reported for only 30 of the 44 relapse/reactivation cases, 30 of whom were recorded as being treated.

[b] Rate compared with new TB 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 – resistant to at least isoniazid and rifampicin.

# MOLECULAR TYPING

TB molecular typing results were available for 99.6% (264/265) of culture-positive new TB cases in 2020. A total of 105 (39.8%) new TB cases had non-unique molecular types and were in 65 separate molecular clusters. No new clusters were identified in 2020.

In the last five years, 1,242 new TB cases had molecular typing results, of which 489 (39.4%) had non-unique molecular types and were in 203 separate molecular clusters. The median cluster size was one case (range 1–35)[ii] and the majority of clusters (90.6%, 184/203) had less than five cases. The remaining 19 clusters were distributed in the following cluster sizes: 5−9 cases (11), 10−19 cases (6) 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 2016 and 2020 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 2016–2020 by age group, sex, ethnic group, DHB, region of birth, NZDep2013 quintiles and clinical manifestation.

In 2016–2020, 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 (75.3%) and Māori (73.6%) were part of a cluster (Figure 16).

**Figure 15. Percentage of new TB cases with non-unique molecular types by age group and sex, 2016–2020**

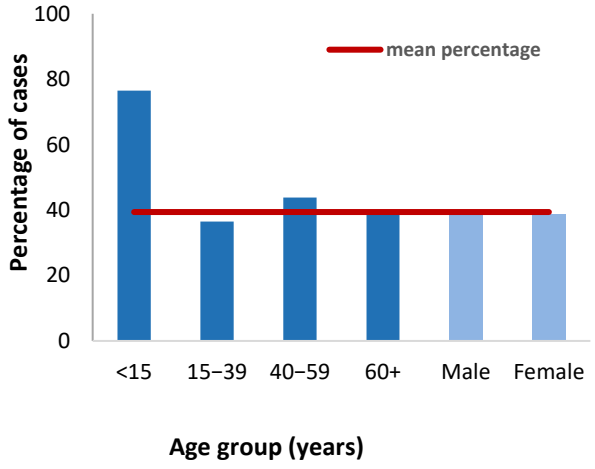
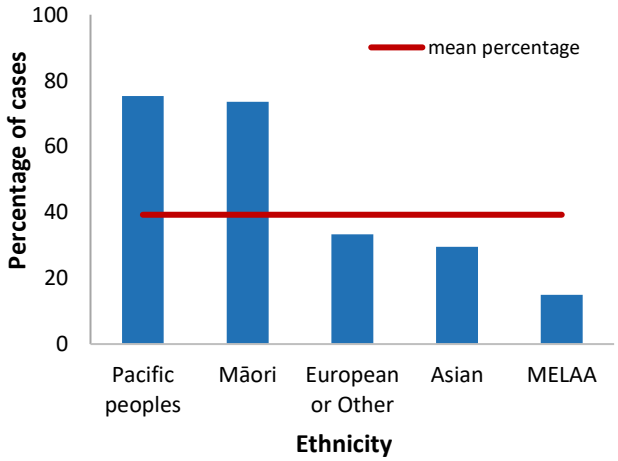


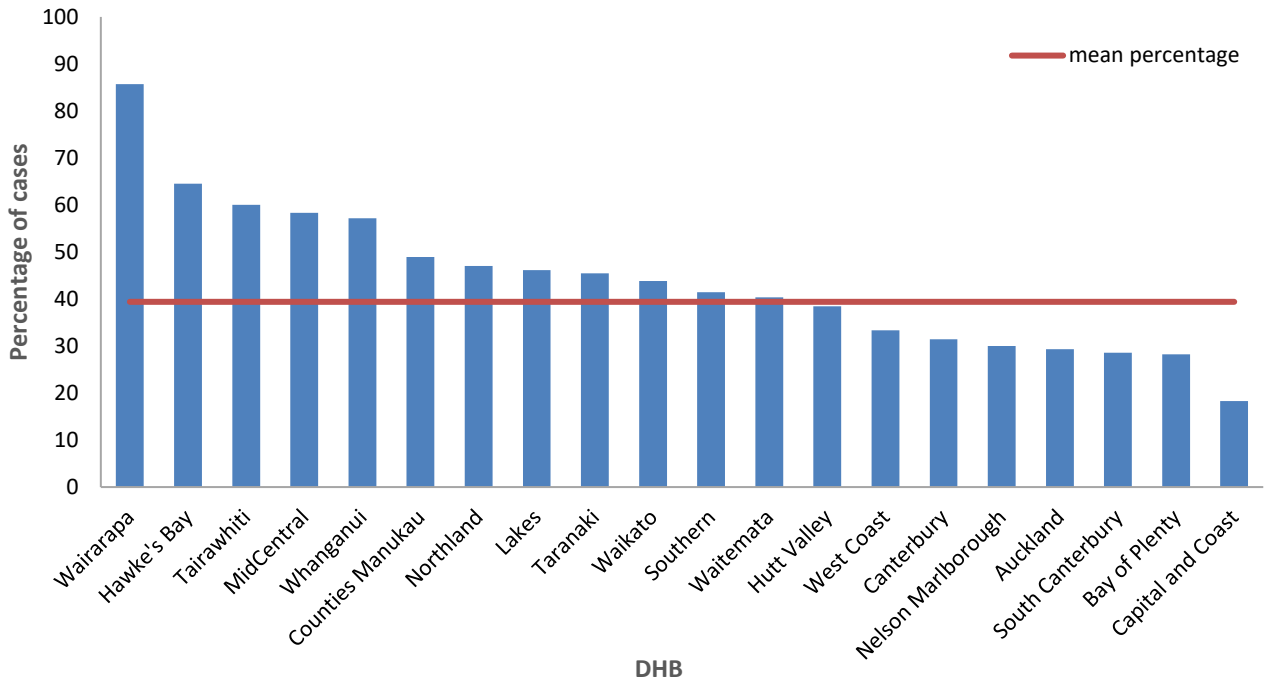

**Figure 16. Percentage of new TB cases with non-unique molecular types by ethnicity, 2016–2020**




Wairarapa (85.7%), Hawke's Bay (64.5%), and Tairawhiti (60.0%) DHBs had the highest proportions of new TB cases belonging to clusters, while Capital and Coast (18.3%), Bay of Plenty (28.3%) and South Canterbury (28.6%) DHBs had the lowest (Figure 17).

[ii] 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 five years.

**Figure 17. Percentage of new TB cases with non-unique molecular types by DHB, 2016–2020**




In 2016–2020, new TB cases born in the Pacific Islands and New Zealand were more likely to be part of a cluster than other overseas-born cases (Figure 18). New TB cases living in more socioeconomically deprived areas (NZDep2013 quintile 5) were also more likely to be part of a cluster (Figure 19).

**Figure 18. Percentage of new TB cases with non-unique molecular types by region of birth, 2016–2020**

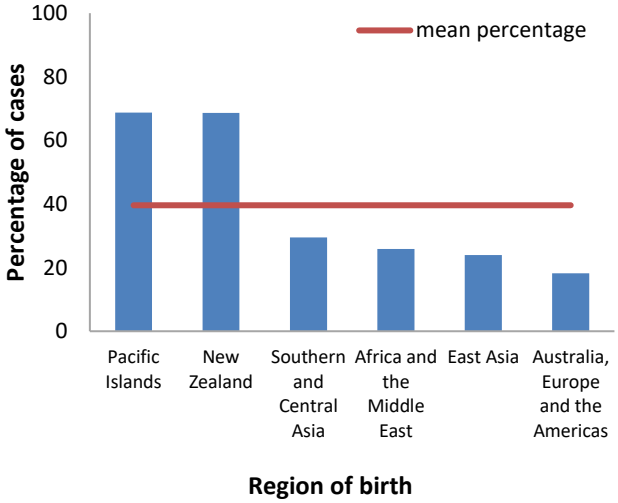
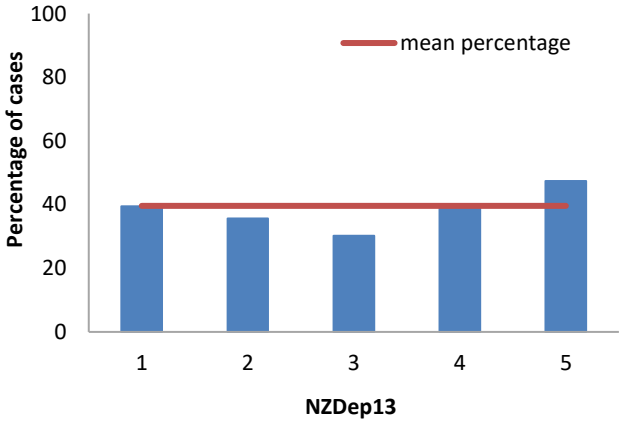
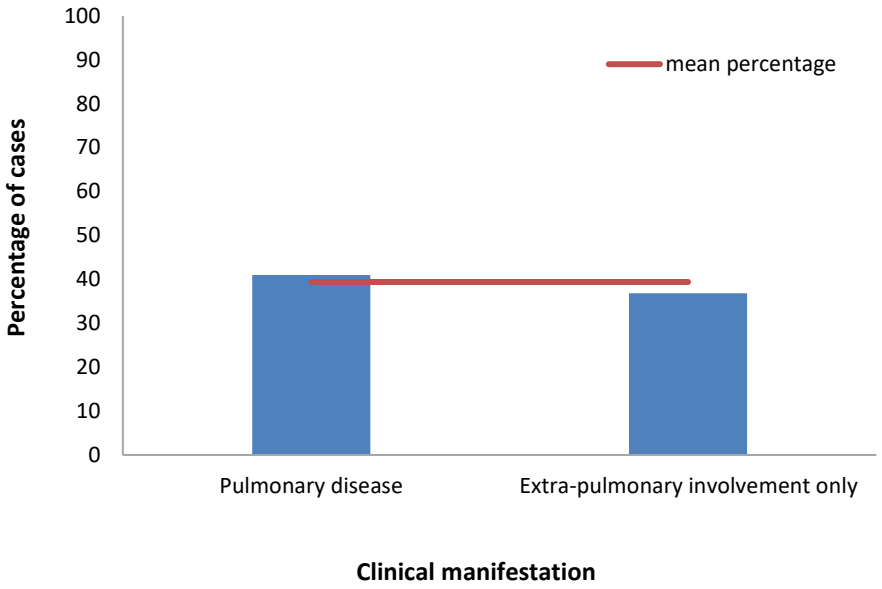



**Figure 19. Percentage of new TB cases with non-unique molecular types by NZDep2013, 2016–2020**



Similar proportions of new TB cases with pulmonary disease (41.0 %) and extra-pulmonary involvement only (36.8%) belonged to clusters (Figure 20).

**Figure 20. Percentage of new TB cases with non-unique molecular types by clinical manifestation, 2016–2020**



# 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 2020, the notification rate was 6.3 per 100,000 population. The incidence of TB in 2020 in New Zealand is higher than in some developed countries, such as the USA (2.2 per 100.000) [1] and Canada (4.7 per 100,000) [2, 11], but lower than in others. such as Australia and the UK (both 7.3 per 100,000) [3, 4]. 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 [12].

## CLINICAL PRESENTATION AND TREATMENT

Nearly all (97%) the TB cases notified in 2020 were "new disease", meaning there was no history of prior treatment. There were nine relapse/reactivation cases, and all were born outside New Zealand. Information on the place of original diagnosis was reported for eight cases and all were previously diagnosed overseas. Treatment periods for their previous illness were between three and nine months. The low proportion of relapse/reactivation cases reported reflects the low incidence of TB in New Zealand and suggests effective treatment and high treatment compliance.

Pulmonary disease was reported in 50% of new TB cases in 2020, compared with 60% in 2019. This is similar to the proportion reported in England (49% in 2020) [4], but lower than in Canada (67% in 2017–2020) [11], and Australia (64% in 2018) [13]. Four new TB cases aged <5 years were reported in 2020. All four cases were born in New Zealand and had pulmonary disease.

For cases notified in 2019, 84% were reported to have completed treatment. There were 39 cases who did not complete treatment, the majority of which (24 cases) went overseas. Nine cases received no treatment.

## COUNTRY OF BIRTH

The majority of TB cases continue to occur in people born outside New Zealand and accounted for 82.0% of new TB cases in 2019. During the past five years, an average of 81.5% (range: 80–83%) of TB cases 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 13 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 new TB cases who were born in New Zealand. In 2020, 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 outside New Zealand.

## DRUG SUSCEPTIBILITIES AND MDR-TB

Over the last 10 years from 2011 to 2020, there has been no overall change in the prevalence of pyrazinamide, isoniazid, rifampicin, ethambutol or streptomycin resistance.

There were four MDR-TB cases in 2020, all in people born outside New Zealand. All 36 MDR-TB cases reported in New Zealand in the past 10 years were born outside New Zealand, 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 aged <15 years born within the country as an indicator [7].The 2020 rate of TB in New Zealand-born children aged <15 years was 0.5 per 100,000. The three-year moving average rate of TB in New Zealand-born children in the <15 years age group was 0.7 per 100,000 in 2020, the same as in 2019.

Identifying clustered cases (by MIRU typing) is a useful indicator for ongoing transmission within a community. Between 2016 and 2020, 39% of strain-typed new TB cases in New Zealand were part of a cluster and 91% of these clusters had fewer than five cases. A high proportion (77%) of children under 15 years were part of a TB cluster, as were Māori and Pacific cases (74% and 75% respectively).

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 than cases born in other overseas regions. In the future, whole genome sequencing may provide greater understanding of TB transmission [4].

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# APPENDIX

**Table 13. Numbers and rates of tuberculosis (new cases) notifications by age group, sex, ethnicity, DHB and year, 2016−2020**

| Category | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cases | Rate[a] | Cases | Rate[a] | Cases | Rate[a] | Cases | Rate[a] | Cases | Rate[a] |
| **Age group (years)** | | | | | | | | | | |
| <5 | 6 | 2.0 | 3 | - | 1 | - | 1 | - | 4 | - |
| 5−14 | 8 | 1.3 | 3 | - | 8 | 1.2 | 1 | - | 2 | - |
| 15−39 | 160 | 10.1 | 169 | 10.3 | 141 | 8.4 | 153 | 9.0 | 165 | 9.4 |
| 40−59 | 53 | 4.3 | 52 | 4.1 | 67 | 5.3 | 83 | 6.5 | 67 | 5.2 |
| ≥60 | 56 | 5.9 | 67 | 6.9 | 79 | 7.9 | 67 | 6.4 | 73 | 6.7 |
| **Sex** | | | | | | | | | | |
| Male | 149 | 6.4 | 143 | 6.0 | 150 | 6.2 | 167 | 6.8 | 161 | 6.4 |
| Female | 134 | 5.6 | 151 | 6.2 | 146 | 5.9 | 138 | 5.5 | 150 | 5.9 |
| **Ethnic group[b]** | | | | | | | | | | |
| Māori | 24 | 3.3 | 24 | 3.3 | 24 | 2.9 | 29 | 3.5 | 31 | 3.7 |
| Pacific peoples | 35 | 11.5 | 36 | 11.6 | 39 | 11.8 | 46 | 13.7 | 38 | 11.1 |
| Asian | 177 | 32.0 | 205 | 36.3 | 198 | 26.6 | 195 | 25.8 | 211 | 27.3 |
| MELAA | 9 | 17.0 | 6 | 11.1 | 13 | 18.2 | 15 | 20.7 | 7 | 9.5 |
| European or Other | 34 | 1.1 | 23 | 0.7 | 17 | 0.6 | 19 | 0.6 | 22 | 0.7 |
| Unknown | 4 | - | 1 | - | 5 | - | 1 | - | 2 | - |
| **District health board** | | | | | | | | | | |
| Northland | 2 | - | 3 | - | 3 | - | 6 | 3.2 | 5 | 2.6 |
| Waitemata | 34 | 5.8 | 35 | 5.8 | 51 | 8.3 | 37 | 5.9 | 46 | 7.2 |
| Auckland | 54 | 11.2 | 58 | 11.9 | 35 | 7.1 | 45 | 9.0 | 48 | 9.5 |
| Counties Manukau | 63 | 11.7 | 55 | 9.9 | 67 | 11.8 | 75 | 13.0 | 69 | 11.6 |
| Waikato | 21 | 5.2 | 28 | 6.8 | 18 | 4.3 | 29 | 6.8 | 32 | 7.3 |
| Lakes | 6 | 5.5 | 2 | - | 4 | - | 3 | - | 3 | - |
| Bay of Plenty | 10 | 4.3 | 9 | 3.7 | 14 | 5.6 | 7 | 2.7 | 15 | 5.7 |
| Tairawhiti | 1 | - | 1 | - | 0 | - | 4 | - | 3 | - |
| Taranaki | 3 | - | 4 | - | 3 | - | 4 | - | 2 | - |
| Hawke's Bay | 16 | 9.6 | 12 | 7.1 | 6 | 3.5 | 7 | 4.0 | 6 | 3.4 |
| Whanganui | 2 | - | 0 | - | 2 | - | 0 | - | 4 | - |
| MidCentral | 6 | 3.4 | 6 | 3.4 | 9 | 5.0 | 5 | 2.7 | 3 | - |
| Hutt Valley | 4 | - | 15 | 9.9 | 7 | 4.5 | 10 | 6.4 | 18 | 11.3 |
| Capital & Coast | 19 | 6.2 | 17 | 5.5 | 31 | 9.8 | 20 | 6.3 | 14 | 4.3 |
| Wairarapa | 2 | - | 4 | - | 2 | - | 0 | - | 1 | - |
| Nelson Marlborough | 4 | - | 4 | - | 5 | 3.2 | 7 | 4.4 | 8 | 5.0 |
| West Coast | 1 | - | 0 | - | 0 | - | 2 | - | 1 | - |
| Canterbury | 26 | 4.8 | 33 | 6.0 | 27 | 4.8 | 27 | 4.7 | 22 | 3.8 |
| South Canterbury | 2 | - | 0 | - | 3 | - | 3 | - | 2 | - |
| Southern | 7 | 2.2 | 8 | 2.4 | 9 | 2.7 | 14 | 4.1 | 9 | 2.6 |
| **Total** | **283** | **6.0** | **294** | **6.1** | **296** | **6.0** | **305** | **6.1** | **311** | **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, MELAA and European or Other.

**Table 14. Tuberculosis (new case) notifications for cases born in New Zealand for by DHB and year, 2016–2020**

| District health board | 2016 | 2017 | 2018 | 2019 | 2020 | Total |
|---|---|---|---|---|---|---|
| Northland | 0 | 1 | 1 | 2 | 1 | **5** |
| Waitemata | 2 | 3 | 5 | 3 | 9 | **22** |
| Auckland | 4 | 3 | 3 | 10 | 4 | **24** |
| Counties Manukau | 12 | 8 | 18 | 12 | 9 | **59** |
| Waikato | 7 | 9 | 3 | 8 | 9 | **36** |
| Lakes | 1 | 1 | 2 | 0 | 1 | **5** |
| Bay of Plenty | 1 | 3 | 4 | 2 | 4 | **14** |
| Tairawhiti | 1 | 1 | 0 | 0 | 2 | **4** |
| Taranaki | 2 | 1 | 0 | 0 | 0 | **3** |
| Hawke's Bay | 7 | 5 | 3 | 1 | 3 | **19** |
| Whanganui | 1 | 0 | 2 | 0 | 2 | **5** |
| MidCentral | 1 | 2 | 3 | 2 | 1 | **9** |
| Hutt Valley | 1 | 2 | 3 | 2 | 4 | **12** |
| Capital & Coast | 4 | 2 | 4 | 0 | 0 | **10** |
| Wairarapa | 2 | 1 | 1 | 0 | 0 | **4** |
| Nelson Marlborough | 1 | 0 | 0 | 4 | 1 | **6** |
| West Coast | 1 | 0 | 0 | 1 | 0 | **2** |
| Canterbury | 5 | 5 | 3 | 8 | 4 | **25** |
| South Canterbury | 0 | 0 | 0 | 0 | 0 | **0** |
| Southern | 5 | 2 | 2 | 0 | 2 | **11** |
| **Total** | **58** | **49** | **57** | **55** | **56** | **275** |

**Table 15. Tuberculosis (new case) notifications with extra-pulmonary involvement by site of infection and year, 2016–2020**

| Site of infection | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cases[a] | % | Case[a] | % | Cases[a] | % | Cases[a] | % | Cases[a] | % |
| Lymph node (excl. abdominal) | 87 | 51.2 | 84 | 50.3 | 87 | 50.3 | 86 | 49.1 | 95 | 47.0 |
| Pleural | 25 | 14.7 | 33 | 19.8 | 22 | 12.7 | 33 | 18.9 | 36 | 17.8 |
| Intra-abdominal (excl. renal) | 16 | 9.4 | 20 | 12.0 | 21 | 12.1 | 18 | 10.3 | 26 | 12.9 |
| Bone/joint | 8 | 4.7 | 12 | 7.2 | 19 | 11.0 | 12 | 6.9 | 21 | 10.4 |
| Renal/genitourinary tract | 4 | 2.4 | 7 | 4.2 | 4 | 2.3 | 10 | 5.7 | 8 | 4.0 |
| Soft tissue/skin | 14 | 8.2 | 11 | 6.6 | 6 | 4.0 | 3 | 1.7 | 9 | 4.5 |
| Miliary tuberculosis | 5 | 2.9 | 6 | 3.6 | 9 | 4.6 | 8 | 4.6 | 12 | 5.9 |
| Central nervous system TB[b] | 11 | 6.5 | 16 | 10.2 | 23 | 12.7 | 14 | 8.0 | 23 | 11.4 |
| Other | 16 | 9.4 | 6 | 1.8 | 4 | 2.3 | 5 | 2.9 | 2 | 1.0 |
| **Total[c]** | **170** | **100** | **167** | **100** | **173** | **100** | **175** | **100** | **202** | **100** |

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

[b] Includes meningitis.

[c] Total number of new TB cases reported with extra-pulmonary involvement, including cases with pulmonary disease.

## Table 16. Numbers and percentages of non-unique and unique strain for tuberculosis (new case) notifications for selected variables, 2016−2020

| Variable[a] | Non-unique | | Unique | |
|---|---|---|---|---|
| | Cases | %[b] | Cases | %[b] |
| **Age group (years)** | **489** | **39.4** | **753** | **60.6** |
| <15 years | 13 | 76.5 | 4 | 23.5 |
| 15 to 39 years | 244 | 36.5 | 424 | 63.5 |
| 40 to 59 years | 114 | 43.8 | 146 | 56.2 |
| 60+ years | 118 | 39.7 | 179 | 60.3 |
| **Sex** | **489** | **39.4** | **753** | **60.6** |
| Male | 257 | 40.0 | 386 | 60.0 |
| Female | 232 | 38.7 | 367 | 61.3 |
| **Ethnic group** | **484** | **39.3** | **749** | **60.7** |
| Māori | 78 | 73.6 | 28 | 26.4 |
| Pacific Peoples | 125 | 75.3 | 41 | 24.7 |
| Asian | 245 | 29.5 | 586 | 70.5 |
| MELAA | 6 | 15.0 | 34 | 85.0 |
| European or Other | 30 | 33.3 | 60 | 66.7 |
| **District Health Board** | **489** | **39.4** | **753** | **60.6** |
| Northland | 8 | 47.1 | 9 | 52.9 |
| Waitemata | 71 | 40.3 | 105 | 59.7 |
| Auckland | 63 | 29.3 | 152 | 70.7 |
| Counties Manukau | 141 | 49.0 | 147 | 51.0 |
| Waikato | 46 | 43.8 | 59 | 56.2 |
| Lakes | 6 | 46.2 | 7 | 53.8 |
| Bay of Plenty | 13 | 28.3 | 33 | 71.7 |
| Tairawhiti | 3 | 60.0 | 2 | 40.0 |
| Taranaki | 5 | 45.5 | 6 | 54.5 |
| Hawke's Bay | 20 | 64.5 | 11 | 35.5 |
| Whanganui | 4 | 57.1 | 3 | 42.9 |
| MidCentral | 14 | 58.3 | 10 | 41.7 |
| Hutt Valley | 15 | 38.5 | 24 | 61.5 |
| Capital & Coast | 15 | 18.3 | 67 | 81.7 |
| Wairarapa | 6 | 85.7 | 1 | 14.3 |
| Nelson Marlborough | 6 | 30.0 | 14 | 70.0 |
| West Coast | 1 | 33.3 | 2 | 66.7 |
| Canterbury | 33 | 31.4 | 72 | 68.6 |
| South Canterbury | 2 | 28.6 | 5 | 71.4 |
| Southern | 17 | 41.5 | 24 | 58.5 |
| **Region of birth** | **489** | **39.4** | **753** | **60.6** |
| New Zealand | 149 | 68.7 | 68 | 31.3 |
| Southern and Central Asia | 203 | 29.5 | 486 | 70.5 |
| East Asia | 28 | 23.9 | 89 | 76.1 |
| Pacific Islands | 88 | 68.8 | 40 | 31.3 |
| Africa and the Middle East | 15 | 25.9 | 43 | 74.1 |
| Australia, Europe and the Americas | 6 | 18.2 | 27 | 81.8 |
| **NZ Deprivation Index (2013) quintile** | **458** | **39.6** | **700** | **60.4** |
| 1 | 47 | 39.5 | 72 | 60.5 |
| 2 | 63 | 35.6 | 114 | 64.4 |
| 3 | 57 | 30.2 | 132 | 69.8 |
| 4 | 125 | 38.7 | 198 | 61.3 |
| 5 | 166 | 47.4 | 184 | 52.6 |
| **Clinical manifestation** | **489** | **39.4** | **753** | **60.6** |
| Pulmonary disease | 310 | 41.0 | 446 | 59.0 |
| Extra-pulmonary involvement only | 179 | 36.8 | 307 | 63.2 |

[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.


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