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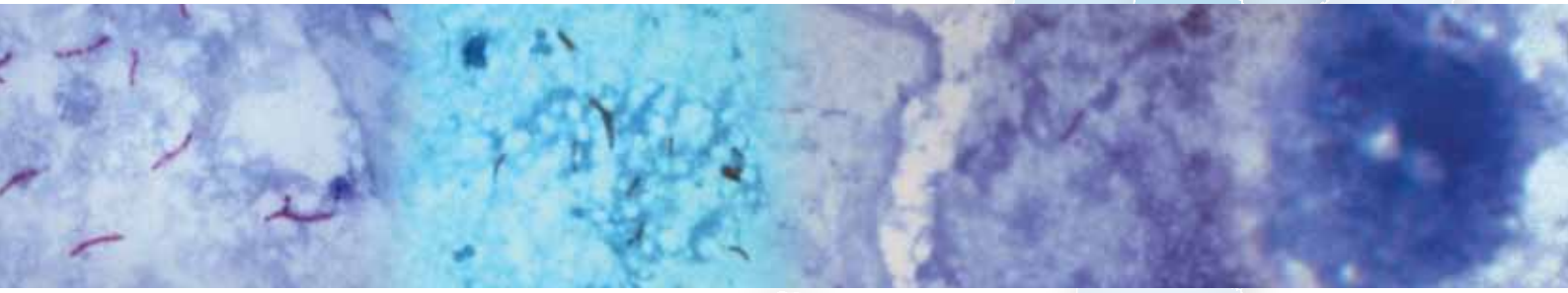

Tuberculosis in New Zealand

2010

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

September 2011

Client Report FW 11057

TUBERCULOSIS IN NEW ZEALAND
ANNUAL REPORT 2010

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

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SUMMARY

SUMMARY

Tuberculosis (TB) remains a significant disease globally and in New Zealand where it is notifiable to the Medical Officer of Health under the Tuberculosis Act 1948. The main findings from the surveillance of TB disease in 2010 are summarised in this section.

There were 661 cases of TB notified in 2010. These notifications comprised 304 cases of TB disease (new and relapse/reactivation cases) and 357 cases of TB infection (treatment of latent infection and old disease on preventive treatment).

Annual TB disease notification rates have more than halved between 1980 (15.1 per 100 000 population) and 2010 (7.0 per 100 000), although there has been little change in rates over the last five years.

Disease notification rates in 2010 were highest in those aged 30 to 39 years (11.7 per 100 000, 67 cases). This age group also contained the highest number of cases.

The highest rate of TB disease occurred in the Asian ethnic group in 2010 (51.9 per 100 000), followed by 'Other' ethnicity (35.4 per 100 000). Case numbers were greatest in the Asian ethnic group (177 cases), followed by Pacific Peoples (45 cases).

More than half of the disease notifications (52.0%, 158 cases) were reported by the three District Health Boards (DHBs) in the Auckland region. The highest rates of TB disease were in Auckland DHB (14.0 per 100 000, 63 cases), followed by Counties Manukau DHB (12.4 per 100 000, 61 cases) and Capital and Coast DHB (9.6 per 100 000, 28 cases).

TB disease notifications were skewed towards those living in more socio-economically deprived areas with 58% of cases in the four most deprived New Zealand Social Deprivation Index deciles.

The most commonly reported risk factors amongst the cases were being born overseas 80.1% (242/302) and current or recent residence with a person born outside of New Zealand (76.2%, 198/260). Twenty five percent (59/241) of cases had been in prior contact with a confirmed TB case.

Based on country of birth, the highest disease rate occurred in those born in Asia (64.9 per 100 000, 163 cases), followed by those born in Sub-Saharan Africa (33.8 per 100 000, 20 cases) and in the Pacific Islands (32.4 per 100 000, 44 cases).

For almost half of the cases born overseas (89/183), TB disease was reported less than five years after arriving in New Zealand.

Over three-quarters (83.2%, 253/304) of the TB disease notifications in 2010 were culture positive, of which 250 (98.8%) were due to *Mycobacterium tuberculosis* and three (1.2%) were due to *Mycobacterium bovis*.

Over half of the cases had pulmonary disease (55.6%, 163/293). The most common site of infection among cases of extra-pulmonary disease were lymph nodes (excluding abdominal) (41.7%, 68 cases), followed by pleural sites (14.7%, 24 cases) and 'other' sites (includes TB of the skin) (14.1%, 23 cases).

About 60% (174/296) of cases were hospitalised, and the mortality rate was 3.0% (9/302). Of the 304 TB disease cases, three (1.0%) were co-infected with HIV.

In 2010, nine cases (3.0% of total TB disease notifications) were involved in five outbreaks of *M. tuberculosis.*

The median interval between symptom onset in cases and starting treatment was two months, with 32.1% of cases (62/193) commencing treatment within one month of symptom onset.

Based on 2009 notifications, 85.9% (244/284) of TB disease cases completed their treatment course, 15 (5.3%) went overseas, 16 (5.6%) died before completion of treatment, and five (1.8%) stopped treatment because of adverse effects. Around 31% (89/289) of the cases received directly observed therapy throughout the course of their treatment.

Of the 250 culture-positive cases due to *M. tuberculosis* in 2010, 55 (22.0%) had a non-unique molecular type. These cases were associated with 26 separate molecular types. The remaining 195 cases (78.0%) had a unique molecular type.

Over the last 10 years, there have been no significant changes in resistance to the five routinely tested antimicrobial drugs used to treat TB. In 2010, there were four (1.6%) cases of multidrug-resistant TB (MDR-TB). A total of 28 MDR-TB cases have been identified during the last 10 years, and all but two are assumed to have acquired their MDR-TB overseas. Notably, one of the 2010 MDR-TB cases was extensively drug-resistant (XDR-TB) and represents the first case of XDR-TB identified in New Zealand.

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 New Zealand TB is notifiable to the Medical Officer of Health under the Tuberculosis Act 1948. The annual incidence rate of TB disease notifications in New Zealand was 6.9 per 100 000 population in 2009. Based on the 2009 statistics reported by the World Health Organization [1], this incidence rate is higher than the United States (4.1 per 100 000), Canada (4.8 per 100 000) and Australia (6.4 per 100 000), but lower than the United Kingdom (12.0 per 100 000).

Purpose

This report summarises the descriptive epidemiology of TB notifications (disease and latent infections) in New Zealand for 2010 and examine trends from 2006 to 2010. This report includes TB drug susceptibility data and TB molecular typing data, and may be used to monitor TB policy. The primary audience for this report is the New Zealand Ministry of Health, 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 LabPlus (Auckland City Hospital), Wellington Hospital and Waikato 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.

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 relapse/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-tuberculous 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 three mycobacteriology reference laboratories: LabPlus, Wellington Hospital and Waikato 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 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 identification 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 2009, all isolates have been primarily typed using mycobacterial interspersed repetitive units (MIRU) analysis at 12 loci. Secondary typing by restriction fragment length polymorphism (RFLP) is performed when an isolate has the same MIRU as a previously typed isolate. 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 or MIRU/ RFLP combination does not match that of any other isolate in the national database. All known RFLP-based clusters at the time of the methodology switch had at least one isolate retrospectively MIRU-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 within EpiSurv.

TB/HIV co-infection data

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

Analytical methods

This report includes all notifications of TB reported in New Zealand from 1 January 2010 to 31 December 2010. This dataset includes all notifications and status categories of 'TB disease - new cases', 'TB disease - relapse or reactivation', 'TB - treatment of latent infection' and 'TB infection - old disease on preventive treatment'. In this report notifications of 'TB disease - new cases' and 'TB disease - relapse or reactivations' are referred to as TB disease and 'TB - treatment of latent infection' and 'TB infection - old disease on preventive treatment' are referred to as TB infections.

Due to the length of time taken for treatment of TB disease to be completed, 2009 notification data are presented in the sections on use of directly observed treatment (DOT) and treatment outcomes. The notification data were extracted from EpiSurv on 1 July 2011; 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 2010 mid-year population estimates from Statistics New Zealand except where otherwise noted in the text. In particular, disease rates for ethnic groups are based on 2006 census population data from Statistics New Zealand. Rates are expressed as 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 grouped into regions according to the Statistics New Zealand standard.

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*.

RESULTS

RESULTS

Overall TB notifications

During 2010, a total of 661 notified cases of TB were recorded in EpiSurv (Table 1). Of these, 304 cases were TB disease (293 new cases and 11 relapse or reactivations of TB disease) and 357 cases were TB infection (350 treatment of latent infection and seven on preventive treatment).

Table 1: Tuberculosis notifications by status, 2010

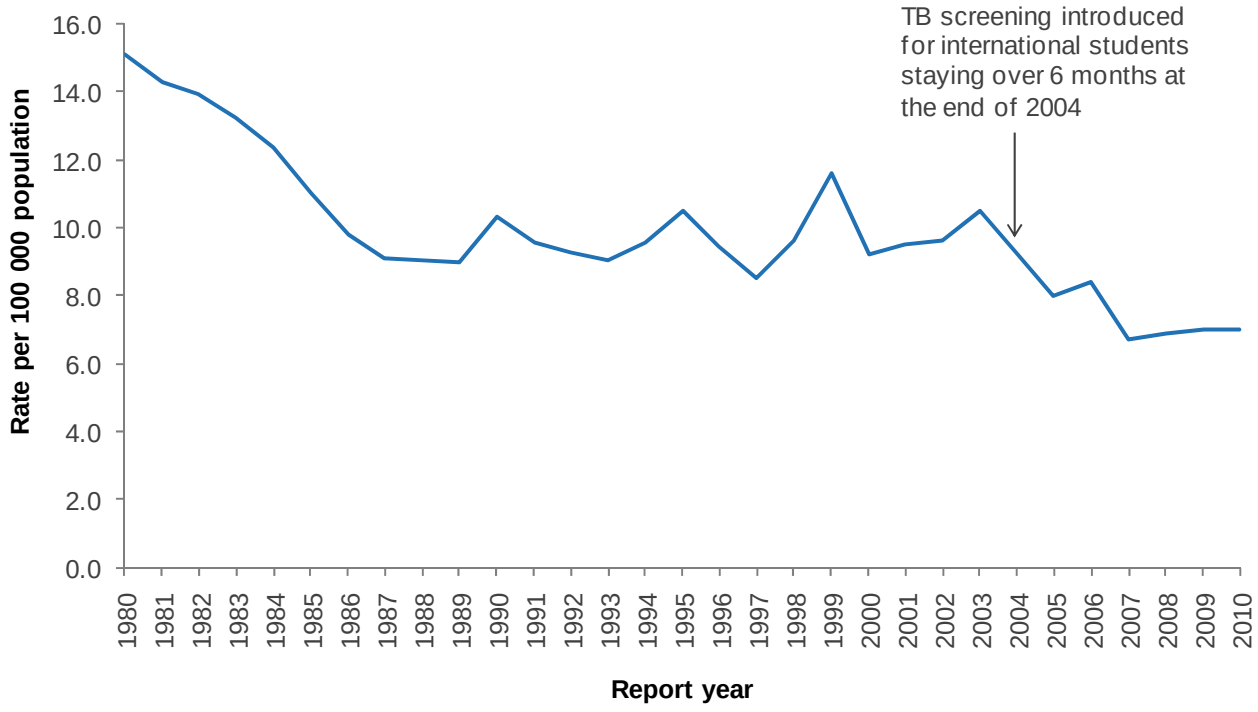
Disease	Status				Total
	Confirmed	Probable	Under investigation	Not applicable	
TB disease – new case	250	43	0	-	293
TB disease – relapse or reactivation	10	1	0	-	11
TB – treatment of latent infection	-	-	-	350	350
TB infection – on preventive treatment	-	-	-	7	7
Total	**260**	**44**	**0**	**357**	**661**

TB disease notifications

Trends

Figure 1 shows the annual rate for TB disease notifications in New Zealand from 1980 to 2010. From 1980 to 2010 the annual notification rate per 100 000 population has decreased by 53.6% (15.1 in 1980 compared with 7.0 in 2010).

Figure 1: Rate per 100 000 population of tuberculosis disease cases[1] by year, 1980 to 2010



[1] Rate per 100 000 based on census data for 1980 to 1990 and mid-year population estimates for 1991 to 2010

From 2006 to 2010 the annual number of TB disease notifications decreased by 13.1% (from 350 cases to 304 cases, respectively). The annual rate per 100 000 decreased by 16.7% (from 8.4 in 2006 to 7.0 in 2010) with a five-year average rate of 7.1 per 100 000 (Table 2). After a drop between 2006 and 2007, the annual rate has remained almost level since 2007 (Figure 1).

Table 2: Distribution of tuberculosis disease notifications by status, 2006 to 2010

Year	Status				Total	Rate[1]
	Confirmed	Probable	Under investigation	Unknown		
2006	275	74	1	-	350	8.4
2007	233	46	3	-	282	6.7
2008	247	42	4	-	293	6.9
2009	251	46	1	-	298	6.9
2010	260	44	-	-	304	7.0
Total	**1266**	**252**	**9**	**0**	**1527**	**7.1**

[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 20 in the appendix.

Demographic information

The annual TB disease rates differed by sex and age group in 2010 (Table 3). The TB disease rate for males was higher than for females (7.2 per 100 000 compared with 6.7 per 100 000, respectively).

The highest age-specific rate was reported in the 30 to 39 years age group (11.7 per 100 000, 67 cases), followed by the 20 to 29 years (9.9 per 100 000, 60 cases), 60 to 69 years (9.8 per 100 000, 40 cases), and 70 years and over (8.7 per 100 000, 34 cases) age groups. For those aged less than 15 years, the TB disease notification rate was 1.5 per 100 000, with 13 cases.

Table 3: Age-sex distribution of tuberculosis disease notifications, 2010

Age group (years)	Male		Female		Total	
	Cases	Rate[1]	Cases	Rate[1]	Cases	Rate[1]
<1	1	-	0	-	1	-
1 to 4	1	-	1	-	2	-
5 to 9	2	-	1	-	3	-
10 to 14	3	-	4	-	7	2.4
15 to 19	7	4.2	9	5.7	16	5.0
20 to 29	30	9.8	30	10.0	60	9.9
30 to 39	32	11.8	35	11.7	67	11.7
40 to 49	23	7.5	20	6.1	43	6.8
50 to 59	14	5.3	17	6.1	31	5.7
60 to 69	24	12.1	16	7.7	40	9.8
70+	17	9.8	17	7.7	34	8.7
Total	**154**	**7.2**	**150**	**6.7**	**304**	**7.0**

[1] Rate per 100 000 based on 2010 mid-year population estimates

The highest age-specific rate for males was reported in the 60 to 69 years age group (12.1 per 100 000, 24 cases), whereas for females it was in the 30 to 39 years age group (11.7 per 100 000, 35 cases).

The age-specific rates between males and females showed a comparable distribution. However, in the 60 to 69 years and 70 years and over age groups the rates in males substantially exceeded that of females (Figure 2).

Figure 2: Age-sex distribution of tuberculosis disease notifications, 2010

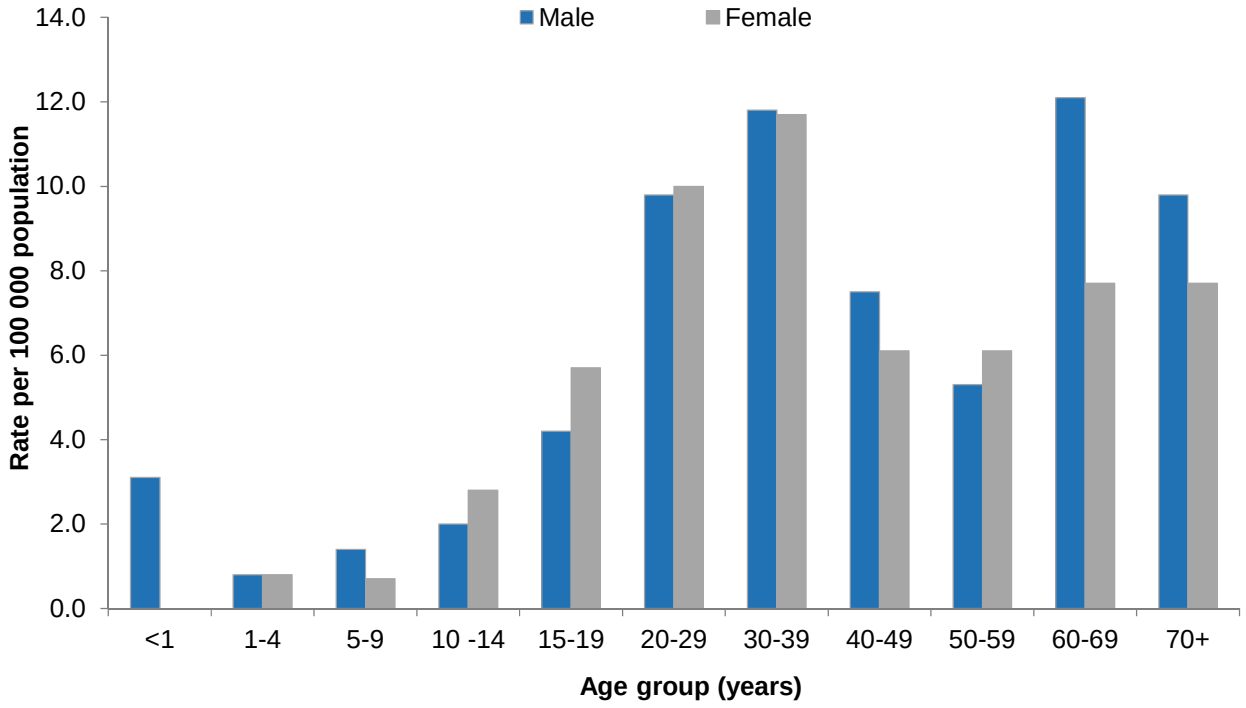


Table 4 shows the distribution of TB cases by ethnicity in 2010. The highest rate of TB disease occurred in the Asian ethnic group (51.9 per 100 000, 177 cases), followed by 'Other' (35.4 per 100 000, 12 cases), Pacific Peoples (19.9 per 100 000, 45 cases), Māori (6.2 per 100 000, 35 cases) and European (1.1 per 100 000, 30 cases).

Table 4: Tuberculosis disease notifications by ethnicity[1], 2010

Ethnicity[1]	Cases	Rate[2]
Māori	35	6.2
Pacific Peoples	45	19.9
Asian	177	51.9
Other	12	35.4
European	30	1.1
Unknown	5	-
Total	**304**	**7.5**

[1] Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, Other, and European

[2] Rate per 100 000 based on the 2006 census data

Geographic information

The numbers of cases and rates of TB disease varied across the District Health Boards (DHBs) in 2010 (Table 20 in the appendix). More than half of the disease notifications (52.0%, 158 cases) were reported by the three DHBs in the Auckland region. The highest rates of TB disease were in the Auckland DHB (14.0 per 100 000, 63 cases), followed by Counties Manukau (12.4 per 100 000, 61 cases), Capital and Coast (9.6 per 100 000, 28 cases), and Hutt Valley (9.0 per 100 000, 13 cases) DHBs.

Risk and protective factor information

For the 304 TB disease notifications in 2010, data completion varied for each risk/protective factor. Table 5 shows TB disease notification for 2010 by risk/protective factors.

For those cases where the risk/protective factor information was recorded, 79.3% (130 cases) had been vaccinated with Bacillus Calmette-Guérin (BCG), 76.2% (198 cases) were currently residing or had recently resided with a person born overseas, 24.5% (59 cases) had contact with a confirmed case, 17.8% (50 cases) had an immunosuppressive illness, 8.2% (18 cases) were exposed in a healthcare setting, 4.6% (13 cases) were on immunosuppressive medication, and 3.4% (8 cases) were currently residing or had recently resided in an institution.

Table 5: Tuberculosis disease notifications by selected risk and protective factors, 2010

Category	Yes		No		Total
	No.	%	No.	%	
Vaccinated with BCG	130	79.3	34	20.7	164
Current/recent residence with person born outside NZ	198	76.2	62	23.8	260
Contact with a confirmed case	59	24.5	182	75.5	241
Has immunosuppressive illness	50	17.8	231	82.2	281
Exposure in a healthcare setting	18	8.2	202	91.8	220
On immunosuppressive medication	13	4.6	270	95.4	283
Current/recent residence in an institution	8	3.4	228	96.6	236

Of the 304 TB disease notifications in 2010, information on whether the case was born in New Zealand or overseas was recorded for 302 cases (99.3%). Of these 302 cases, 19.9% (60 cases) were born in New Zealand and 80.1% (242 cases) were born overseas.

The highest TB disease rate was for those born in Asia (64.9 per 100 000, 163 cases), followed by those born in Sub-Saharan Africa (33.8 per 100 000, 20 cases) and in the Pacific Islands (32.4 per 100 000, 44 cases) (Table 6).

Table 6: Tuberculosis disease notifications by birth country, 2010

Birth country region (n=300)[2]	Cases	Rate[1]
Asia	163	64.9
Australia	0	-
New Zealand	60	2.0
North Africa and the Middle East	2	-
North America	0	-
North West Europe	8	2.7
Pacific Islands	44	32.4
South and Central America	0	-
Southern and Eastern Europe	3	-
Sub-Saharan Africa	20	33.8

[1] Rate per 100 000 based on census 2006 birthplace for the usually resident population counts
[2] Two cases born overseas but with no country information were excluded

Table 7 shows the number and percentage of TB disease cases born in New Zealand or overseas by ethnicity. For cases born in New Zealand, the largest proportion of TB disease notifications occurred among Māori (56.7%), followed by those of European (21.7%) ethnicity and Pacific Peoples (16.7%). For cases born overseas, the largest proportion of TB disease notifications occurred among those of Asian ethnicity (72.3%) followed by Pacific Peoples (14.0%).

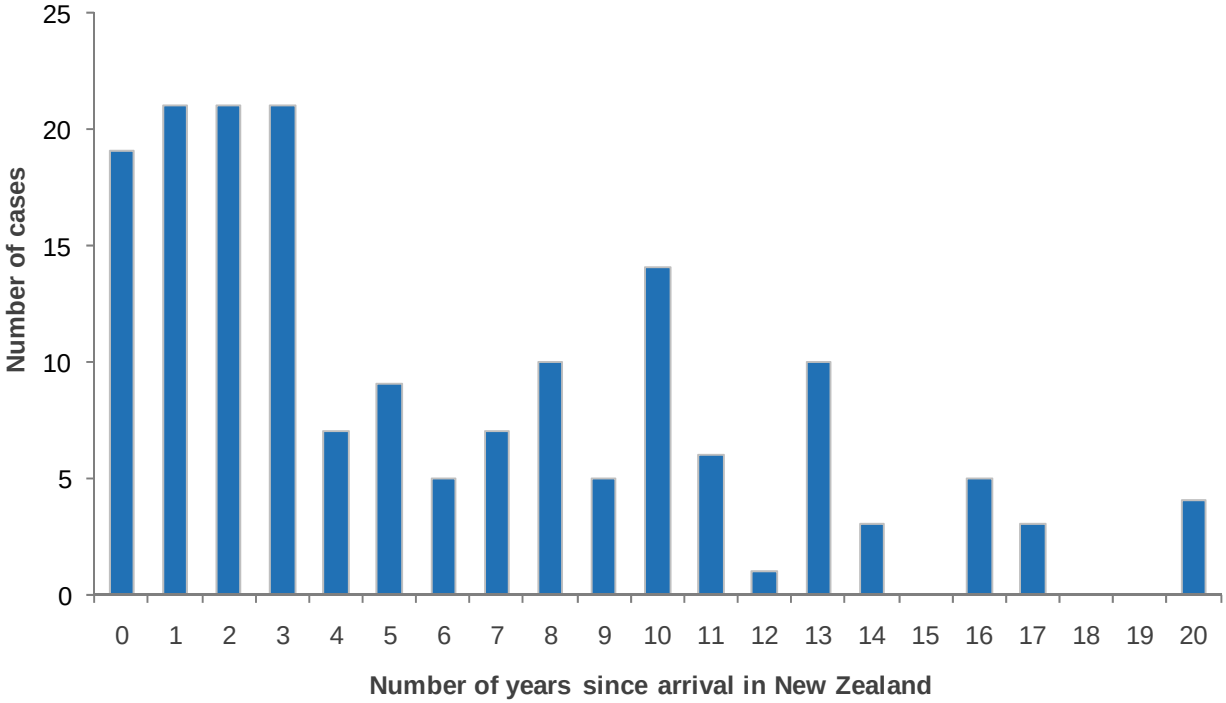
Table 7: New Zealand-born and overseas-born tuberculosis disease notifications by ethnicity, 2010

Ethnicity[1]	Born in New Zealand		Born Overseas	
	No.	%	No.	%
Māori	34	56.7	-	-
Pacific Peoples	10	16.7	34	14.0
Asian	2	3.3	175	72.3
Other	-	-	12	5.0
European	13	21.7	17	7.0
Unknown	1	1.7	4	1.7
Total	**60**	**100**	**242**	**100**

[1] Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, Other, and European

The date of arrival in New Zealand was recorded for 76.3% (183/242) of the overseas-born TB disease notifications in 2010. Of these, the interval between date of arrival in New Zealand and the TB disease notification date ranged from 19 days to 59 years, with a median interval of five years. For 48.6% 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 by number of years since arrival in New Zealand[1], 2010



[1] Excludes 12 cases with TB disease notification >20 years after arrival in New Zealand and 59 cases where information on arrival date was not recorded

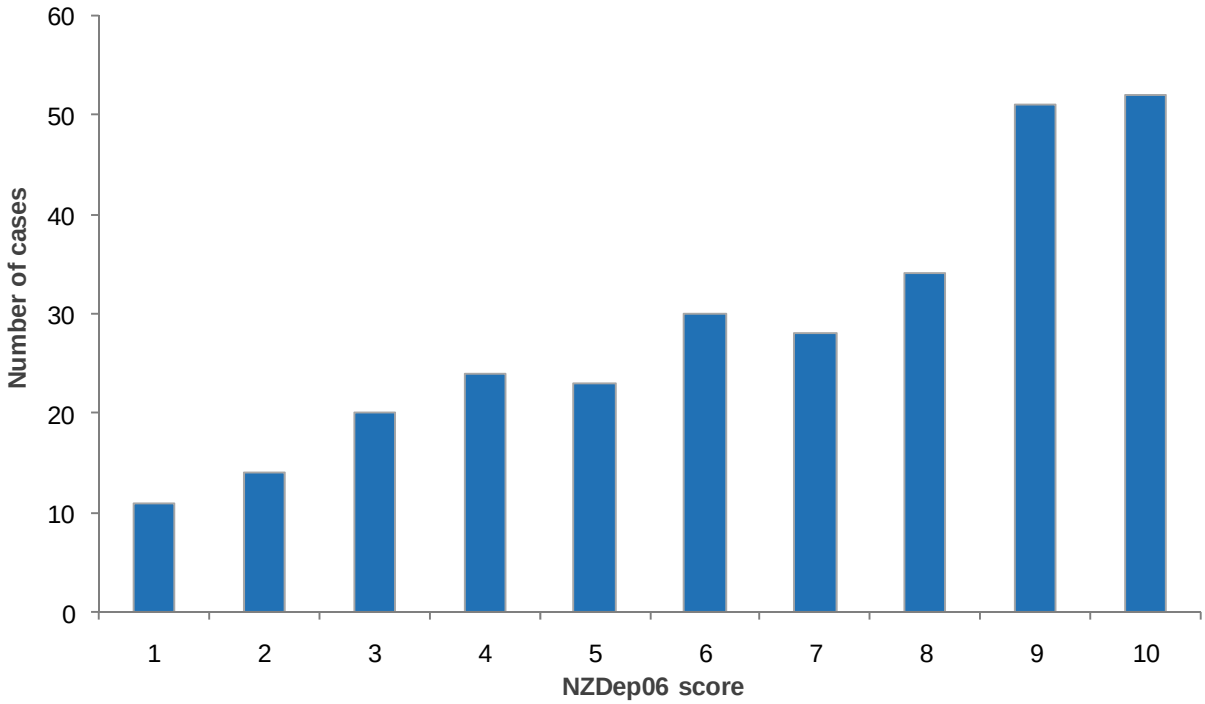
Table 8 shows that over the five-year period from 2006 to 2010, the median interval between arrival in New Zealand and TB disease notification fluctuated between three and five years. The mean interval between arrival in New Zealand and TB disease notification was 7.6 years in 2010, a decrease from 8.5 years in 2009.

Table 8: Time interval between arrival in New Zealand and tuberculosis disease notification among overseas-born cases, 2006 to 2010

Year	Mean interval (years)	Median interval (years)
2006	6.9	4
2007	6.9	3
2008	8.4	4
2009	8.5	4
2010	7.6	5
Total	**7.6**	**4**

Figure 4 shows the distribution of TB disease notifications in 2010 by the NZDep06 decile score. In 2010, 94.4% (287/304) of TB disease notifications had residential addresses recorded that could be linked to NZDep06. Of these, the highest proportion 18.1% (52 cases) resided in the most deprived areas (NZDep06 decile 10), while the lowest proportion 3.8% (11 cases) resided in the least deprived areas (NZDep06 decile 1). Fifty-eight percent of cases resided in areas of NZDep06 decile 7 or higher.

Figure 4: Tuberculosis disease notifications by the NZDep06 decile scale, 2010



Basis of discovery

Table 9 shows the way cases were discovered in 2010. Of the 304 TB disease notifications, information was available for 289 (95.1%) cases. TB disease was mostly discovered when the symptomatic case presented to a health practitioner (68.4% of total cases). Immigrant or refugee screening was the basis of discovery for 8.9% of cases, and 3.9% of cases were discovered through contact follow-up. Fourteen percent of cases were discovered through unspecified ways other than described previously.

Table 9: Tuberculosis disease notifications by basis of discovery, 2010

Basis of discovery	Cases	Percent
Attended practitioner with symptoms	208	68.4
Contact follow-up	12	3.9
Immigrant/refugee screening	27	8.9
Other	42	13.8
Unknown	15	4.9

Basis of diagnosis

Table 10 shows the basis of diagnosis for the 304 TB disease notifications recorded in 2010. Isolation of *M. tuberculosis* or *M. bovis* from a clinical specimen was recorded as the basis of diagnosis for 83.2% of the cases.

Table 10: Tuberculosis disease notifications by basis of diagnosis, 2010

Basis of diagnosis[1]	Cases	Percent
Isolation of *M. tuberculosis* or *M. bovis* from a clinical specimen	253	83.2
Demonstration of acid-fast bacilli in a clinical specimen	119	39.1
Demonstration of *M. tuberculosis* nucleic acid (PCR or LCR only)	69	22.7
Histology strongly suggestive of tuberculosis	48	15.8

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

Mycobacterium species

Based on information received from the three mycobacteriology reference laboratories, 253 (83.2%) of the 304 TB disease notifications in 2010 were culture positive. Among the 253 culture-positive cases, 250 (98.8%) were due to *M. tuberculosis* and three cases (1.2%) were due to *M. bovis*.

Site of infection

Site of infection was recorded for 98.0% (298/304) of TB disease notifications in 2010. Of these, 135 (45.3%) cases were pulmonary only, 28 (9.4%) cases were both pulmonary and extra-pulmonary and 135 (45.3%) cases were extra-pulmonary only. Table 11 shows the distribution of disease sites among the 163 cases with extra-pulmonary TB. Of the seven cases with either tuberculous meningitis or miliary TB, none were aged less than 15 years.

Table 11: Extra-pulmonary tuberculosis disease notifications by site of infection, 2010

Site[1] of extra-pulmonary TB	Cases	Percent
Node (excluding abdominal)	68	41.7
Intra-abdominal (excluding renal)	19	11.7
Pleural	24	14.7
Bone/joint	16	9.8
Renal/urinary tract	4	2.5
Tuberculous meningitis	4	2.5
Miliary tuberculosis	3	1.8
Other[2]	23	14.1
Not stated	2	1.2

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

[2] Other includes TB of skin

Pulmonary cases

Of the 298 TB cases with information in 2010, 163 (54.7%) had pulmonary disease. Of these pulmonary TB disease notifications, 151 (92.6%) had outcome information recorded regarding the demonstration of acid-fast bacilli in a clinical specimen. A total of 92 (60.9%) were smear positive, that is, they demonstrated acid-fast bacilli in a clinical specimen. Of these, 67 (72.8%) were from sputum specimens.

Hospitalisations

Hospitalisation status was known for 97.4% (296/304) of TB disease notifications in 2010. Of these, 174 (58.8%) cases were hospitalised.

Mortality

Mortality status was known for 99.3% (302/304) of TB disease notifications in 2010. Of these, nine deaths were reported giving a mortality rate of 3.0%.

Outbreaks

In 2010 there were nine cases (3.0% of total TB disease notifications) involved in five TB outbreaks. All were outbreaks of *M. tuberculosis*. These outbreaks were reported from Hutt Valley, Capital and Coast, and Waikato DHBs.

Delay to treatment

The interval between onset of symptoms and start of treatment could be calculated for 193 (63.5%) of the 304 TB disease notifications in 2010. Of these, 62 (32.1%) cases started treatment within one month of the onset of symptoms and 58 (30.1%) cases started treatment between one and three months. The median interval to start of treatment was two months.

Treatment delay in patients with pulmonary TB disease represents a risk to public health from disease transmission. The interval between onset of symptoms and start of treatment could be calculated for 100 (61.3%) of the 163 TB disease cases with pulmonary disease alone. Of these, 40 (40.0%) cases started treatment within one month of the onset of symptoms and 32 (32.0%) started treatment between one and three months. The median interval to start of treatment was two months.

Use of directly observed therapy and treatment outcomes

Due to the length of time taken for treatment of TB disease to be completed, data for the 298 TB disease cases notified in 2009 are presented in this section. Information on the use of directly observed therapy (DOT) was known for 289 (97.0%) of 298 cases notified in 2009. Of these, 89 (30.8%) received DOT throughout the course of treatment. Treatment outcome information was recorded for 284 (95.3%) of the 298 cases. Of these, 244 (85.9%) completed treatment to the satisfaction of the prescribing doctor, 16 (5.6%) died before completion of treatment, 15 (5.3%) went overseas, and five (1.8%) stopped treatment because of adverse effects.

TB molecular typing

Of the 250 culture-positive cases due to *M. tuberculosis* in 2010, 55 (22.0%) cases had a non-unique molecular type. These cases were associated with 26 separate molecular types. The remaining 195 cases (78.0%) had a unique molecular type.

Table 12 and Table 13 compare the distribution of cases with non-unique and unique molecular types across demographic information, risk and protective factors and clinical features for the period 2006 to 2010. This comparison is based on subcategory-specific proportions. Due to small expected numbers in some of the subcategories, it is important to refer to the actual number of cases reported in the tables when interpreting the significance of these results. Over the five-year period, there were 1196 *M. tuberculosis* cases that had TB molecular typing results, of which 393 (32.9%) were non-unique. These 393 cases were associated with 133 molecular types.

Cases with non-unique molecular types were significantly ($p \leq 0.05$) more likely to be aged less than one year, 5 to 9 years, 10 to 14 years or 15 to 19 years, to be of Māori or Pacific Peoples ethnicity, and to reside in Northland, Tairawhiti, Hawke's Bay, Whanganui or Wairarapa DHBs. Such cases were also significantly more likely to have the following risk factors and clinical features: contact with a confirmed case of TB, no exposure in a healthcare setting, born in New Zealand or a Pacific Island country, no current or recent residence with a person born outside of New Zealand, current or recent residence in an institution, not having been vaccinated with BCG and having pulmonary TB disease.

In contrast, cases with unique molecular types were significantly ($p \leq 0.05$) more likely to be aged 20 to 29 years or 70 years and over, to be of Asian or 'Other' ethnicity, and to reside in Waitemata or Auckland DHBs. These cases were also significantly more likely to have the following risk factors: no contact with a confirmed case, born outside New Zealand, born in Asia or Sub-Saharan Africa, current or recent residence with a person born outside New Zealand, no exposure in a healthcare setting and not to have pulmonary TB disease.

Table 12: Comparison of tuberculosis disease cases with unique and non-unique molecular types by demographic factors, 2006 to 2010

Category	Sub-category	Molecular type				$\chi 2$	*p*-value
		Non-unique (n=393)		Unique (n=803)			
		No.	%	No.	%		
Age group (years)	<1	6	75.0	2	25.0	6.5	0.011
	1 to 4	2	66.7	1	33.3	1.6	0.212
	5 to 9	5	71.4	2	28.6	4.7	0.029
	10 to 14	19	90.5	2	9.5	32.2	<0.001
	15 to 19	44	62.9	26	37.1	30.3	<0.001
	20 to 29	66	24.9	199	75.1	9.8	0.002
	30 to 39	70	28.8	173	71.2	2.3	0.132
	40 to 49	52	34.4	99	65.6	0.2	0.659
	50 to 59	48	34.3	92	65.7	0.1	0.702
	60 to 69	48	35.0	89	65.0	0.3	0.564
	70+	33	21.9	118	78.1	9.5	0.002
Sex	Male	196	33.3	392	66.7	0.1	0.732
	Female	196	32.4	409	67.6	0.1	0.730
	Unknown	1	33.3	2	66.7	0.0	0.986
Ethnicity (prioritised)[1]	Māori	141	75.0	47	25.0	179.5	<0.001
	Pacific Peoples	89	56.0	70	44.0	44.4	<0.001
	Asian	103	16.3	527	83.7	164.5	<0.001
	Other	14	20.0	56	80.0	5.6	0.018
	European	38	31.1	84	68.9	0.2	0.671
	Unknown	8	29.6	19	70.4	0.1	0.718
District Health Board	Northland	25	52.1	23	47.9	8.4	0.004
	Waitemata	44	26.2	124	73.8	3.9	0.047
	Auckland	50	21.2	186	78.8	18.2	<0.001
	Counties Manukau	85	36.2	150	63.8	1.5	0.228
	Waikato	29	37.2	49	62.8	0.7	0.401
	Lakes	5	41.7	7	58.3	0.4	0.514
	Bay of Plenty	10	30.3	23	69.7	0.1	0.751
	Tairawhiti	5	83.3	1	16.7	7.0	0.008
	Taranaki	4	57.1	3	42.9	1.9	0.170
	Hawke's Bay	24	66.7	12	33.3	19.2	<0.001
	Whanganui	6	75.0	2	25.0	6.5	0.011
	MidCentral	18	41.9	25	58.1	1.6	0.201
	Hutt Valley	14	31.8	30	68.2	0.0	0.881
	Capital and Coast	26	31.0	58	69.0	0.1	0.700
	Wairarapa	2	100.0	0	0.0	4.1	0.043
	Nelson Marlborough	4	28.6	10	71.4	0.1	0.731
	West Coast	1	33.3	2	66.7	0.0	0.986
	Canterbury	39	32.8	80	67.2	0.0	0.983
	South Canterbury	0	0.0	3	100.0	1.5	0.225
	Southern	2	11.8	15	88.2	3.5	0.062

[1] Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, Other, and European.

Table 13: Comparison of tuberculosis disease cases with unique and non-unique molecular types by risk and protective factors, and clinical features, 2006 to 2010

Category	Sub-category	Molecular type				χ^2	*p*-value
		Non-unique (n=393)		Unique (n=803)			
		No.	%	No.	%		
Contact with a confirmed case	Yes	143	53.6	124	46.4	66.8	<0.001
	No	162	24.7	493	75.3	43.3	<0.001
	Unknown	88	32.1	186	67.9	0.1	0.766
Exposure in a healthcare setting	Yes	19	27.5	50	72.5	0.9	0.332
	No	294	34.9	548	65.1	5.5	0.019
	Unknown	80	28.1	205	71.9	3.9	0.049
Born outside NZ	Yes	198	22.0	702	78.0	194.4	<0.001
	No	187	67.0	92	33.0	192.5	0.000
	Unknown	8	47.1	9	52.9	1.6	0.209
Current or recent residence with person born outside NZ	Yes	179	24.5	552	75.5	59.7	<0.001
	No	153	51.7	143	48.3	63.2	<0.001
	Unknown	61	36.1	108	63.9	0.9	0.334
Birth country region	New Zealand	187	67.0	92	33.0	192.5	<0.001
	Australia	3	75.0	1	25.0	3.2	0.072
	Pacific Island	74	51.0	71	49.0	24.7	<0.001
	North Western Europe	3	14.3	18	85.7	3.3	0.068
	Southern and Eastern Europe	1	11.1	8	88.9	1.9	0.163
	North Africa and the Middle East	0	0.0	7	100.0	3.4	0.063
	South-East Asia	29	14.7	168	85.3	35.2	<0.001
	North-East Asia	31	20.0	124	80.0	13.3	<0.001
	Southern and Central Asia	36	13.8	225	86.2	55.0	<0.001
	North America	0	0.0	1	100.0	0.5	0.484
	Southern and Central America	0	0.0	5	100.0	2.5	0.117
	Sub-Saharan Africa	21	23.1	70	76.9	4.3	0.039
	Unknown	8	38.1	13	61.9	0.3	0.606
Current or recent residence in an institution	Yes	21	56.8	16	43.2	9.9	0.002
	No	307	32.5	638	67.5	0.3	0.594
	Unknown	65	30.4	149	69.6	0.7	0.393
Has immunosuppressive illness	Yes	72	33.2	145	66.8	0.0	0.912
	No	284	31.8	609	68.2	1.8	0.182
	Unknown	37	43.0	49	57.0	4.3	0.037
On immunosuppressive medication	Yes	18	32.1	38	67.9	0.0	0.907
	No	340	32.5	706	67.5	0.5	0.490
	Unknown	35	37.2	59	62.8	0.9	0.347
Vaccinated with BCG	Yes	138	29.6	329	70.4	3.8	0.051
	No	74	39.8	112	60.2	4.8	0.029
	Unknown	181	33.3	362	66.7	0.1	0.750
Pulmonary disease	Yes	298	36.7	514	63.3	16.9	<0.001
	No	85	24.3	265	75.7	16.5	<0.001
	Unknown	10	29.4	24	70.6	0.2	0.664

TB and HIV co-infection

Of the 304 TB disease notifications in 2010, HIV and TB co-infection was noted in three (1.0%) cases.

TB drug susceptibility

Antimicrobial susceptibility data for the isolates from 253 culture-positive TB disease cases in 2010 were available. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 14. Overall, during the last 10 years from 2001 to 2010, there has been no significant change ($p \leq 0.05$) in resistance to any of these five antimicrobials.

Table 14: Resistance to each antimicrobial, by mycobacterial species, 2010

Antimicrobial	Resistant[1]					
	M. tuberculosis (n=250)		*M. bovis* (n=3)		All isolates (n=253)	
	No.	%	No.	%	No.	%
Isoniazid (0.1 mg/L)	19	7.6	1	33.3	20	7.9
Isoniazid (0.4 mg/L)[2]	15	6.0	0	-	15	5.9
Rifampicin	5	2.0	0	-	5	2.0
Ethambutol	3	1.2	0	-	3	1.2
Pyrazinamide	2	0.8	3[3]	100	5	2.0
Streptomycin	16	6.4	0	-	16	6.3

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

[2] 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

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

In 2010, 86.2% (218/253) of the isolates were fully susceptible to all five antimicrobials tested. There were four cases of multidrug-resistant tuberculosis (MDR-TB, defined as resistance to at least isoniazid and rifampicin) (Table 15). In the last 10 years there have been 28 cases of MDR-TB – an average annual rate of 1.0% among culture-positive TB disease cases. All but two of these 28 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). For the first time in New Zealand, one of the MDR-TB cases was XDR-TB in 2010. The isolate was resistant to isoniazid, rifampicin, ethambutol, pyrazinamide, streptomycin, ofloxacin, amikacin, capreomycin and ethionamide. The patient was from South East Asia and had been in New Zealand for approximately three years prior to being diagnosed with TB.

Table 15: Distribution of antimicrobial resistance patterns among tuberculosis isolates, 2010

	Resistance pattern[1]	Percent (No.) of isolates with each pattern
Fully susceptible		**86.2 (218)**
Resistant to 1 agent		**10.7 (27)**
	H	5.1 (13)
	S	4.4 (11)
	Z	0.8 (2)
	E	0.4 (1)
Resistant to 2 agents		**2.4 (6)**
	HR[2]	0.8 (2)
	HS	0.8 (2)
	HZ	0.4 (1)
	RS	0.4 (1)
Resistant to 5 agents		**0.8 (2)**
	HREZS[2,3]	0.8 (2)

[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

[3] One of these two MDR-TB cases was XDR-TB (extensively drug-resistant tuberculosis, that is, MDR-TB with additional resistance to any fluoroquinolone and at least one of the following second-line drugs: capreomycin, kanamycin or amikacin)

Table 16 compares antimicrobial resistance among isolates from cases born in New Zealand and cases born overseas. Except for pyrazinamide, resistance was higher among cases born overseas, although the differences were not significant ($p \leq 0.05$). When the intrinsically resistant *M. bovis* isolates were excluded, there was also no significant difference in pyrazinamide resistance among isolates from New Zealand-born cases and those from overseas-born cases. All four cases of MDR-TB were born overseas.

Table 16: Antimicrobial resistance by place of birth, 2010[1]

	Born in New Zealand (n=46)		Born overseas (n=206)		*p*-value[2]
	No.	%	No.	%	
Fully susceptible					
	41	89.1	176	85.4	0.513
Resistant to:[3]					
Isoniazid[4]	1	2.2	19	9.2	0.138
Rifampicin	0	-	5	2.4	0.588
Ethambutol	0	-	3	1.5	1.000
Pyrazinamide	3	6.5	2	1.0	0.044
Streptomycin	2	4.4	14	6.8	0.744
MDR-TB[5]					
	0	-	4	1.9	1.000

[1] Place of birth not known for one case

[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, ethambutol and streptomycin resistance was most frequent among cases of Asian ethnicity, with 85.0% (17/20) of isoniazid-resistant isolates, all (5/5) rifampicin-resistant isolates, all (3/3) ethambutol-resistant isolates, and 68.8% (11/16) of streptomycin-resistant isolates being from cases of Asian ethnicity (Table 17). The three pyrazinamide-resistant cases in Māori were all *M. bovis* infections. All four cases of MDR-TB were of Asian ethnicity.

Table 17: Antimicrobial resistance by ethnicity, 2010

	Māori (n=30)		Pacific Peoples (n=39)		Asian (n=151)		Other (n=9)		European (n=21)		Unknown (n=3)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fully susceptible												
	25	83.3	38	97.4	126	83.4	8	88.9	19	90.5	2	66.7
Resistant to:[1]												
Isoniazid[2]	1	3.3	0	-	17	11.3	1	11.1	0	-	1	33.3
Rifampicin	0	-	0	-	5	3.3	0	-	0	-	0	-
Ethambutol	0	-	0	-	3	2.0	0	-	0	-	0	-
Pyrazinamide	3	10.0	0	-	2	1.3	0	-	0	-	0	-
Streptomycin	2	6.7	1	2.6	11	7.3	0	-	2	9.5	0	-
MDR-TB[3]												
	0	-	0	-	4	2.7	0	-	0	-	0	-

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

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

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

Ten (4.0%) of the 253 culture-positive cases, for which antimicrobial susceptibility data were available in 2010, 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, 2006 to 2010. During this period, 59 (4.8%) of the 1233 cases, that were culture positive and for which antimicrobial susceptibility data are available, were reported to be relapses/reactivations. Information on previous treatment was recorded for 46 of these 59 relapses/reactivations and, of these, 39 (84.8%) 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 Table 18. Compared with new cases, previously treated cases were significantly more resistant to isoniazid, more resistant to rifampicin, more likely to be MDR-TB, and less likely to be fully susceptible to all antimicrobials tested.

Table 18: Antimicrobial resistance among new cases, relapses/reactivations and previously treated cases, 2006 to 2010

	New cases (n=1174)	Relapse/reactivation cases			
		All (n=59)		Previously treated[1] (n=39)	
	%	%	*p*-value[2]	%	*p*-value[2]
Fully susceptible					
	87.7	78.0	0.030	71.8	0.004
Resistant to:[3]					
Isoniazid[4]	7.1	13.6	0.072	18.0	0.021
Rifampicin	1.1	6.8	0.007	10.3	0.002
Ethambutol	0.5	0.0	1.000	0.0	1.000
Pyrazinamide	3.1	5.1	0.672	5.1	0.756
Streptomycin	5.6	8.5	0.382	12.8	0.073
MDR-TB[5]					
	1.0	5.1	0.031	7.7	0.011

[1] Information on previous treatment reported for only 46 of the 59 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 notifications

During 2010, a total of 357 cases of TB infection (350 on treatment of latent infection and seven on preventive treatment) were notified. The TB infection rate was highest in Hutt Valley DHB (34.1 per 100 000, 49 cases), followed by Auckland (14.7 per 100 000, 66 cases) and Counties Manukau DHB (13.2 per 100 000, 65 cases) (Table 19).

Table 19: TB infections - cases and rates by DHB, 2010

District Health Board	Cases	Rate[1]
Northland	2	-
Waitemata	69	12.8
Auckland	66	14.7
Counties Manukau	65	13.2
Waikato	20	5.5
Lakes	-	-
Bay of Plenty	5	2.4
Tairawhiti	-	-
Taranaki	-	-
Hawke's Bay	4	-
Whanganui	3	-
MidCentral	18	10.8
Hutt Valley	49	34.1
Capital and Coast	34	11.7
Wairarapa	-	-
Nelson Marlborough	2	-
West Coast	-	-
Canterbury	19	3.7
South Canterbury	-	-
Southern	1	-
Total	**357**	**8.2**

[1]Rate per 100 000 using 2010 mid-year population estimate

APPENDIX

APPENDIX

Table 20: Tuberculosis disease notifications by demographic and geographic factors, 2006–2010

Category	2006		2007		2008		2009		2010	
	Cases	Rate[1]	Cases	Rate[1]	Cases	Rate[1]	Cases	Rate[1]	Cases	Rate[1]
Age group										
<1	3	-	3	-	1	-	3	-	1	-
1 to 4	9	4.0	9	3.9	3	1.3	9	3.7	2	-
5 to 9	4	-	7	2.4	6	2.1	6	2.1	3	-
10 to 14	19	6.1	4	-	6	2.0	3	-	7	2.4
15 to 19	20	6.4	20	6.3	15	4.7	15	4.6	16	5.0
20 to 29	88	16.0	53	9.5	59	10.4	64	10.9	60	9.9
30 to 39	58	9.7	51	8.6	58	9.9	52	9.0	67	11.7
40 to 49	47	7.5	33	5.2	29	4.6	47	7.4	43	6.8
50 to 59	33	6.5	29	5.7	35	6.7	39	7.3	31	5.7
60 to 69	26	7.6	34	9.4	39	10.3	30	7.6	40	9.8
70+	43	12.1	39	10.7	42	11.3	30	7.9	34	8.7
Unknown	0	-	0	-	0	-	0	-	0	-
Sex										
Male	176	8.6	133	6.4	156	7.5	152	7.2	154	7.2
Female	171	8.0	149	6.9	137	6.3	146	6.6	150	6.7
Unknown	3	-	0	-	0	-	0	-	0	-
Ethnicity (prioritised)[2, 3]										
Māori	62	11.0	48	8.5	45	8.0	52	9.2	35	6.2
Pacific Peoples	48	21.2	27	11.9	52	23.0	32	14.1	45	19.9
Asian	152	44.6	140	41.1	145	42.5	157	46.1	177	51.9
Other	31	91.5	22	64.9	12	35.4	13	38.4	12	35.4
European	50	1.9	37	1.4	31	1.2	40	1.5	30	1.1
Unknown	7	-	8	-	8	-	4	-	5	-
District Health Board										
Northland	30	19.7	15	9.7	7	4.5	8	5.1	6	3.8
Waitemata	31	6.1	40	7.8	49	9.4	48	9.1	34	6.3
Auckland	56	13.1	52	12.0	54	12.3	63	14.2	63	14.0
Counties Manukau	67	14.7	39	8.4	57	12.0	66	13.7	61	12.4
Waikato	33	9.4	21	5.9	18	5.1	14	3.9	22	6.0
Lakes	3	-	1	-	4	-	6	5.9	3	-
Bay of Plenty	7	3.5	8	3.9	8	3.9	12	5.8	6	2.9
Tairawhiti	0	-	0	-	1	2.2	6	13.0	3	6.5
Taranaki	3	-	3	-	3	-	0	-	1	-
Hawke's Bay	8	5.2	17	11.1	5	3.3	9	5.8	10	6.4
Whanganui	2	-	3	-	3	-	0	-	2	-
MidCentral	31	18.9	10	6.1	7	4.3	6	3.6	9	5.4
Hutt Valley	8	5.7	11	7.8	17	12.0	10	7.0	13	9.0
Capital and Coast	32	11.5	17	6.0	25	8.8	17	5.9	28	9.6
Wairarapa	2	-	1	-	0	-	0	-	1	-
Nelson Marlborough	4	-	3	-	5	3.7	4	-	5	3.6
West Coast	2	-	1	-	0	-	2	-	1	-
Canterbury	21	4.3	36	7.3	28	5.6	22	4.4	27	5.3
South Canterbury	1	-	1	-	0	-	2	-	0	-
Southern	9	3.1	3	1.0	2	-	3	-	9	3.0
Total	**350**	**8.4**	**282**	**6.7**	**293**	**6.9**	**298**	**6.9**	**304**	**7.0**

[1] Rate per 100 000 based on the mid-year population estimate.

[2] Rate per 100 000 based on 2006 census data

[3] Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, Other, and European

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