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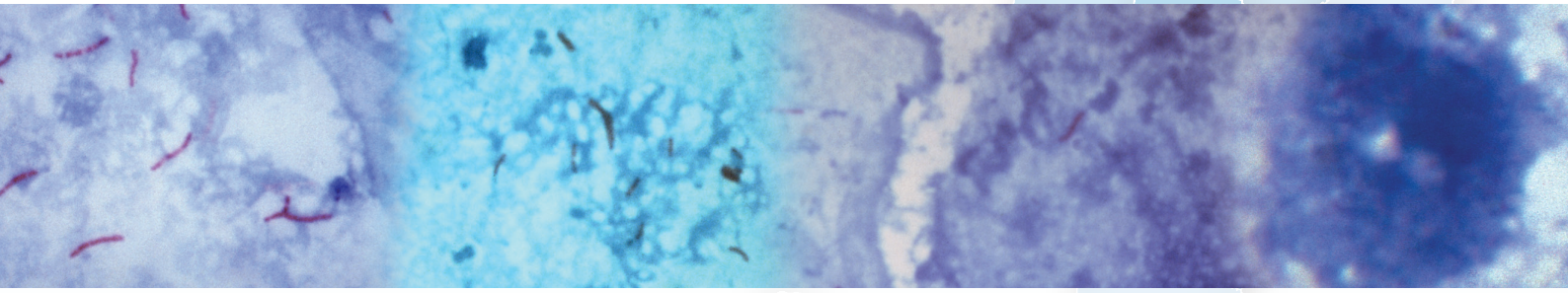

# Tuberculosis in New Zealand

# 2011

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

August 2012

Client Report FW 12019

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# TUBERCULOSIS IN NEW ZEALAND
# ANNUAL REPORT 2011

Prepared as part of a Ministry of Health
contract for scientific services

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August 2012

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

First published: 31 August 2012

Suggested citation:

Bissielo, A., Lim, E., and Heffernan, H.,
*Tuberculosis in New Zealand: Annual Report 2011*,
2012, Institute of Environmental Science and Research Ltd (ESR):
Wellington, New Zealand

Cover picture:

CDC / Courtesy of George P. Kubica and Ronald W. Smithwick

Client Report FW12019

## Acknowledgements

The authors would like to thank the mycobacteriology reference laboratories at Auckland City Hospital (LabPlus) , Waikato Hospital and Wellington Hospital for the species and susceptibility data, and LabPlus for the molecular typing data; Ali Borman for data quality checking; Ruth Pirie for her help with the TB molecular typing analysis. Thanks also to Kerry Sexton and Hilary Michie for reviewing this report.

The Ministry of Health reviewer, Grant Storey, is thanked for his helpful comments and feedback.

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# SUMMARY

# SUMMARY

Tuberculosis (TB) disease remains significant globally and in New Zealand, where it is notifiable to medical officers of health under the Tuberculosis Act 1948. The main findings from the surveillance of TB disease in 2011 are summarised in this section.

There were 626 cases of TB reported in 2011. These comprised 308 cases of TB disease (new and relapse/reactivation cases) and 318 cases of TB infection (treatment of latent infection and old disease on preventive treatment).

In 2011, the TB disease rate was 7.0 cases per 100 000, unchanged from the rate reported in 2010. However, annual TB disease rates have more than halved between 1980 (15.1 per 100 000 population) and 2011, although there has been little change in rates over the last five years.

The highest age-specific rate of TB disease was in those aged 20 to 29 years (13.1 per 100 000, 81 cases). This age group also contained the highest number of cases.

The rate of TB disease was highest in the Middle Eastern/Latin American/African ethnic group (42.5 per 100 000, 16 cases), followed by the Asian ethnic group (40.6 per 100 000, 165 cases). Case numbers were greatest in the Asian ethnic group (165 cases), followed by the Pacific Peoples ethnic group (48 cases).

More than half of the TB disease cases (54.2%, 167 cases) were reported by the three District Health Boards (DHBs) in the Auckland region. The highest rate of disease was in Auckland DHB (17.7 per 100 000, 81 cases), followed by Capital and Coast (11.9 per 100 000, 35 cases), Hawke's Bay (10.9 per 100 000, 17 cases), Counties Manukau (10.2 per 100 000, 51 cases) and MidCentral (7.1 per 100 000, 12 cases) DHBs.

TB disease cases were skewed towards those living in more socio-economically deprived areas, with 58.5% of cases in the four most deprived New Zealand Deprivation Index deciles.

The most commonly reported risk factors among the cases were being born overseas (75.4%, 227/301) and current or recent residence with a person born outside of New Zealand (74.0%, 205/277). Twenty-eight percent (67/242) of cases had been in prior contact with a confirmed TB case.

Based on country of birth, the highest TB disease rate was among those born in Asia (61.7 per 100 000, 155 cases), followed by those born in Sub-Saharan Africa (38.9 per 100 000, 23 cases) and in the Pacific Islands (27.2 per 100 000, 37 cases).

For more than half of the cases born overseas (52.7%, 88/167), TB disease was reported less than five years after arriving in New Zealand.

Three-quarters (233/308) of the TB disease cases in 2011 were culture positive, and all were due to *Mycobacterium tuberculosis*.

Over half of the TB disease cases had pulmonary disease (60.1%, 173/288). The most common sites of infection among cases of extra-pulmonary disease were lymph nodes (excluding abdominal) (46.7%, 57 cases), followed by intra-abdominal (excluding renal) sites (13.1%, 16 cases), and bone or joint sites (10.7%, 13 cases).

Of the 305 TB disease cases for whom hospitalisation status was known, 55.7% (170/305) of cases were hospitalised, and the mortality rate was 6.9% (21/303). Three (1.0%) cases were co-infected with HIV.

In 2011, 17 cases (5.5% of the total TB disease notifications) were involved in five outbreaks of *M. tuberculosis.*

The median interval between symptom onset in cases and starting treatment was five months, with 39.1% (63/161) of cases commencing treatment within one month of symptom onset.

Given the long course of TB treatment, 2010 data were analysed for information on the use of directly observed therapy (DOT). This information was known for 97.7% (297/304) of cases notified in 2010. Of these, 32.0% received DOT throughout the course of treatment. Treatment outcome information was recorded for 96.7% (294/304) of the cases in 2010. Based on 2010 notifications, 83.7% (246/294) of TB disease cases completed their treatment course, 8.8% (26/294) died before completion of treatment, 3.7% (11/294) went overseas, 2.7% (8/294) stopped treatment because of adverse effects, 0.7% (2/294) refused to complete the treatment and 0.3% (1/294) of cases were lost to follow up.

There were 232 culture-positive cases due to *M. tuberculosis* with TB molecular typing results notified in 2011. Among the 232 cases, 78 cases (33.6%) had a non-unique molecular type. These cases were associated with 41 separate molecular types. The remaining 154 cases (66.4%) had a unique molecular type. Age group, sex, and ethnic group were significant predictors of a case having a non-unique molecular type. For the cases aged less than 20 years, those cases that had contact with a confirmed case or had pulmonary disease were more likely to have a non-unique molecular type. For the cases aged 20 years and over, those cases in contact with a confirmed case were more likely to have a non-unique molecular type and cases that had an immunosuppressive illness were less likely to have a non-unique molecular type.

Over the last 10 years, there has been a significant trend of decreasing resistance to ethambutol and pyrazinamide. In 2011, there were two (0.9%) cases of multidrug-resistant TB (MDR-TB). A total of 30 MDR-TB cases have been identified during the last 10 years, and all but two are assumed to have acquired their MDR-TB overseas.

In conclusion, the rate of TB disease declined substantially between 1980 and 2007, but has remained relatively stable since then. Most cases in 2011 were associated with people born in Asia, Sub-Saharan Africa, and in the Pacific Islands.

# INTRODUCTION

# INTRODUCTION

Worldwide, tuberculosis (TB) is one of the most common causes of death from communicable disease. Infection is usually curable with a combination of specific antibiotics, but this relies upon full compliance. In 2010, the global TB incidence rate was 128 per 100 000 population, with widely variable regional rates: Africa (276 per 100 000), the Americas (29 per 100 000), Eastern Mediterranean (109 per 100 000), Europe (47 per 100 000), South-East Asia (193 per 100 000), and Western Pacific (93 per 100 000) [1]. In New Zealand, TB disease is notifiable to medical officers of health under the Tuberculosis Act 1948. The annual notification rate of TB disease in New Zealand in 2010 was 7.0 per 100 000 population. Based on the 2010 statistics reported by the World Health Organization [1], this rate is higher than that in the United States (4.1 per 100 000), Canada (4.7 per 100 000) and Australia (6.3 per 100 000), but lower than in the United Kingdom (13.0 per 100 000).

## Purpose

This report summarises the descriptive epidemiology of TB cases (disease and latent infections) in New Zealand for 2011 and examines trends from 2007 to 2011. This report includes TB drug susceptibility data and TB molecular typing data, and may be used to monitor TB policy. The primary audiences for this report are the New Zealand Ministry of Health, and TB practitioners, including medical officers of health and respiratory and infectious disease physicians.

# METHODS

# METHODS

## Data sources

This report is based on an analysis of TB notification data reported in EpiSurv, the national notifiable diseases database; TB drug susceptibility and mycobacterial species identification data reported to the Institute of Environmental Science and Research (ESR) Ltd by the mycobacteriology reference laboratories at Auckland City Hospital (LabPlus), Waikato Hospital and Wellington Hospital; and TB molecular typing data reported to ESR by LabPlus.

### TB notification data

EpiSurv is the national notifiable diseases database managed by ESR on behalf of the Ministry of Health. Clinicians are required to notify all cases of TB disease to their local medical officer of health under the Tuberculosis Act 1948. Unlike active TB disease, cases diagnosed with latent TB infection or with old inactive TB disease are not notifiable under the Tuberculosis Act 1948. Reporting of patients in the categories of treatment for latent infection or old disease on preventive treatment occurs on a voluntary basis, and is therefore unlikely to be a true reflection of the incidence of these conditions in the population. The reporting is, however, useful for surveillance purposes.

When a public health service (PHS) receives a notification, a staff member enters details of the case into EpiSurv using the TB Case Report Form. This case report form includes information such as the type of TB, demographic details, clinical details, laboratory results, risk factors and case management.

TB cases are reported in one of the following categories:

- Tuberculosis disease – new case
  *Active TB in a person who has never been treated for TB before*
- Tuberculosis disease – relapse or reactivation
  *Active TB in a person whose TB has been non-infectious or quiescent following full, partial or no treatment*
- Tuberculosis – treatment of latent infection
  *A person with all of the following: a positive Mantoux test or Mantoux conversion, no evidence of active disease, and placed on chemoprophylaxis with one or more drugs*
- Tuberculosis infection – old disease on preventive treatment
  *A person on anti-tuberculosis treatment with multiple drugs in whom active disease is suspected but remains unproven or reactivation is likely to occur.*

For TB disease cases (new cases or relapses/reactivations) the following status definitions apply:

- Confirmed (with laboratory confirmation)
  *A case that is laboratory confirmed by one of the following: positive culture for* Mycobacterium tuberculosis *or* Mycobacterium bovis*, positive microscopic examination for acid-fast bacilli when a culture has not been or cannot be obtained, demonstration of* M. tuberculosis *nucleic acid in specimens, or histology strongly suggestive of TB*
- Probable – presumptive (without laboratory confirmation)
  *There is no laboratory confirmation but (a) there are symptoms or signs compatible with active TB, such as compatible radiology or clinical evidence of current disease, AND (b) full anti-tuberculosis treatment had been started by a clinician*
- Under investigation
  *A case which had been notified, but information is not yet available to classify it as confirmed.*

### TB species and drug susceptibility data

Antimicrobial susceptibility testing of *M. tuberculosis* and *M. bovis* isolates is undertaken by the mycobacteriology reference laboratories at Auckland City Hospital (LabPlus), Waikato Hospital and Wellington Hospital. These laboratories use the BACTEC® 460 radiometric method or the BACTEC® MGIT 960 method to test for drug susceptibility. Susceptibility to isoniazid (at concentrations of 0.1 mg/L and 0.4 mg/L), rifampicin, ethambutol, pyrazinamide and streptomycin is routinely tested. In addition, multidrug-resistant isolates are tested for susceptibility to second-line antimicrobials at LabPlus. The susceptibility results and species identifications are sent to ESR and integrated with the TB disease case notifications recorded in EpiSurv.

### TB molecular typing data

The national TB molecular typing database is maintained by LabPlus where all of the human TB molecular typing work in New Zealand is undertaken. 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 with MIRU only performed where isolates had fewer than or equal to six bands on RFLP.

Patients' TB isolates are defined as having a unique molecular type if the MIRU 12 + MIRU 24 combination does not match that of any other isolate in the national database. All known MIRU/RFLP or RFLP-based clusters have had at least one isolate retrospectively MIRU 12- and MIRU 24-typed to enable future matching of isolates to these clusters. The TB molecular typing data from LabPlus are routinely reported to ESR and are periodically integrated with TB disease case notifications recorded in EpiSurv.

### TB/HIV co-infection data

This information is sourced from the AIDS Epidemiology Group at the University of Otago.

## Analytical methods

This report includes all cases of TB reported in New Zealand from 1 January 2011 to 31 December 2011. This dataset includes all TB notifications categorised as 'TB disease - new case', 'TB disease - relapse or reactivation', 'TB - treatment of latent infection' or 'TB infection - old disease on preventive treatment'. In this report, notifications of 'TB disease - new case' and 'TB disease - relapse or reactivation' are referred to as TB disease cases and 'TB - treatment of latent infection' and 'TB infection - old disease on preventive treatment' are referred to as TB infections cases.

Due to the length of time taken for the treatment of TB disease to be completed, 2010 notification data are presented in the sections on the use of directly observed treatment (DOT) and treatment outcomes. The notification data were extracted from EpiSurv on 30 June 2012; therefore, any changes made to the EpiSurv data by PHS staff after this date will not be reflected in this report.

All disease rates have been calculated using 2011 mid-year population estimates from Statistics New Zealand except where otherwise noted in the text. Rates are expressed as the number of cases per 100 000 population. Rates are not shown in tables for those categories with fewer than five cases. Rates are subject to variation, and this directly relates to the number of events or cases used to calculate the rates. The smaller the number of cases, the higher the variability. To assist the reader in interpreting the importance of a given rate, each table in this report contains the number of cases, rates or percentages.

Birth country regions are based on the country of birth and are grouped into regions according to the Statistics New Zealand standard.

Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, Middle Eastern/Latin American/African (MELAA), European or Other Ethnicity (including New Zealander). More information about ethnicity classification is available on the Ministry of Health (MoH) web site: http://www.health.govt.nz/publication/ethnicity-data-protocols-health-and-disability-sector.

Socio-economic deprivation is based on the 2006 New Zealand Deprivation Index (NZDep06). NZDep06 combines nine variables from the 2006 census which reflect eight dimensions of deprivation. NZDep06 provides a deprivation score for each meshblock in New Zealand. Meshblocks are geographical units defined by Statistics New Zealand, containing a median of approximately 87 people in 2006. The NZDep06 ordinal scale ranges from 1 to 10, where 1 represents the areas with the lowest deprivation scores and 10 the areas with the highest deprivation scores [2].

For the TB molecular typing section, the dataset is limited to cases of TB disease due to *M. tuberculosis* with molecular typing results. Multivariable logistic regression analysis was conducted on the explanatory variables (age group, sex, and ethnic group) to identify whether these variables were significant predictors for a case having a non-unique molecular type. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated from the logistic regression model coefficients. Only the 1152 TB disease cases where age, sex and ethnicity information was recorded over the five-year period 2007-2011 was included in this analysis. Further analyses were carried out with the cases in the under 20 year old age group and the 20 years and over age groups. Risk factor, protective factor and clinical feature information with known status were adjusted for the confounding variables age group (20 years and over analysis only), sex and ethnic group. Statistical significance was assessed by log likelihood tests and p-values of less than 0.05 were considered statistically significant.

For the TB drug susceptibility section, data analyses were performed with SAS software v.9.1.3 (SAS Institute Inc, Cary, NC, USA). The chi-square test or Fisher's exact test, as appropriate, were used to determine the significance of any observed differences. The Cochran-Armitage trend test was used to calculate the significance of time trends. An associated P-value of 0.05 was used to identify whether a difference or trend was significant.

# RESULTS

# RESULTS

## Overall TB cases

During 2011, 626 cases of TB were recorded in EpiSurv (Table 1). Of these, 308 (49.2%) cases were TB disease (302 new cases and six relapse or reactivations of TB disease) and 318 (50.8%) cases were TB infection (312 treatment of latent infection and six on preventive treatment).

**Table 1: Tuberculosis cases by status, 2011**

| Disease Name | Status | | | |
|---|---|---|---|---|
| | Confirmed | Probable | Under investigation | Total |
| TB disease – new case | 238 | 62 | 2 | 302 |
| TB disease – relapse or reactivation | 5 | 1 | 0 | 6 |
| TB infection – treatment of latent infection | n/a[1] | n/a | n/a | 312 |
| TB infection – on preventive treatment | n/a | n/a | n/a | 6 |
| **Total** | **243** | **63** | **2** | **626** |

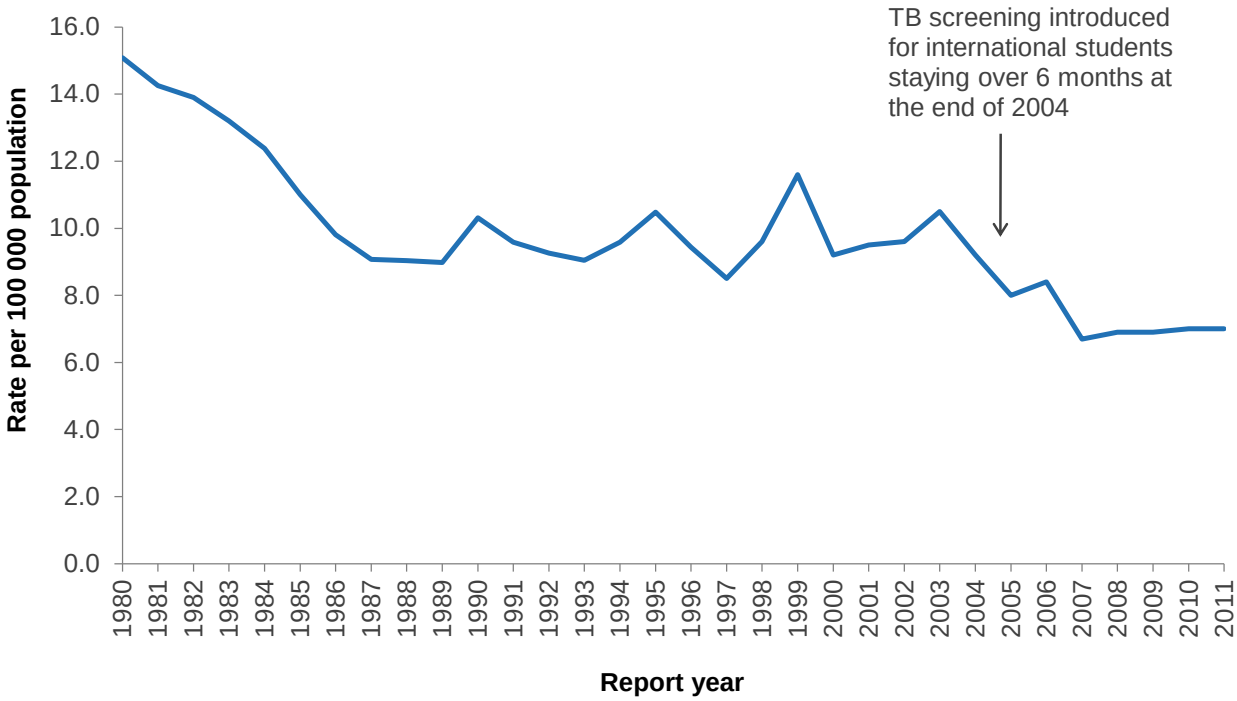
[1] n/a = not applicable

## TB disease cases

### Trends

Figure 1 shows the annual rates of TB disease in New Zealand from 1980 to 2011. Between 1980 and 2011, the annual rate decreased by 53.6% (15.1 per 100 000 in 1980 compared with 7.0 per 100 000 in 2011).

**Figure 1: Rate per 100 000 population of tuberculosis disease cases by year, 1980 to 2011**




**Note**: Rate per 100 000 based on census data from 1980 to 1990 and mid-year population estimates from 1991 to 2011

Between 2007 and 2011, the annual number of TB disease cases increased by 9.2% (from 282 cases to 308 cases). The annual rate of disease increased by 4.5% (from 6.7 per 100 000 to 7.0 per 100 000), with a five-year average rate of 6.9 per 100 000 (Table 2). After a drop between 2006 and 2007, the annual rate has remained relatively stable since 2007 (Figure 1).

**Table 2: Distribution of tuberculosis disease cases by status, 2007 to 2011**

| Year | Status | | | | Total | Rate[1] |
|---|---|---|---|---|---|---|
| | Confirmed | Probable | Under Investigation | Unknown | | |
| 2007 | 233 | 46 | 3 | 0 | 282 | 6.7 |
| 2008 | 247 | 42 | 4 | 0 | 293 | 6.9 |
| 2009 | 252 | 46 | 0 | 0 | 298 | 6.9 |
| 2010 | 260 | 44 | 0 | 0 | 304 | 7.0 |
| 2011 | 243 | 63 | 2 | 0 | 308 | 7.0 |
| **Total** | **1235** | **241** | **9** | **0** | **1485** | **6.9** |

[1] Rate per 100 000 based on the mid-year population estimates for each year

More detailed trend data, including rates by age group, sex, ethnicity and geographic area, are presented in Table 21 in the appendix.

### Demographic information

The annual TB disease rates differed by sex and age group in 2011 (Table 3). The TB disease rate for males was higher than for females (7.3 per 100 000 compared with 6.7 per 100 000).

The highest age-specific rate was reported in the 20 to 29 years age group (13.1 per 100 000, 81 cases), followed by the 60 to 69 years (8.9 per 100 000, 37 cases), 70 years and over (8.8 per 100 000, 36 cases) and 30 to 39 years (7.8 per 100 000, 44 cases) age groups. For those aged less than 15 years, the TB disease rate was 2.2 per 100 000 (20 cases).

**Table 3: Age-sex distribution of tuberculosis disease cases, 2011**

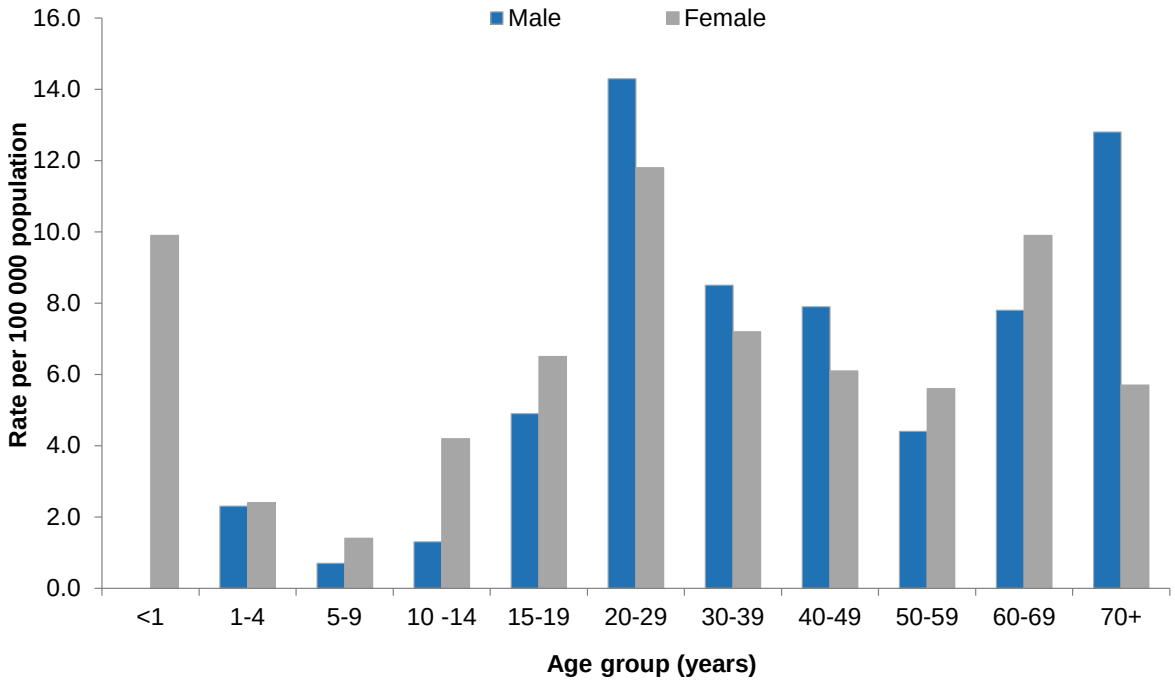
| Age group (years) | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] |
| <1 | 0 | - | 3 | - | 3 | - |
| 1 to 4 | 3 | - | 3 | - | 6 | 2.4 |
| 5 to 9 | 1 | - | 2 | - | 3 | - |
| 10 to 14 | 2 | - | 6 | 4.2 | 8 | 2.7 |
| 15 to 19 | 8 | 4.9 | 10 | 6.5 | 18 | 5.7 |
| 20 to 29 | 45 | 14.3 | 36 | 11.8 | 81 | 13.1 |
| 30 to 39 | 23 | 8.5 | 21 | 7.2 | 44 | 7.8 |
| 40 to 49 | 24 | 7.9 | 20 | 6.1 | 44 | 7.0 |
| 50 to 59 | 12 | 4.4 | 16 | 5.6 | 28 | 5.0 |
| 60 to 69 | 16 | 7.8 | 21 | 9.9 | 37 | 8.9 |
| 70+ | 23 | 12.8 | 13 | 5.7 | 36 | 8.8 |
| **Total** | **157** | **7.3** | **151** | **6.7** | **308** | **7.0** |

[1] Rate per 100 000 based on 2011 mid-year population estimates; not shown for counts less than 5 cases

The highest age-specific rates for males and females were reported in the same age group, 20 to 29 years: 14.3 per 100 000 (45 cases) and 11.8 per 100 000 (36 cases), respectively.

The age-specific rates for males and females were similar in most age groups, however, in the 20 to 29 years and 70 years and over age groups the rates in males substantially exceeded those in females (Figure 2).

### Figure 2: Age-sex specific rates[1] of tuberculosis disease, 2011




[1]Rates calculated on fewer than 5 cases should be interpreted with caution.

Table 4 shows the distribution of TB cases by ethnicity in 2011. The highest rate of TB disease occurred in the Middle Eastern/Latin American/African (MELAA) ethnic group (42.5 per 100 000, 16 cases), followed by the Asian (40.6 per 100 000, 165 cases), Pacific Peoples (18.0 per 100 000, 48 cases), Māori (6.2 per 100 000, 40 cases) and European or Other (1.0 per 100 000, 31 cases) ethnic groups.

### Table 4: Tuberculosis disease cases by ethnicity, 2011

| Ethnicity[1] | Cases | Rate[2] |
|---|---|---|
| Māori | 40 | 6.2 |
| Pacific Peoples | 48 | 18.0 |
| Asian | 165 | 40.6 |
| MELAA | 16 | 42.5 |
| European or other | 31 | 1.0 |
| Unknown | 8 | - |
| **Total** | **308** | **7.0** |

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

[2] Rate (cases per 100 000) based on Census 2006 applied to 2011 mid-year population estimates

### Geographic information

The numbers of cases and rates of TB disease varied across the District Health Boards (DHBs) in 2011 (Table 21 in the appendix). More than half of the cases (54.2%, 167 cases) were reported by the three DHBs in the Auckland region. The highest rate of TB disease was in Auckland DHB (17.7 per 100 000, 81 cases), followed by Capital and Coast (11.9 per 100 000, 35 cases), Hawke's Bay (10.9 per 100 000, 17 cases), Counties Manukau (10.2 per 100 000, 51 cases) and MidCentral (7.1 per 100 000, 12 cases) DHBs.

### Risk and protective factor information

For the 308 TB disease cases in 2011, data completion varied for each risk/protective factor. Table 5 shows the risk/protective factors recorded for the 2011 TB disease cases.

For those cases where risk/protective factor information was recorded, 74.0% (205 cases) were currently residing or had recently resided with a person born overseas, 73.5% (125 cases) had been vaccinated with Bacillus Calmette-Guérin (BCG), 27.7% (67 cases) had been in contact with a confirmed case, 17.8% (51 cases) had an immunosuppressive illness, 4.9% (14 cases) were on immunosuppressive medication, 4.1% (10 cases) were exposed in a healthcare setting, and 1.6% (4 cases) were currently residing or had recently resided in an institution.

**Table 5: Tuberculosis disease cases by selected risk and protective factors, 2011**

| Category[1] | Yes | | No | | Total |
|---|---|---|---|---|---|
| | Cases | % | Cases | % | |
| Current/recent residence with person born outside NZ | 205 | 74.0 | 72 | 26.0 | 277 |
| Vaccinated with BCG | 125 | 73.5 | 45 | 26.5 | 170 |
| Contact with a confirmed case | 67 | 27.7 | 175 | 72.3 | 242 |
| Has immunosuppressive illness | 51 | 17.8 | 235 | 82.2 | 286 |
| On immunosuppressive medication | 14 | 4.9 | 271 | 95.1 | 285 |
| Exposure in a healthcare setting | 10 | 4.1 | 231 | 95.9 | 241 |
| Current/recent residence in an institution | 4 | 1.6 | 244 | 98.4 | 248 |

[1] A case may have more than one category recorded

### Birth country or region

Of the 308 TB disease cases in 2011, information on whether the case was born in New Zealand or overseas was recorded for 97.7% (301 cases). Of these 301 cases, 24.6% (74 cases) were born in New Zealand and 75.4% (227 cases) were born overseas.

People born in Asia had the highest rate of TB disease (61.7 per 100 000, 155 cases), followed by those born in Sub-Saharan Africa (38.9 per 100 000, 23 cases) and in the Pacific Islands (27.2 per 100 000, 37 cases) (Table 6).

### Table 6: Tuberculosis disease cases by birth country, 2011

| Birth country region (*n* = 301) | Number of cases[2] | Rate[1] |
|---|---|---|
| Asia | 155 | 61.7 |
| Australia | 0 | - |
| New Zealand | 74 | 2.5 |
| North Africa & the Middle East | 2 | - |
| North America | 0 | - |
| North-West Europe | 6 | 2.0 |
| Pacific Islands | 37 | 27.2 |
| South & Central America | 0 | - |
| Southern & Eastern Europe | 4 | - |
| Sub-Saharan Africa | 23 | 38.9 |

[1] Rate per 100 000 based on census 2006 birthplace for the usually resident population counts; rates not shown for counts less than 5 cases

[2] Seven cases with no country information were excluded

Table 7 shows the numbers and percentages of TB disease cases born in New Zealand or overseas by ethnicity. For cases born in New Zealand, the largest proportion of cases occurred among Māori (50.0%), followed by those of European or Other (24.3%) and Pacific Peoples (17.6%) ethnicities. For cases born overseas, the largest proportion of cases occurred among those of Asian ethnicity (70.5%), followed by those of Pacific Peoples ethnicity (14.5%).

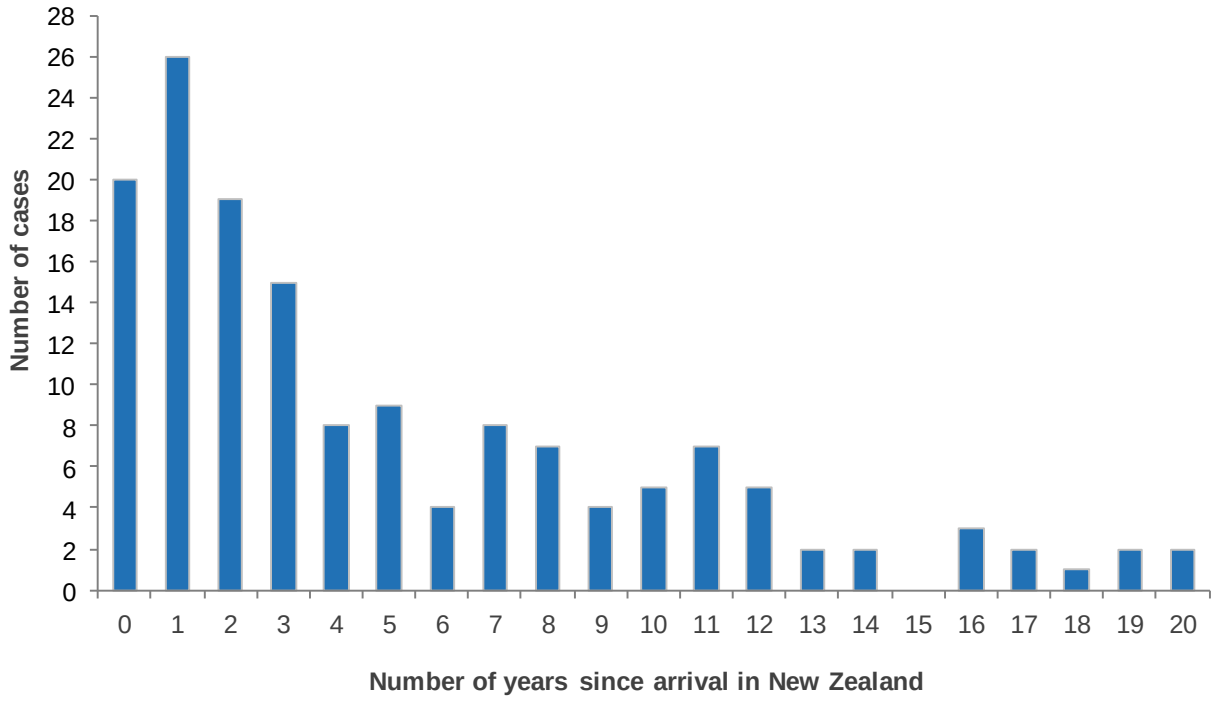
### Table 7: New Zealand-born and overseas-born tuberculosis disease cases by ethnicity, 2011

| Ethnicity[1] | Born in New Zealand | | Born overseas | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Māori | 37 | 50.0 | 0 | - |
| Pacific Peoples | 13 | 17.6 | 33 | 14.5 |
| Asian | 5 | 6.8 | 160 | 70.5 |
| MELAA | 1 | 1.4 | 15 | 6.6 |
| European or other | 18 | 24.3 | 11 | 4.8 |
| Unknown | 0 | - | 8 | 3.5 |
| **Total** | **74** | **100** | **227** | **100** |

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

The date of arrival in New Zealand was recorded for 73.6% (167/227) of the overseas-born TB disease cases in 2011. Of these, the interval between date of arrival in New Zealand and the TB disease notification date ranged from 18 days to 73 years, with a median interval of four years. For 52.7% of overseas-born cases, TB disease notification occurred less than five years after arriving in New Zealand. Figure 3 shows the distribution of the time intervals between the dates that overseas-born TB disease cases arrived in New Zealand and the dates of their disease notification.

**Figure 3: Overseas-born tuberculosis disease cases notified in 2011 by number of years since arrival in New Zealand**




**Note**: Excludes 16 cases with TB disease notification >20 years after arrival in New Zealand and 60 cases where information on arrival date was not recorded

Table 8 shows that over the five-year period from 2007 to 2011, the median interval between arrival in New Zealand and TB disease notification fluctuated between three and five years. The mean interval between arrival in New Zealand and TB disease notification was 8.1 years in 2011, an increase from 7.6 years in 2010.

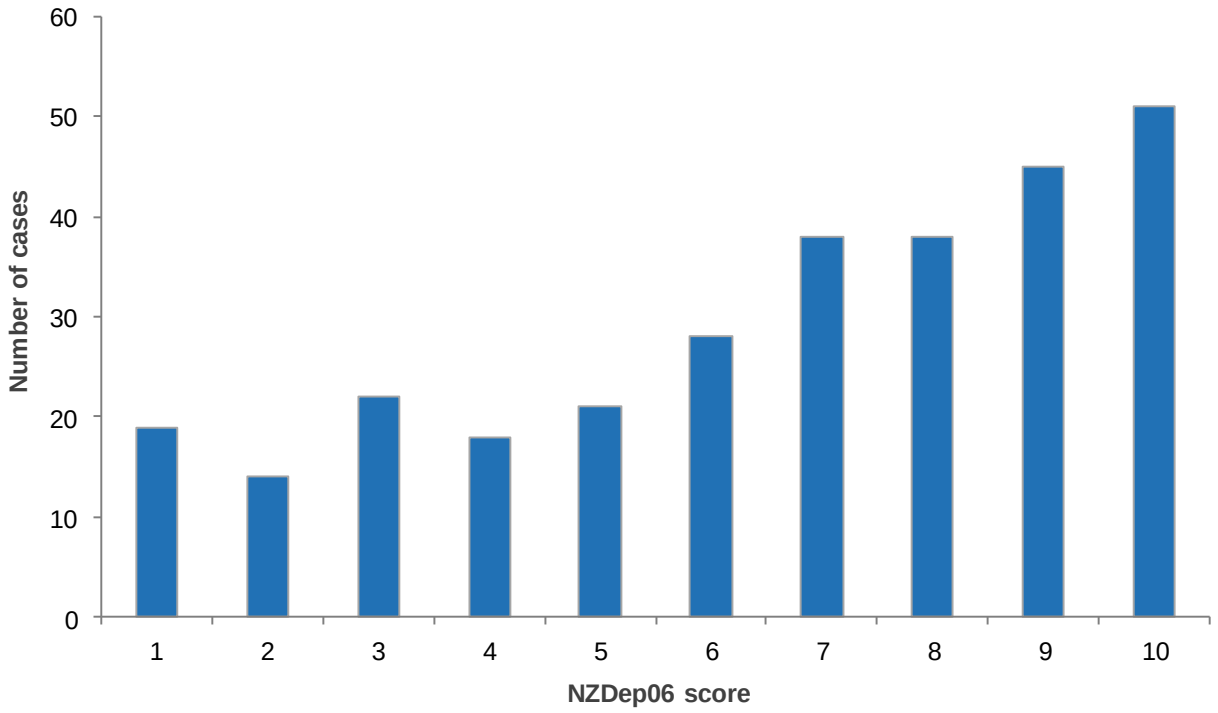
**Table 8: Time interval between arrival in New Zealand and tuberculosis disease notification among overseas-born cases, 2007 to 2011**

| Report year | Mean interval (years) | Median interval (years) |
|---|---|---|
| 2007 | 6.9 | 3 |
| 2008 | 8.4 | 4 |
| 2009 | 8.5 | 4 |
| 2010 | 7.6 | 5 |
| 2011 | 8.1 | 4 |
| **Total** | **7.9** | **4** |

### Socio-economic deprivation

Figure 4 shows the distribution of TB disease cases in 2011 by the NZDep06 decile score. In 2011, 95.5% (294/308) of cases had residential addresses recorded that could be linked to NZDep06. Of these, the highest proportion of cases (17.3%, 51 cases) resided in the most deprived areas (NZDep06 decile 10), while the lowest proportion of cases (4.8% 14 cases) resided in one of the least deprived areas (NZDep06 decile 2). Almost 60% (58.5%) of cases resided in areas of NZDep06 decile 7 or higher.

**Figure 4: Tuberculosis disease cases by the NZDep06 decile scale, 2011**




## Basis of discovery

Information on the means by which their TB disease was discovered was reported for 96.8% (298/308) of cases in 2011. TB disease was mostly discovered when the symptomatic case presented to a health practitioner (69.5% of the total cases). Immigrant or refugee screening was the basis of discovery for 9.1% of the cases, and 8.4% of the cases were discovered through contact follow-up. Almost 10% of cases (9.7%) were discovered through unspecified ways other than those described previously Table 9.

**Table 9: Tuberculosis disease cases by basis of discovery, 2011**

| Basis of discovery | Cases | % |
|---|---|---|
| Attended practitioner with symptoms | 214 | 69.5 |
| Immigrant/refugee screening | 28 | 9.1 |
| Contact follow-up | 26 | 8.4 |
| Other | 30 | 9.7 |
| Unknown | 10 | 3.2 |

## Basis of diagnosis

Table 10 shows the basis of diagnosis for the 308 TB disease cases in 2011. Isolation of *M. tuberculosis* or *M. bovis* from a clinical specimen was recorded as the basis of diagnosis for 71.4% of the cases.

**Table 10: Tuberculosis disease cases by basis of diagnosis, 2011**

| Basis of diagnosis[1] | Cases | % |
|---|---|---|
| Isolation of *M. tuberculosis* or *M. bovis* from a clinical specimen | 220 | 71.4 |
| Demonstration of acid-fast bacilli in a clinical specimen | 116 | 37.7 |
| Demonstration of *M. tuberculosis* nucleic acid (PCR or LCR only) | 99 | 32.1 |
| Histology strongly suggestive of tuberculosis | 36 | 11.7 |

[1] A case may have more than one basis of diagnosis recorded

### *Mycobacterium* species

In contrast to the information reported in the case notification record (Table 10), based on information received from the three mycobacteriology reference laboratories, 75.7% (233/308) of the TB disease cases in 2011 were culture positive. All culture-positive cases were due to *M. tuberculosis.*

### Site of infection

Site of infection was recorded for 95.8% (295/308) of TB disease cases in 2011. Of these, 145 (49.2%) cases were pulmonary only, 28 (9.5%) cases were both pulmonary and extra-pulmonary, and 122 (41.4%) cases were extra-pulmonary only. Table 11 shows the distribution of disease sites among the 122 cases with extra-pulmonary TB only. Of the two cases with tuberculous meningitis, neither was aged less than 15 years. There were no cases of miliary TB in 2011.

**Table 11: Extra-pulmonary tuberculosis disease cases by site of infection, 2011**

| Site[1] of extra-pulmonary TB | Cases | % |
|---|---|---|
| Node (excluding abdominal) | 57 | 46.7 |
| Intra-abdominal (excluding renal) | 16 | 13.1 |
| Pleural | 9 | 7.4 |
| Bone/joint | 13 | 10.7 |
| Renal/urinary tract | 5 | 4.1 |
| Tuberculous meningitis | 2 | 1.6 |
| Miliary tuberculosis | 0 | - |
| Other[2] | 23 | 18.9 |
| Not stated | 1 | 0.8 |

[1] A case may have more than one site recorded

[2] Other includes TB of skin

### Pulmonary cases

Of the 288 TB cases with information recorded in 2011, 173 (60.1%) had pulmonary disease. Of these pulmonary TB disease cases, 154 (89.0%) had outcome information recorded regarding the demonstration of acid-fast bacilli in a clinical specimen. A total of 89 (57.8%) were smear positive, that is, they demonstrated acid-fast bacilli in a clinical specimen. Of these, 52 (58.4%) were sputum specimens.

### Hospitalisations

Hospitalisation status was known for 99.0% (305/308) of TB disease cases in 2011. Of these, 170 (55.7%) cases were hospitalised.

### Mortality

Mortality status was known for 98.4% (303/308) of TB disease cases in 2011. Of these, 21 deaths were reported, giving a mortality rate of 6.9%.

### Outbreaks

In 2011, there were 17 cases (5.5% of total TB disease cases) involved in five TB outbreaks. These outbreaks were reported from Auckland, Hutt Valley, Capital and Coast (1 each), and Waikato (2) DHBs.

### Delay to treatment

The interval between the onset of symptoms and the start of treatment could be calculated for 52.3% (161/308) of the TB disease cases in 2011. Of these, 63 (39.1%) cases started treatment within one month of the onset of symptoms and 47 (29.2%) cases started treatment between one and three months from the onset of symptoms. The median interval to the start of treatment was five months from the onset of symptoms.

Treatment delay in patients with pulmonary TB disease represents a risk to public health from disease transmission. The interval between the onset of symptoms and the start of treatment could be calculated for 50.3% (73/145) of the TB disease cases with pulmonary disease alone. Of these, 29 (39.7%) cases started treatment within one month of the onset of symptoms and 44 (60.3%) started treatment between one and three months from the onset of symptoms. The median interval to the start of treatment was two months from the onset of symptoms.

### Use of directly observed therapy

Due to the length of time taken for the treatment of TB disease to be completed, data for the 304 TB disease cases notified in 2010 are presented in this section. Information on the use of directly observed therapy (DOT) was known for 97.7% (297/304) of cases notified in 2010. Of these, 95 (32.0%) received DOT throughout the course of treatment.

### Treatment outcomes

Treatment outcome information was recorded for 96.7% (294/304) of the cases in 2010. Of these, 246 (83.7%) completed treatment to the satisfaction of the prescribing doctor, 26 (8.8%) died before treatment completion, 11 (3.7%) went overseas, eight (2.7%) stopped treatment because of adverse effects, two (0.7%) refused to complete the treatment, and one (0.3%) was lost to follow up.

## TB molecular typing

There were 232 culture-positive cases with TB molecular typing results notified in 2011; all were due to *M. tuberculosis.* Among the 232 cases, 78 cases (33.6%) had a non-unique molecular type. These cases were associated with 41 separate molecular types. The remaining 154 cases (66.4%) had a unique molecular type.

Over the five-year period, 2007 to 2011, there were 1182 *M. tuberculosis* cases that had TB molecular typing results, of which 404 (34.2%) were non-unique. These 404 cases were associated with 127 molecular types.

Multivariable logistic regression analysis was conducted on the explanatory variables listed in Within age groups, cases in the less than 20 years age group were over six-times more likely to have a non-unique molecular type than the reference group of 60 years and over (OR 6.44, 95% CI 3.70-11.41). Cases in the 20 to 39 years and 40 to 59 years age groups were 1.9 and 1.7 times, respectively, more likely to have non-unique molecular types than the reference group (OR 1.90, 95% CI 1.29-2.80 and OR 1.66, 95% CI 1.10-2.51, respectively).

Male cases were more likely to have a non-unique molecular type than female cases (OR 1.36, 95% CI 1.02-1.81).

Cases in the Māori and Pacific Peoples ethnic groups were more likely to have a non-unique molecular type than the reference group of cases in the European or Other ethnic group (OR 5.14, 95% CI 3.07-8.77 and OR 2.77, 95% CI 1.68-4.64, respectively), whereas cases in the Asian/MELAA combined ethnic group were less likely to have a non-unique molecular type (OR 0.32 95% CI 0.20-0.50).

Table 12 (age group, sex, and ethnic group) to identify whether these variables were significant predictors for a case having a non-unique molecular type. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated from the logistic regression model coefficients. Only the 1152 TB disease cases where age, sex, and ethnic group information was recorded over the five-year period 2007-2011 were included in this analysis.

The variables in Table 13 and Table 14 were adjusted for the confounding variables age group (20 years and over analysis only), ethnic group and sex. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated from logistic regression models. Crude (unadjusted) odds ratios have also been calculated and included in the tables for reference. Statistical significance was assessed by log likelihood tests and p-values of less than 0.05 were considered statistically significant.

All demographic factors (age group, sex, and ethnic group) were significant predictors of whether a case had a non-unique molecular type.

Within age groups, cases in the less than 20 years age group were over six-times more likely to have a non-unique molecular type than the reference group of 60 years and over (OR 6.44, 95% CI 3.70-11.41). Cases in the 20 to 39 years and 40 to 59 years age groups were 1.9 and 1.7 times, respectively, more likely to have non-unique molecular types than the reference group (OR 1.90, 95% CI 1.29-2.80 and OR 1.66, 95% CI 1.10-2.51, respectively).

Male cases were more likely to have a non-unique molecular type than female cases (OR 1.36, 95% CI 1.02-1.81).

Cases in the Māori and Pacific Peoples ethnic groups were more likely to have a non-unique molecular type than the reference group of cases in the European or Other ethnic group (OR 5.14, 95% CI 3.07-8.77 and OR 2.77, 95% CI 1.68-4.64, respectively), whereas cases in the Asian/MELAA combined ethnic group were less likely to have a non-unique molecular type (OR 0.32 95% CI 0.20-0.50).

**Table 12: Number and percentage of tuberculosis disease cases with non-unique molecular types, and odds ratios from multivariable logistic regression with 95% confidence intervals by demographic factors, 2007 to 2011**

| Category | Sub-category | Odds ratio (95% CI) | Number of cases | | Percentage of non-unique molecular types (%) |
|---|---|---|---|---|---|
| | | | Non-unique molecular types | Total | |
| **Age (years)** *p*-value: <0.001 | <20 | 6.44 (3.70-11.41) | 72 | 106 | 67.9 |
| | 20 to 39 | 1.90 (1.29-2.80) | 135 | 477 | 28.3 |
| | 40 to 59 | 1.66 (1.10-2.51) | 98 | 272 | 36.0 |
| | 60+ | Reference group | 89 | 297 | 30.0 |
| **Sex** *p*-value: 0.038 | Male | 1.36 (1.02-1.81) | 209 | 572 | 36.5 |
| | Female | Reference group | 185 | 580 | 31.9 |
| **Ethnic group (prioritised)**[1] *p*-value: <0.001 | Māori | 5.14 (3.07-8.77) | 132 | 175 | 75.4 |
| | Pacific Peoples | 2.77 (1.68-4.64) | 103 | 165 | 62.4 |
| | Asian/ MELAA[2] | 0.32 (0.20-0.50) | 118 | 690 | 17.1 |
| | European or Other | Reference group | 41 | 122 | 33.6 |

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

[2] The Asian and MELAA ethnic groups were combined due to the small number of cases in the MELAA ethnic group

After adjusting for the effects of age (analysis of 20 years and over age group only), sex and ethnic group, odds ratios and 95% confidence intervals were computed separately for the cases aged less than 20 years (Table 13) and for the cases aged 20 years and over (Table 14).

No cases in the less than 20 years age group reported having an immunosuppressive illness, being on immunosuppressive medication or exposure in a healthcare setting. There were only two cases that reported current or recent residence in an institution. These factors were therefore not included in the analysis.

For the cases aged less than 20 years, two factors were significant predictors of a case having a non-unique molecular type. Cases who had contact with a confirmed case were 5.3 times more likely to have a

non-unique molecular type (OR 5.29 95% CI 1.60-19.24) and cases that had pulmonary disease were 3.7 times more likely to have a non-unique molecular type (OR 3.68, 95% CI 1.02-15.79).

For the cases aged 20 years and over, cases that were in contact with a confirmed case were 1.8 times more likely to have a non-unique molecular type (OR 1.77 95% CI 1.20-2.60) and cases that had an immunosuppressive illness were less likely to have a non-unique molecular type (OR 0.63, 95% CI 0.41-0.97). Other factors were not significant predictors of non-unique molecular type.

## Table 13: Number and percentage of tuberculosis disease cases aged less than 20 years with non-unique molecular types, crude and adjusted odds ratios with 95% confidence intervals by risk and protective factors and clinical features, 2007 to 2011.

| Risk factor | Exposed | | | Not exposed | | | Crude | Adjusted | |
|---|---|---|---|---|---|---|---|---|---|
| | Non-Unique | Total | %[a] | Non-Unique | Total | %[a] | OR[b] (95% CI) | OR[b,c] (95% CI) | *p*-value |
| Contact with a confirmed case | 41 | 48 | 85.4 | 15 | 34 | 44.1 | 7.42 (2.6-21.18) | 5.29 (1.60-19.24) | 0.006 |
| Pulmonary disease | 58 | 82 | 70.7 | 12 | 22 | 54.5 | 2.01 (0.77-5.28) | 3.68 (1.02-15.79) | 0.047 |
| Born outside New Zealand | 27 | 55 | 49.1 | 45 | 51 | 88.2 | 0.13 (0.05-0.35) | 0.54 (0.13-2.18) | 0.380 |
| Vaccinated with BCG | 22 | 43 | 51.2 | 24 | 28 | 85.7 | 0.17 (0.05-0.59) | 0.67 (0.11-3.83) | 0.647 |
| Current or recent residence with person born outside NZ | 44 | 74 | 59.5 | 23 | 24 | 95.8 | 0.06 (0.01-0.5) | 0.63 (0.02-8.42) | 0.733 |

[a] Percentage of cases with non-unique molecular types
[b] Odds ratios (OR)
[c] OR adjusted for the effects of sex and ethnic group with 95% confidence interval

## Table 14: Number and percentage of tuberculosis disease cases aged 20 years and over with non-unique molecular types, crude and adjusted odds ratios with 95% confidence intervals by risk and protective factors and clinical features, 2007 to 2011.

| Risk factor | Exposed | | | Not exposed | | | Crude | Adjusted | |
|---|---|---|---|---|---|---|---|---|---|
| | Non-Unique | Total | %[a] | Non-Unique | Total | %[a] | OR[b] (95% CI) | OR[b,c] (95% CI) | *p*-value |
| Contact with a confirmed case | 88 | 194 | 45.4 | 156 | 622 | 25.1 | 2.48 (1.77-3.47) | 1.77 (1.20-2.60) | 0.004 |
| Has immunosuppressive illness | 76 | 220 | 34.5 | 219 | 766 | 28.6 | 1.32 (0.96-1.81) | 0.63 (0.41-0.97) | 0.038 |
| Vaccinated with BCG | 120 | 431 | 27.8 | 50 | 144 | 34.7 | 0.73 (0.49-1.09) | 1.41 (0.85-2.38) | 0.19 |
| Born outside New Zealand | 184 | 820 | 22.4 | 136 | 221 | 61.5 | 0.18 (0.13-0.25) | 0.66 (0.34-1.27) | 0.215 |
| Current or recent residence with person born outside NZ | 150 | 659 | 22.8 | 124 | 253 | 49 | 0.31 (0.23-0.42) | 0.78 (0.48-1.28) | 0.32 |
| On immunosuppressive medication | 17 | 57 | 29.8 | 279 | 926 | 30.1 | 0.99 (0.55-1.77) | 0.78 (0.39-1.51) | 0.468 |
| Pulmonary disease | 233 | 675 | 34.5 | 84 | 341 | 24.6 | 1.61 (1.2-2.16) | 1.12 (0.80-1.57) | 0.512 |
| Exposure in a healthcare setting | 15 | 59 | 25.4 | 237 | 735 | 32.2 | 0.72 (0.39-1.31) | 0.87 (0.43-1.68) | 0.678 |
| Current or recent residence in an institution | 20 | 36 | 55.6 | 247 | 825 | 29.9 | 2.93 (1.49-5.74) | 1.15 (0.49-2.67) | 0.753 |

[a] Percentage of cases with non-unique molecular types
[b] Odds ratios (OR)
[c] OR adjusted for age group, sex and ethnic group with 95% confidence intervals

## TB and HIV co-infection

Of the 308 TB disease cases in 2011, three (1.0%) were co-infected with HIV and TB.

## TB drug susceptibility

Antimicrobial susceptibility data for the isolates from 233 culture-positive TB disease cases in 2011 were available. All isolates were *M. tuberculosis*. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 15. Over the last 10 years, 2002 to 2011, there have been significant trends ($p \leq 0.05$) of decreasing ethambutol resistance and pyrazinamide resistance, but no significant changes in resistance to isoniazid, rifampicin or streptomycin.

**Table 15: Resistance to each antimicrobial among *M. tuberculosis* (*n* = 233), 2011**

| Antimicrobial[1] | Resistant[2] | |
|---|---|---|
| | No. | % |
| Isoniazid (0.1 mg/L) | 16 | 6.9 |
| Isoniazid (0.4 mg/L)[3] | 11 | 4.7 |
| Rifampicin | 2 | 0.9 |
| Ethambutol | 0 | - |
| Pyrazinamide | 1 | 0.4 |
| Streptomycin | 17 | 7.3 |

[1] All culture-positive cases in 2011 were due to *M. tuberculosis*

[2] Includes resistance alone or in combination with other antimicrobials

[3] 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

In 2011, 88.0% (205/233) of the isolates were fully susceptible to all five antimicrobials routinely tested. There were two cases of multidrug-resistant tuberculosis (MDR-TB, defined as resistance to at least isoniazid and rifampicin) (Table 16). In the last 10 years there have been 30 cases of MDR-TB – an average annual rate of 1.1% among culture-positive TB disease cases. All but two of these 30 cases were born overseas and assumed to have acquired their MDR-TB overseas.

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 drugs: capreomycin, kanamycin or amikacin). Neither of the MDR-TB cases in 2011 was XDR-TB. Only one case of XDR-TB has been identified in New Zealand – this case occurred in 2010.

### Table 16: Distribution of antimicrobial resistance patterns among tuberculosis isolates, 2011

| | Resistance pattern[1] | Percent (No.) of isolates with each pattern |
|---|---|---|
| **Fully susceptible** | | **88.0 (205)** |
| **Resistant to 1 agent** | | **9.4 (22)** |
| | H | 4.3 (10) |
| | S | 5.2 (12) |
| **Resistant to 2 agents** | | **1.7 (4)** |
| | HS | 1.7 (4) |
| **Resistant to 3 agents** | | **0.9 (2)** |
| | HRZ[2] | 0.4 (1) |
| | HRS[2] | 0.4 (1) |

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

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

Table 17 compares antimicrobial resistance among isolates from cases born in New Zealand and cases born overseas. Isolates from cases born in New Zealand were significantly more likely to be fully susceptible to the five antimicrobials routinely tested. Where there was a difference in resistance to any of the individual antimicrobials, resistance was higher, but not significantly so, among isolates from cases born overseas. Both MDR-TB cases were born overseas.

### Table 17: Antimicrobial resistance by place of birth, 2011

| | Born in New Zealand[1] (*n* = 50) | | Born overseas[1] (*n* = 180) | | *p*-value[2] |
|---|---|---|---|---|---|
| | No. | % | No. | % | |
| **Fully susceptible** | | | | | |
| | 48 | 96.0 | 154 | 85.6 | 0.046 |
| **Resistant to:**[3] | | | | | |
| Isoniazid[4] | 1 | 2.0 | 15 | 8.3 | 0.205 |
| Rifampicin | 0 | - | 2 | 1.1 | 1.000 |
| Ethambutol | 0 | - | 0 | - | - |
| Pyrazinamide | 0 | - | 1 | 0.6 | 1.000 |
| Streptomycin | 1 | 2.0 | 16 | 8.9 | 0.130 |
| **MDR-TB**[5] | | | | | |
| | 0 | - | 2 | 1.1 | 1.000 |

[1] Place of birth not known for three cases

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

[3] Includes resistance alone or in combination with other antimicrobials

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

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

Isoniazid, rifampicin, pyrazinamide and streptomycin resistance was most frequent among cases of Asian ethnicity, with 87.5% (14/16) of isoniazid-resistant isolates, both rifampicin-resistant isolates, the one pyrazinamide-resistant isolate, and 88.2% (15/17) of streptomycin-resistant isolates being from cases of Asian ethnicity (Table 18). Both MDR-TB cases were of Asian ethnicity.

### Table 18: Antimicrobial resistance by ethnicity, 2011

| | Māori (*n* = 29) | | Pacific Peoples (*n* = 37) | | Asian (*n* = 131) | | MELAA (*n* = 10) | | European or Other (*n* = 18) | | Unknown (*n* = 8) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Fully susceptible**[1] | | | | | | | | | | | | |
| | 29 | 100.0 | 37 | 100.0 | 107 | 81.7 | 8 | 80.0 | 17 | 94.4 | 7 | 87.5 |
| **Resistant to:**[2] | | | | | | | | | | | | |
| Isoniazid[3] | 0 | - | 0 | - | 14 | 10.7 | 1 | 10.0 | 1 | 5.6 | 0 | - |
| Rifampicin | 0 | - | 0 | - | 2 | 1.5 | 0 | - | 0 | - | 0 | - |
| Ethambutol | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| Pyrazinamide | 0 | - | 0 | - | 1 | 0.8 | 0 | - | 0 | - | 0 | - |
| Streptomycin | 0 | - | 0 | - | 15 | 11.5 | 1 | 10.0 | 0 | - | 1 | 12.5 |
| **MDR-TB**[4] | | | | | | | | | | | | |
| | 0 | - | 0 | - | 2 | 1.5 | 0 | - | 0 | - | 0 | - |

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

[2] Includes resistance alone or in combination with other antimicrobials

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

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

In 2011, 2.2% (5/233) of the culture-positive cases were reported to be TB disease relapses or reactivations. This category of disease could also include cases of re-infection. As the number of cases notified as TB disease relapses/reactivations in any one year is small, the following analysis of drug resistance among relapses/reactivations covers the last five years, 2007 to 2011. During this period, 4.0% (48/1202) of the culture-positive cases were reported to be relapses/reactivations. Information on previous treatment was recorded for 37 of these 48 relapses/reactivations and, of these, 31 (83.8%) were recorded as having received previous anti-tuberculosis drug treatment.

Antimicrobial resistance among new cases of TB, cases reported to be relapses/reactivations, and cases that were reported to have been previously treated, is shown in. Compared with new cases, previously treated cases were significantly more resistant to isoniazid, rifampicin and streptomycin, more likely to be MDR-TB, and less likely to be fully susceptible to all antimicrobials tested.

**Table 19: Antimicrobial resistance among new cases, relapses/reactivations and previously treated cases, 2007 to 2011**

| | New cases (*n* = 1154) | Relapse/reactivation cases | | | |
|---|---|---|---|---|---|
| | | All (*n* = 48) | | Previously treated[1] (*n* = 31) | |
| | % | % | *p*-value[2] | % | *p*-value[2] |
| **Fully susceptible** | | | | | |
| | 88.0 | 72.9 | 0.0020 | 61.3 | <0.001 |
| **Resistant to:**[3] | | | | | |
| Isoniazid[4] | 7.1 | 16.7 | 0.0226 | 25.8 | 0.001 |
| Rifampicin | 1.1 | 10.4 | <0.0001 | 16.1 | <0.001 |
| Ethambutol | 0.4 | 0.0 | 1.000 | 0.0 | 1.000 |
| Pyrazinamide | 2.3 | 6.3 | 0.1141 | 6.5 | 0.174 |
| Streptomycin | 5.6 | 12.5 | 0.0552 | 19.4 | 0.008 |
| **MDR-TB**[5] | | | | | |
| | 1.0 | 8.3 | 0.0029 | 12.9 | <0.001 |

[1] Information on previous treatment reported for only 37 of the 48 relapse/reactivation cases

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

[3] Includes resistance alone or in combination with other antimicrobials

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

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

## TB infection cases

During 2011, a total of 318 cases of TB infection (312 on treatment of latent infection and six on preventive treatment) were reported. The TB infection rate was highest in Capital and Coast DHB (16.3 per 100 000, 48 cases), followed by MidCentral (14.3 per 100 000, 24 cases), Hawke's Bay (14.1 per 100 000, 22 cases), Auckland (14.0 per 100 000, 64 cases) and Hutt Valley (13.1 per 100 000, 19 cases) DHBs (Table 20).

## Table 20: TB infections - cases and rates by DHB, 2011

| District Health Board | Number of cases | Rate[1] |
|---|---|---|
| Northland | 2 | - |
| Waitemata | 57 | 10.4 |
| Auckland | 64 | 14.0 |
| Counties Manukau | 50 | 10.0 |
| Waikato | 20 | 5.4 |
| Lakes | 0 | - |
| Bay of Plenty | 1 | - |
| Tairawhiti | 0 | - |
| Taranaki | 2 | - |
| Hawke's Bay | 22 | 14.1 |
| Whanganui | 0 | - |
| MidCentral | 24 | 14.3 |
| Hutt Valley | 19 | 13.1 |
| Capital and Coast | 48 | 16.3 |
| Wairarapa | 0 | - |
| Nelson Marlborough | 5 | 3.6 |
| West Coast | 0 | - |
| Canterbury | 4 | - |
| South Canterbury | 0 | - |
| Southern | 0 | - |
| **Total** | **318** | **7.2** |

[1]Rate per 100 000 using 2011 mid-year population estimate, rates not shown where counts <5 cases

# APPENDIX

# APPENDIX

## Table 21: Tuberculosis disease cases by demographic and geographic factors, 2007–2011

| Category | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Rate[1] | No. | Rate[1] | No. | Rate[1] | No. | Rate[1] | No. | Rate[1] |
| **Age group (years)** | | | | | | | | | | |
| <1 | 3 | - | 1 | - | 3 | - | 1 | - | 3 | - |
| 1 to 4 | 9 | 3.9 | 3 | - | 9 | 3.7 | 2 | - | 6 | 2.4 |
| 5 to 9 | 7 | 2.4 | 6 | 2.1 | 6 | 2.1 | 3 | - | 3 | - |
| 10 to 14 | 4 | - | 6 | 2.0 | 3 | - | 7 | 2.4 | 8 | 2.7 |
| 15 to 19 | 20 | 6.3 | 15 | 4.7 | 15 | 4.6 | 16 | 5.0 | 18 | 5.7 |
| 20 to 29 | 53 | 9.5 | 59 | 10.4 | 64 | 10.9 | 60 | 9.9 | 81 | 13.1 |
| 30 to 39 | 51 | 8.6 | 58 | 9.9 | 52 | 9.0 | 67 | 11.7 | 44 | 7.8 |
| 40 to 49 | 33 | 5.2 | 29 | 4.6 | 47 | 7.4 | 43 | 6.8 | 44 | 7.0 |
| 50 to 59 | 29 | 5.7 | 35 | 6.7 | 39 | 7.3 | 31 | 5.7 | 28 | 5.0 |
| 60 to 69 | 34 | 9.4 | 39 | 10.3 | 30 | 7.6 | 40 | 9.8 | 37 | 8.9 |
| 70+ | 39 | 10.7 | 42 | 11.3 | 30 | 7.9 | 34 | 8.7 | 36 | 8.8 |
| Unknown | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| **Sex** | | | | | | | | | | |
| Male | 133 | 6.4 | 156 | 7.5 | 152 | 7.2 | 154 | 7.2 | 157 | 7.3 |
| Female | 149 | 6.9 | 137 | 6.3 | 146 | 6.6 | 150 | 6.7 | 151 | 6.7 |
| Unknown | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| **Ethnicity (prioritised)[2]** | | | | | | | | | | |
| Māori | 49 | 7.8 | 45 | 7.1 | 52 | 8.2 | 35 | 5.4 | 40 | 6.2 |
| Pacific Peoples | 27 | 10.4 | 52 | 20.0 | 32 | 12.2 | 45 | 17.0 | 48 | 18.0 |
| Asian | 140 | 35.7 | 146 | 36.9 | 157 | 39.3 | 177 | 43.9 | 165 | 40.6 |
| MELAA | 20 | 54.6 | 10 | 27.1 | 11 | 29.6 | 12 | 32.0 | 16 | 42.5 |
| European/Other | 40 | 1.4 | 33 | 1.1 | 42 | 1.4 | 30 | 1.0 | 31 | 1.0 |
| Unknown | 6 | - | 7 | - | 4 | - | 5 | - | 8 | - |
| **District Health Board** | | | | | | | | | | |
| Northland | 15 | 9.7 | 7 | 4.5 | 8 | 5.1 | 6 | 3.8 | 6 | 3.8 |
| Waitemata | 40 | 7.8 | 49 | 9.4 | 48 | 9.1 | 34 | 6.3 | 35 | 6.4 |
| Auckland | 52 | 12.0 | 54 | 12.3 | 63 | 14.2 | 63 | 14.0 | 81 | 17.7 |
| Counties Manukau | 39 | 8.4 | 57 | 12.0 | 66 | 13.7 | 62 | 12.6 | 51 | 10.2 |
| Waikato | 21 | 5.9 | 18 | 5.1 | 14 | 3.9 | 22 | 6.0 | 18 | 4.9 |
| Lakes | 1 | - | 4 | - | 6 | 5.9 | 3 | - | 2 | - |
| Bay of Plenty | 8 | 3.9 | 8 | 3.9 | 12 | 5.8 | 5 | 2.4 | 14 | 6.6 |
| Tairawhiti | 0 | - | 1 | - | 6 | 13.0 | 3 | - | 3 | - |
| Taranaki | 3 | - | 3 | - | 0 | - | 1 | - | 1 | - |
| Hawke's Bay | 17 | 11.1 | 5 | 3.3 | 9 | 5.8 | 10 | 6.4 | 17 | 10.9 |
| Whanganui | 3 | - | 3 | - | 0 | - | 2 | - | 1 | - |
| MidCentral | 10 | 6.1 | 7 | 4.3 | 6 | 3.6 | 9 | 5.4 | 12 | 7.1 |
| Hutt Valley | 11 | 7.8 | 17 | 12.0 | 10 | 7.0 | 13 | 9.0 | 9 | 6.2 |
| Capital and Coast | 17 | 6.0 | 25 | 8.8 | 17 | 5.9 | 28 | 9.6 | 35 | 11.9 |
| Wairarapa | 1 | - | 0 | - | 0 | - | 1 | - | 0 | - |
| Nelson Marlborough | 3 | - | 5 | 3.7 | 4 | - | 5 | 3.6 | 4 | - |
| West Coast | 1 | - | 0 | - | 2 | - | 1 | - | 0 | - |
| Canterbury | 36 | 7.3 | 28 | 5.6 | 22 | 4.4 | 27 | 5.3 | 14 | 2.8 |
| South Canterbury | 1 | - | 0 | - | 2 | - | 0 | - | 1 | - |
| Southern | 3 | - | 2 | - | 3 | - | 9 | 3.0 | 4 | - |
| **New Zealand** | **282** | **6.7** | **293** | **6.9** | **298** | **6.9** | **304** | **7.0** | **308** | **7.0** |

[1] Rate per 100 000 based on the mid-year population estimate; not calculated where cases were less than 5

[2] Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, MELAA, European/Other Ethnicity

# REFERENCES

# REFERENCES

1. WHO. 2010. *Global tuberculosis control*. World Health Organization. Geneva, Switzerland. Available from: http://www.who.int/tb/country/en/index.html

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