TUBERCULOSIS IN NEW ZEALAND
ANNUAL REPORT 2009

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by

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TUBERCULOSIS IN NEW ZEALAND
ANNUAL REPORT 2009

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SUMMARY

In 2009, 671 cases of tuberculosis (TB) were notified, these notifications comprised 300 cases of TB disease (new and relapse/reactivation cases) and 371 cases of TB infection (treatment of latent infection and old disease on preventive treatment).

Annual TB disease notification rates have more than halved since 1980 (15.1 per 100 000 population) and continue to trend downwards with the 2009 notification rate of 7.0 per 100 000 population.

Disease notification rates in 2009 were highest in those aged 20 to 29 years (10.9 per 100 000 population, 64 cases). This age group also contained the highest number of cases.

The highest rate of TB disease occurred in the Asian ethnic group in 2009 (46.4 per 100 000 population), followed by "Other" ethnicity (38.4 per 100 000 population). Case numbers were greatest in the Asian ethnic group (158 cases), followed by Māori (53 cases).

More than half of the disease notifications (59.3%, 178 cases) were reported by the three District Health Boards (DHBs) in the Auckland region. The highest rates of TB disease were in the Auckland DHB (14.2 per 100 000 population, 63 cases), followed by Counties Manukau DHB (13.7 per 100 000 population, 66 cases) and Tairawhiti DHB (13.0 per 100 000 population, 6 cases).

TB disease notifications were skewed towards those living in more socio-economically deprived areas with 60.0% (168/280) of cases assigned to the four most deprived New Zealand Social Deprivation Index deciles.

Being born overseas (73.8%, 220/298) and current or recent residence with a person born outside of New Zealand (67.8%, 166/245), were the most commonly reported risk factors amongst the cases. Thirty-one percent (69/223) 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 (60.9 per 100 000 population, 153 cases), followed by those born in Sub-Saharan Africa (35.5 per 100 000 population, 21 cases) and those born in the Pacific Islands (25.8 per 100 000 population, 35 cases).

For 51.7% of the cases born overseas (775/149) TB disease was reported less than five years after arriving in New Zealand.

Over three-quarters (76.0%, 228/300) of the TB disease notifications in 2009 were culture positive, of which 223 (97.8%) were due to *Mycobacterium tuberculosis* and five (2.2%) were due to *M. bovis*.

Over half of the cases had pulmonary disease (51.4%, 150/292). Among those with extra-pulmonary disease, this was most commonly in a lymph node (excluding abdominal) (32.4%, 46 cases), followed by pleural (14.8%, 21 cases) and "other" sites (includes TB of the skin) (14.1%, 20 cases).

Sixty-one percent of cases were hospitalised (181/296), and the mortality rate was 1.0% (3/291). Three cases (1.0%) were co-infected with HIV and TB.

Three TB outbreaks were reported during 2009, the largest of which involved 12 confirmed cases in multiple health districts, Canterbury and Nelson Marlborough.

The median interval between symptom onset in cases and starting treatment was six months, with 29.3% of cases (49/167) commencing treatment within one month of symptom onset.

Based on the 2008 TB disease notification data, 84.2% of cases (240/285) completed their treatment course, 26 cases (9.1%) went overseas, 16 cases (5.6%) died before treatment completion, four cases (1.4%) stopped treatment because of adverse effects, and one case (0.4%) was lost to follow up. Around 33% of the 2008 cases (95/286) received directly observed therapy throughout the course of their treatment.

Over the 2005 to 2009 period, 1124 *M. tuberculosis* cases had TB molecular typing results of which 397 (35.3%) were non-unique. The 397 cases with non-unique typing results 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, 10 to 14 years or 15 to 19 years, to be of Māori or Pacific ethnicity and to reside in Northland, Counties Manukau or Hawke's Bay DHBs. Such cases were also significantly more likely to have the following risk factors or clinical features: contact with a confirmed case of TB, born in a Pacific Island country and pulmonary TB disease.

From 2000 to 2009, there has been no significant change in resistance to the five routinely tested antimicrobial drugs used to treat TB. In 2009, there were six (2.4%) cases of multidrug-resistant TB (MDR-TB). A total of 22 MDR-TB cases have been identified during the last 10 years, and all but two are assumed to have acquired their MDR-TB overseas. Up until the end of 2009, no cases of extensively drug-resistant TB (XDR-TB) had been identified in New Zealand.

1. 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. The annual incidence rate of TB disease in New Zealand was approximately seven cases per 100 000 population in 2007. Based on the 2007 statistics reported by the World Health Organization (1), this incidence rate is higher than the United States (4 per 100 000 population), Canada (5 per 100 000 population) and Australia (6 per 100 000 population), but lower than the United Kingdom (15 per 100 000 population).

1.1. Purpose

This report summarises the descriptive epidemiology of TB notifications (disease and latent infections) in New Zealand for 2009 and examine trends from 2005 to 2009. 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 New Zealand TB practitioners, including medical officers of health and respiratory and infectious disease physicians.

2. METHODS

2.1. 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) 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.

2.1.1. 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 and infection to their local medical officer of health under the Tuberculosis Act 1948.

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.

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.

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 M. tuberculosis *or* M. 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.

2.1.2. TB Species and Drug Susceptibility Data

Antimicrobial susceptibility testing of *M. tuberculosis* and *M. bovis* isolates is undertaken by 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. Susceptibility to second-line antimicrobials is determined for all multidrug-resistant isolates (MDR-TB). The susceptibility results and species identification are sent to ESR and integrated with the tuberculosis disease case notifications recorded in EpiSurv.

2.1.3. 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. Isolates are primarily typed by restriction fragment length polymorphism (RFLP). For those isolates with fewer than or equal to six bands on RFLP, secondary typing is undertaken using mycobacterial interspersed repetitive units (MIRU) analysis. Tuberculosis molecular typing data from LabPlus are routinely reported to ESR and are periodically integrated with TB disease case notifications recorded within EpiSurv. Patients' TB isolates were defined as having a unique molecular type if the RFLP pattern or MIRU number did not match that of any other isolate in the national database.

2.1.4. TB/HIV Co-infection Data

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

2.2. Analytical Methods

This report includes all notifications of TB reported in New Zealand from 1 January 2009 to 31 December 2009. 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, 2008 notification data are used for the sections on use of directly observed treatment and treatment outcomes. The notification data were extracted from EpiSurv on 1 July 2010, 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 2009 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 data from Statistics New Zealand. Rates are not calculated where there are fewer than five notified cases in any category. Calculating rates from fewer than five cases produces unstable rates for comparisons.

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 (NZDep2006). NZDep2006 combines nine variables from the 2006 Census which reflect eight dimensions of deprivation. NZDep2006 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 NZDep2006 index of deprivation 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*.

3. RESULTS

3.1. Overall TB Notifications

During 2009, a total of 671 notified cases of TB were recorded in EpiSurv. Of these, 300 cases were TB disease (291 new cases and nine relapse or reactivations of TB disease) and 371 cases were TB infection (367 treatment of latent infection and four on preventive treatment) (Table 1).

Table 1: TB notifications by status, 2009

Disease Name	**Status**				
	Confirmed	Probable	Under Investigation	Not Applicable	**Total**
TB disease – new case	242	47	2	-	**291**
TB disease – relapse or reactivation	7	2	0	-	**9**
TB – treatment of latent infection	-	-	-	367	**367**
TB infection – on preventive treatment	-	-	-	4	**4**
Total	**249**	**49**	**2**	**371**	**671**

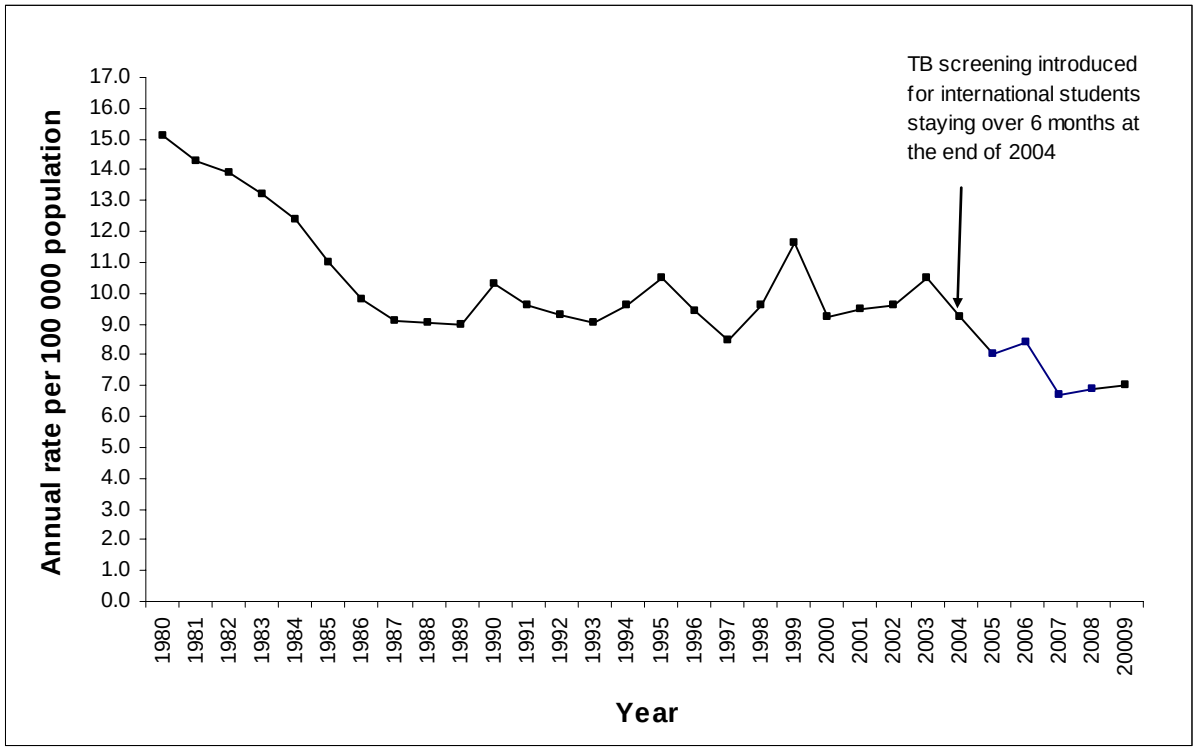
3.2. TB Disease Notifications

3.2.1. Trends

Long-term Trends (1980 to 2009)

Figure 1 shows the annual rate for TB disease notifications in New Zealand from 1980 to 2009. From 1980 to 2009 the annual notification rate per 100 000 population has decreased by 53.6% (15.1 in 1980 compared with 7.0 in 2009).

Figure 1: TB disease rate[1] by year, 1980 to 2009



[1] Rate per 100 000 population based on Census population data for (1980 to1990) and mid-year population estimate for each year (1991 to 2009)

Recent Trends (2005 to 2009)

From 2005 to 2009, the annual number of notifications of TB disease decreased by 9.1% (330 in 2005 compared with 300 in 2009). The annual rate per 100 000 population decreased by 12.5% (8.0 in 2005 compared with 7.0 in 2009) with a five-year average rate of 7.4 per 100 000 population (Table 2).

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

Table 2: TB disease notifications by status and year, 2005 to 2009

Year	Status				Total	Rate[1]
	Confirmed	Probable	Under investigation	Unknown		
2005	268	59	1	2	330	8.0
2006	274	75	1	-	350	8.4
2007	231	48	3	-	282	6.7
2008	247	42	4	-	293	6.9
2009	249	49	2	-	300	7.0
Total	**1269**	**273**	**11**	**2**	**1555**	**7.4**

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

3.2.2. Demographic Information

In 2009, the annual notification rate of TB disease differed by age group and sex (Table 3). The TB disease rate for males was higher than for females (7.2 per 100 000 population compared with 6.7 per 100 000 population, respectively).

The highest age-specific rate was reported in the 20 to 29 years age group (10.9 per 100 000 population, 64 cases), followed by the 30 to 39 years age group (9.2 per 100 000 population, 53 cases), the over 70 years age group (7.9 per 100 000 population, 30 cases), the 60 to 69 years age group (7.6 per 100 000 population, 30 cases) and the 40 to 49 years age group (7.6 per 100 000 population, 48 cases). For individuals aged less than 15 years the TB disease notification rate was 2.4 per 100 000.

The highest age-specific rate for males was reported in the over 70 years age group (12.0 per 100 000 population, 20 cases), whereas for females it was the 20 to 29 years age group (12.7 per 100 000 population, 37 cases).

Table 3: TB disease notifications by age group and sex, 2009

Age group (years)	Male		Female		Total	
	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
<1	0	-	3	-	3	-
1 to 4	4	-	5	4.2	9	3.7
5 to 9	3	-	3	-	6	2.1
10 to 14	2	-	1	-	3	-
15 to 19	10	6.0	5	3.2	15	4.6
20 to 29	27	9.2	37	12.7	64	10.9
30 to 39	23	8.4	30	10.0	53	9.2
40 to 49	25	8.2	23	7.0	48	7.6
50 to 59	22	8.4	17	6.3	39	7.3
60 to 69	17	8.8	13	6.5	30	7.6
70+	20	12.0	10	4.7	30	7.9
Total	**153**	**7.2**	**147**	**6.7**	**300**	**7.0**

[1] Rate per 100 000 population

The highest rate of TB disease occurred in the Asian ethnic group (46.4 per 100 000 population, 158 cases), followed by "Other" (38.4 per 100 000 population, 13 cases), Pacific Peoples (14.1 per 100 000 population, 32 cases), Māori (9.4 per 100 000 population, 53 cases) and European (1.5 per 100 000 population, 40 cases). Table 4 shows the age group and ethnicity distributions of TB cases in 2009.

Table 4: TB disease notifications by age group and ethnicity[1], 2009

Age group (years)	Māori		Pacific Peoples		Asian		Other		European		Unknown		Total	
	No.	Rate[2]	No.	Rate[2]	No.	Rate[2]	No.	Rate[2]	No.	Rate[2]	No.	Rate[2]	No.	Rate[2]
<1	2	-	0	-	0	-	1	-	0	-	0	-	3	-
1 to 4	6	11.5	1	-	2	-	0	-	0	-	0	-	9	4.1
5 to 9	2	-	0	-	1	-	2	-	1	-	0	-	6	2.1
10 to 14	0	-	0	-	2	-	0	-	1	-	0	-	3	-
15 to 19	8	13.7	1	-	4	-	0	-	1	-	1	-	15	5.0
20 to 29	3	-	7	20.2	46	60.7	1	-	5	1.7	2	-	64	12.5
30 to 39	4	-	3	-	38	68.6	4	-	4	-	0	-	53	9.2
40 to 49	12	17.3	3	-	25	45.8	3	-	4	-	1	-	48	7.9
50 to 59	6	14.0	11	64.5	16	53.5	2	-	4	-	0	-	39	8.0
60 to 69	7	30.5	2	-	16	106.3	0	-	5	1.9	0	-	30	9.1
70+	3	-	4	-	8	89.5	0	-	15	4.9	0	-	30	8.6
Total	**53**	**9.4**	**32**	**14.1**	**158**	**46.4**	**13**	**38.4**	**40**	**1.5**	**4**	**-**	**300**	**7.4**

[1] Ethnic groups were prioritised in the following order: Māori, Pacific Peoples, Asian, Other, European, Unknown
[2] Rate per 100 000 population based on the 2006 Census

3.2.3. Geographic Information

More than half of the disease notifications (59.3%, 178 cases) were reported by the three District Health Boards (DHBs) in the Auckland region. The highest rates of TB disease were in the Auckland DHB (14.2 per 100 000 population, 63 cases), followed by Counties Manukau DHB (13.7 per 100 000 population, 66 cases) and Tairawhiti DHB (13.0 per 100 000 population, 6 cases) (Table 5).

Table 5: TB disease notifications and rates by DHB, 2009

District Health Board	Number of cases	Rate[1]
Northland	8	5.1
Waitemata	49	9.3
Auckland	63	14.2
Counties Manukau	66	13.7
Waikato	14	3.9
Lakes	6	5.9
Bay of Plenty	12	5.8
Tairawhiti	6	13.0
Taranaki	0	-
Hawke's Bay	9	5.8
Whanganui	0	-
MidCentral	6	3.6
Hutt Valley	10	7.0
Capital and Coast	18	6.2
Wairarapa	0	-
Nelson Marlborough	4	-
West Coast	2	-
Canterbury	22	4.4
South Canterbury	2	-
Otago	1	-
Southland	2	-
Total	**300**	**7.0**

[1] Rate per 100 000 population

3.2.4. Risk Factor Information

For the 300 TB disease notifications in 2009, data completion varied for each risk/protective factor. Table 6 shows TB disease notification for 2009 by risk/protective factors.

For those cases where the information was recorded, 67.8% (166 cases) currently or recently resided with a person born overseas, 30.9% (69 cases) had contact with a confirmed case, 19.3% (53 cases) had an immunosuppressive illness, 7.7% (21 cases) were on immunosuppressive medication, 5.0% (11 cases) were exposed in a healthcare setting, and 4.2% (10 cases) currently or had recently resided in an institution. Seventy-one percent (105 cases) had been vaccinated with Bacille Calmette-Guérin (BCG).

Table 6: TB disease notifications risk and protective factors, 2009

Category	Yes		No	
	No.	%	No.	%
Contact with a confirmed case (n=223)	69	30.9	154	69.1
Exposure in a healthcare setting (n=221)	11	5.0	210	95.0
Current/recent residence in an institution (n=239)	10	4.2	229	95.8
Current/recent residence with person born outside NZ (n=245)	166	67.8	79	32.2
Has immunosuppressive illness (n=274)	53	19.3	221	80.7
On immunosuppressive medication (n=272)	21	7.7	251	92.3
Vaccinated with BCG (n=149)	105	70.5	44	29.5

Birth Country

Of the 298 cases that had birth country information recorded, 73.8% (220 cases) were born outside of New Zealand. The highest disease rate was for those born in Asia (60.9 per 100 000 population, 153 cases), followed by those born in Sub-Saharan Africa (35.5 per 100 000 population, 21 cases) and those born in the Pacific Islands (25.8 per 100 000 population, 35 cases) (Table 7).

Table 7: TB disease notifications by birth country, 2009

Birth country region (n=220)	**Number of cases**	**Rate**[1]
Asia	153	60.9
Australia	0	-
New Zealand	0	-
North Africa & the Middle East	2	12.1
North America	1	3.7
North West Europe	6	2.0
Pacific Islands	35	25.8
South & Central America	1	13.4
Southern & Eastern Europe	1	4.2
Sub-Saharan Africa	21	35.5

[1] Rate per 100 000 based on Census 2006 birthplace for the usually resident population counts

Table 8 shows the number and percentage of TB disease cases born in New Zealand or overseas by ethnicity. Of the 300 TB disease notifications in 2009, information on country of birth was recorded for 99.3% (298 cases). Of these, 26.2% (78 cases) were born in New Zealand and 73.8% (220 cases) were born overseas. For cases born in New Zealand, the largest proportion of TB disease notifications occurred among Māori (66.7%), followed by those of European (28.2%) ethnicity and Pacific Peoples (2.6%). For cases born overseas, the largest proportion of TB disease notifications occurred among those of Asian ethnicity (70.9%) followed by Pacific Peoples (13.6%).

Table 8: New Zealand-born and overseas-born TB disease notifications by ethnicity, 2009

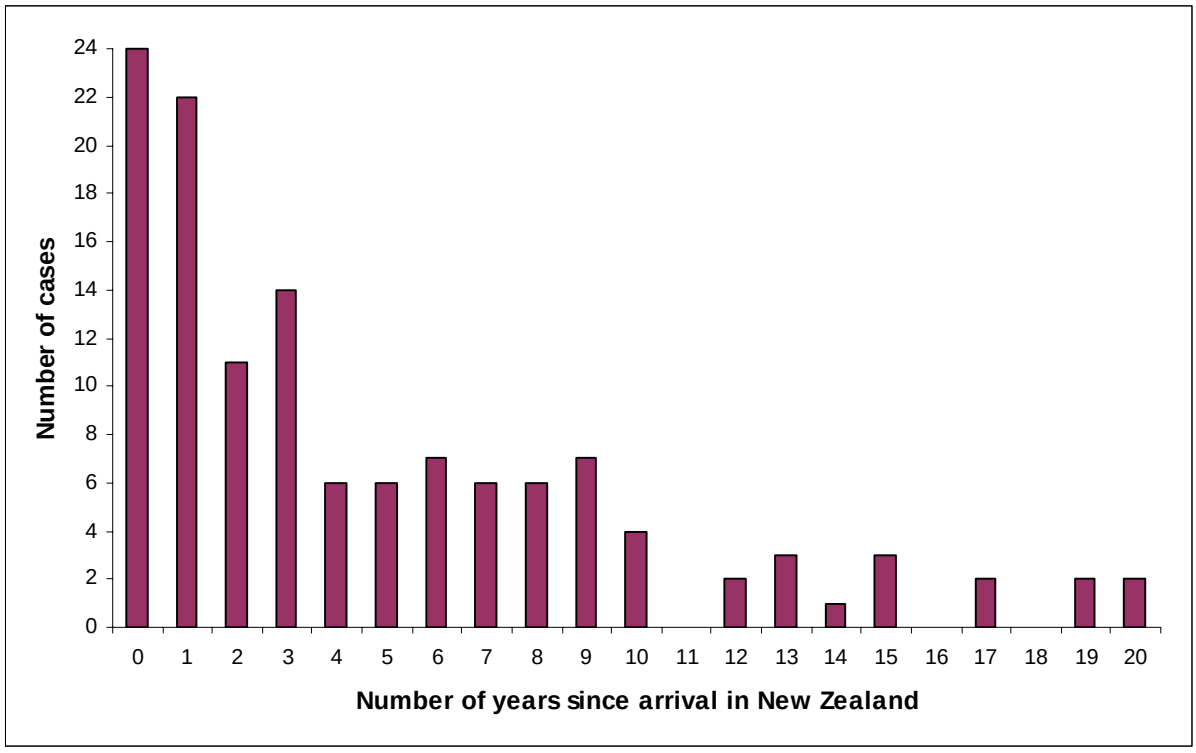
Ethnicity[1]	Born in New Zealand		Born overseas	
	No.	%	No.	%
Māori	52	66.7	1	0.5
Pacific Peoples	2	2.6	30	13.6
Asian	1	1.3	156	70.9
Other	1	1.3	12	5.5
European	22	28.2	17	7.7
Unknown	0	-	4	1.8
Total	**78**	**100**	**220**	**100**

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

The date of arrival in New Zealand was recorded for 67.7% (149/220) of the overseas-born TB disease notifications in 2009. Of these, the interval between date of arrival in New Zealand and TB disease notification date ranged from 11 days to 55 years, with a median interval of two years. For 51.7% of overseas-born cases TB disease notification occurred less than five years after arriving in New Zealand.

Figure 2 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 2: Overseas-born TB disease notifications by number of years since arrival in New Zealand[1], 2009



[1] Excludes 21 cases with TB disease notification >20 years after arrival in New Zealand and 71 cases where no information on arrival date was recorded

Table 9 shows that over the five-year period 2005 to 2009, the median interval between arrival in NZ and TB disease notification fluctuated between three and four years. Over the same time period, the mean interval between arrival in New Zealand and TB disease

notification was 6.1 years in 2005, but this increased to 6.9 years in 2006-2007, and rose to a high of 8.5 years in 2009.

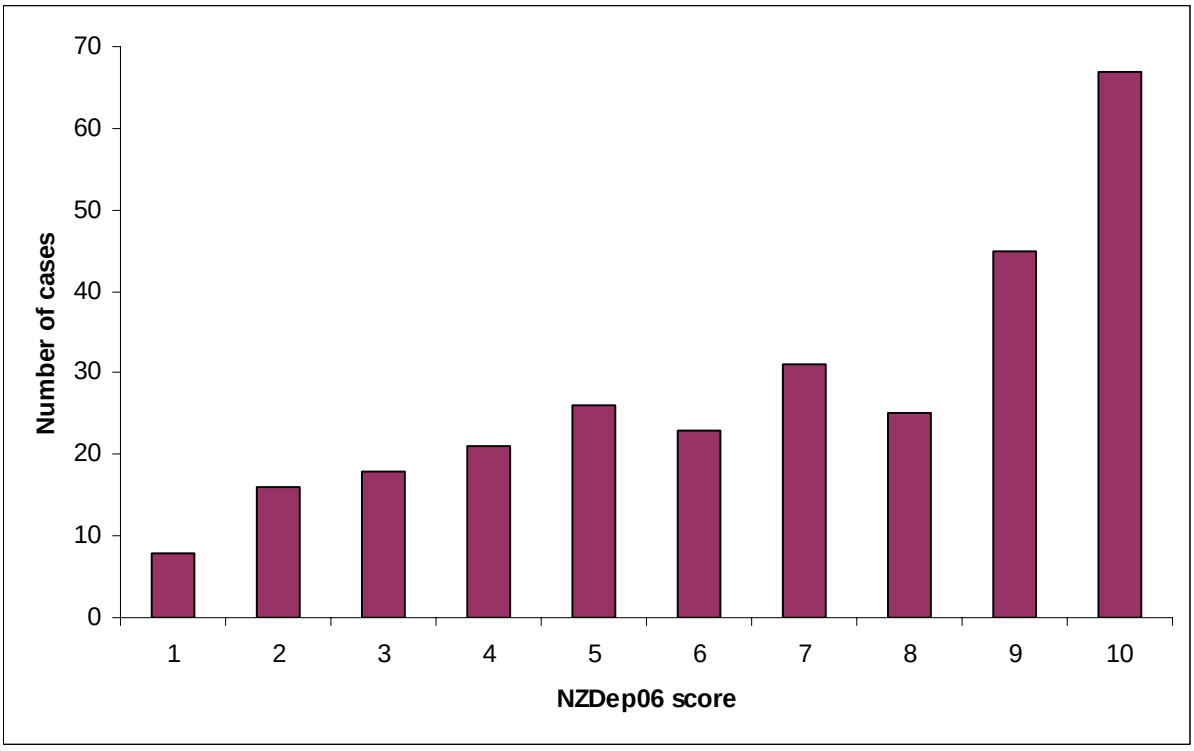
Table 9: Overseas-born TB disease notifications, mean and median time interval between arrival in New Zealand and TB disease notification, 2005 to 2009

Report Year	Mean interval (years)	Median interval (years)
2005	6.1	3
2006	6.9	4
2007	6.9	3
2008	8.4	4
2009	8.5	4
Total	**6.9**	**4**

3.2.5. Socio-economic Deprivation

In 2009, 93.3% (280/300) of TB disease notifications had a residential address recorded that could be linked to NZDep06. Of these, the highest proportion 23.9% (67 cases) resided in NZDep06 decile 10 areas (the most deprived areas), while the lowest proportion 2.9% (8 cases) resided in NZDep06 decile 1 areas (the least deprived areas). Sixty percent of cases resided in NZDep06 decile 7 or higher areas. Figure 3 shows the distribution of TB disease notifications in 2009 by the NZDep06 decile scale.

Figure 3: TB disease notifications by the NZDep06 decile scale, 2009



3.2.6. Basis of Discovery

Table 10 shows the way cases were discovered in 2009. Information was available for 97.0% (291/300) of TB disease notifications. TB disease was most commonly discovered when the symptomatic case presented to a practitioner (69.0% of cases). Immigrant or

refugee screening was the basis of discovery for 9.3% of cases, and 6.0% of cases were identified through contact follow-up.

Table 10: TB disease notifications by basis of discovery, 2009

Basis of discovery	No.	%
Contact follow-up	18	6.0
Immigrant/refugee screening	28	9.3
Attended practitioner with symptoms	207	69.0
Other	38	12.7
Unknown	9	3.0

3.2.6.1. Basis of Diagnosis

Table 11 shows the basis of diagnosis for the 300 TB disease notifications recorded in 2009. Isolation of *M. tuberculosis* or *M. bovis* from a clinical specimen was recorded as the basis of diagnosis for 77.0% of the cases. Note that a case may have more than one basis of diagnosis recorded.

Table 11: TB disease notifications by basis of diagnosis, 2009

Basis of diagnosis[1]	No.	%
Demonstration of acid-fast bacilli in a clinical specimen	107	35.7
Isolation of *M. tuberculosis* or *M. bovis* from a clinical specimen	231	77.0
Demonstration of *M. tuberculosis* nucleic acid (PCR of LCR only)	55	18.3
Histology strongly suggestive of tuberculosis	63	21.0

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

3.2.7. Mycobacterium Species

Based on information received from the three mycobacteriology reference laboratories, 245 (81.7%) of the 300 TB disease notifications in 2009 were culture positive. The figure of 245 differs from the 231 cases, that at the time of notification, were reported to be diagnosed on the basis of isolation of *M. tuberculosis* or *M. bovis* (Table 11). Among the 245 culture-positive cases, 240 (98.0%) were due to *M. tuberculosis* and five cases (2.0%) were due to *M. bovis*.

3.2.8. Site of Infection

Site of infection was recorded for 97.3% (292/300) of TB disease notifications in 2009. Of these, 150 (51.4%) cases were pulmonary only, 38 (13.0%) cases were both pulmonary and extra-pulmonary and 104 (35.6%) cases were extra-pulmonary only. Table 12 shows the distribution of disease sites among the 142 cases with extra-pulmonary TB. Of the eight cases with either tuberculous meningitis or miliary tuberculosis, one was aged less than 15 years.

Table 12: Extra-pulmonary TB disease notifications by site of infection, 2009

Site[1] of extra-pulmonary TB	No.	%
Node (excluding abdominal)	46	32.4
Intra-abdominal (excluding renal)	18	12.7
Pleural	21	14.8
Bone/joint	19	13.4
Renal/urinary tract	10	7.0
Tuberculous meningitis	2	1.4
Miliary tuberculosis	6	1.5
Other[2]	20	14.1
Not stated	0	-

[1] A case may have more than one site recorded
[2] Other includes TB of skin

3.2.9. Pulmonary Cases

In 2009, 188 (62.7%) cases had pulmonary disease. Of these, 94.7% (178/188) of pulmonary TB disease notifications had information recorded regarding the demonstration of acid-fast bacilli in a clinical specimen. A total of 96 (53.9%) were smear positive, that is, they demonstrated acid-fast bacilli in a clinical specimen. Of these, 71 (74.0%) were from sputum specimens.

3.2.10. Hospitalisations

Hospitalisation status was known for 98.7% (296/300) of TB disease notifications in 2009. Of these, 181 (61.1%) cases were hospitalised.

3.2.11. Mortality

Mortality status was known for 97.0% (291/300) of TB disease notifications in 2009. Of these, three deaths were reported giving a mortality rate of 1.0%.

3.2.12. Outbreaks

In 2009 there were a total of three TB outbreaks involving 20 cases (6.7% of total TB disease notifications); all were outbreaks of *M. tuberculosis*. The largest outbreak occurred in multiple health districts, Canterbury and Nelson Marlborough, and included 12 confirmed cases.

3.2.13. Delay to Treatment

The interval between onset of symptoms and start of treatment could be calculated for 167 (55.7%) of the 300 TB disease notifications in 2009. Of these, 49 (29.3%) cases started treatment within one month of the onset of symptoms. An additional 54 (32.3%) cases started treatment between one and three months. The median interval to start of treatment was six 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 78 (52.0%) of the 150 TB disease cases with pulmonary disease alone. Of these, 14 (17.9%) cases started treatment within one month of the onset of

symptoms and 43 (55.1%) started treatment between one and three months. The median interval to start of treatment was two months.

3.2.14. Use of Directly Observed Therapy

Of the 293 TB disease notifications in 2008, information on the use of directly observed therapy (DOT) was known for 286 (97.6%) cases. Of these, 95 (33.2%) received DOT throughout the course of treatment.

3.2.15. Treatment Outcomes

Of the 293 TB disease notifications in 2008, treatment outcome information was recorded for 285 (97.3%) cases. Of these, 240 (84.2%) completed treatment to the satisfaction of the prescribing doctor, 26 (9.1%) went overseas, 16 (5.6%) died before completion of treatment, four (1.4%) stopped treatment because of adverse effects and one (0.4%) was lost for follow-up.

3.3. TB Molecular Typing

Of the 300 TB disease notifications in 2009, 228 (76.0%) had TB molecular typing results. Of the 97.8% (223/228) of cases due to *M. tuberculosis*, 30.0% (67/223) had a non-unique molecular type. These cases were associated with 27 separate molecular types. The remaining 70.0% (135/223) of cases had a unique molecular type.

Table 13 and Table 14 compare the demographic, risk and protective factors, and clinical presentation between cases with non-unique and unique molecular types for the period 2005 to 2009. This analysis is based on the proportions. Therefore, it is important to refer to the actual number of cases reported in the tables when interpreting these results. Over the five-year period, there were 1124 *M. tuberculosis* cases that had a TB molecular typing result of which 397 (35.3%) were non-unique. These 397 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, 10 to 14 years or 15 to 19 years, to be of Māori or Pacific ethnicity and to reside in Northland, Counties Manukau or Hawke's Bay DHBs. Such cases were also significantly more likely to have the following risk factors and clinical features: contact with a confirmed case of TB, born in a Pacific Island country, not have been vaccinated with BCG and have pulmonary TB disease.

In contrast, cases with unique molecular types were significantly ($p \leq 0.05$) more likely to be 20 to 29 years or aged 70 years and over, to be of Asian or "Other" ethnicity, and to reside in Auckland DHB. These cases were also significantly more likely to have the following risk factors: born outside New Zealand, born in Asia, or Southern and Central America or Sub-Saharan Africa, and current or recent residence with a person born outside New Zealand.

Table 13: Comparison of demographic factors of TB disease cases with unique and non-unique molecular types, 2005 to 2009

Category	Sub-category	Molecular type				χ^2	*p*-value
		Non-unique (n=397)		Unique (n=727)			
		No.	%	No.	%		
Age (years)	<1	6	1.5	2	0.3	5.6	0.018
	1 to 4	3	0.8	1	0.1	2.8	0.096
	5 to 9	4	1.0	3	0.4	1.5	0.226
	10 to 14	15	3.8	4	0.6	16.1	0.000
	15 to 19	41	10.3	24	3.3	23.3	0.000
	20 to 29	79	19.9	183	25.2	4.0	0.046
	30 to 39	71	17.9	145	19.9	0.7	0.402
	40 to 49	52	13.1	98	13.5	0.0	0.857
	50 to 59	48	12.1	80	11.0	0.3	0.584
	60 to 69	43	10.8	82	11.3	0.1	0.819
	70+	35	8.8	105	14.4	7.5	0.006
Sex	Male	199	50.1	367	50.5	0.0	0.909
	Female	197	49.6	358	49.2	0.0	0.903
	Unknown	1	0.3	2	0.3	0.0	0.943
Ethnicity (prioritised)[1]	Māori	132	33.2	49	6.7	133.6	0.000
	Pacific Peoples	87	21.9	61	8.4	41.1	0.000
	Asian	104	26.2	455	62.6	136.0	0.000
	Other	18	4.5	59	8.1	5.2	0.023
	European	45	11.3	74	10.2	0.4	0.547
	Unknown	11	2.8	29	4.0	1.1	0.292
District Health Board	Northland	25	6.3	21	2.9	7.6	0.006
	Waitemata	50	12.6	113	15.5	1.8	0.180
	Auckland	52	13.1	171	23.5	17.5	0.000
	Counties Manukau	92	23.2	119	16.4	7.8	0.005
	Waikato	27	6.8	54	7.4	0.2	0.698
	Lakes	4	1.0	10	1.4	0.3	0.595
	Bay of Plenty	8	2.0	23	3.2	1.3	0.261
	Tairawhiti	3	0.8	1	0.1	2.8	0.096
	Taranaki	6	1.5	5	0.7	1.8	0.180
	Hawke's Bay	21	5.3	9	1.2	16.2	0.000
	Whanganui	0	0.0	3	0.4	1.6	0.200
	MidCentral	18	4.5	18	2.5	3.5	0.061
	Hutt	14	3.5	22	3.0	0.2	0.649
	Capital and Coast	25	6.3	56	7.7	0.8	0.384
	Wairarapa	1	0.3	2	0.3	0.0	0.943
	Nelson Marlborough	3	0.8	10	1.4	0.9	0.353
	West Coast	1	0.3	2	0.3	0.0	0.943
	Canterbury	39	9.8	71	9.8	0.0	0.975
	South Canterbury	0	0.0	5	0.7	2.7	0.098
	Otago	1	0.3	8	1.1	2.3	0.127
	Southland	0	0.0	4	0.6	2.2	0.139

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

Table 14: Comparison of risk and protective factors, and clinical presentation of TB disease cases with unique and non-unique molecular types, 2005 to 2009

Category	Sub-category	Molecular type				χ^2	*p*-value
		Non-unique (n=397)		Unique (n=727)			
		No.	%	No.	%		
Contact with a confirmed case	Yes	143	36.0	102	14.0	72.8	0.000
	No	161	40.6	437	60.1	39.4	0.000
	Unknown	93	23.4	187	25.7	0.7	0.395
Exposure in a healthcare setting	Yes	17	4.3	45	6.2	1.8	0.181
	No	300	75.6	497	68.4	6.5	0.011
	Unknown	80	20.2	185	25.4	4.0	0.046
Born outside NZ	Yes	208	52.4	618	85.0	140.2	0.000
	No	176	44.3	94	12.9	138.7	0.000
	Unknown	13	3.3	15	2.0	1.6	0.213
Current or recent residence with person born outside NZ	Yes	193	48.6	482	66.3	33.5	0.000
	No	147	37.0	141	19.4	41.9	0.000
	Unknown	57	14.4	104	14.3	0.0	0.981
Birth country region	New Zealand	176	44.3	95	13.1	0.0	0.917
	Australia	3	0.8	2	0.3	0.0	0.826
	Pacific Island	76	19.1	61	8.4	5.8	0.016
	North Western Europe	3	0.8	13	1.8	15.0	0.000
	Southern and Eastern Europe	1	0.3	5	0.7	6.1	0.014
	North Africa and the Middle East	0	0.0	6	0.8	11.0	0.001
	South-East Asia	30	7.6	138	19.0	189.6	0.000
	North-East Asia	35	8.8	115	15.8	129.5	0.000
	Southern and Central Asia	34	8.6	202	27.8	330.5	0.000
	North America	0	0.0	1	0.1	1.8	0.176
	Southern and Central America	0	0.0	8	1.1	14.8	0.000
	Sub-Saharan Africa	26	6.5	65	8.9	56.5	0.000
	Unknown	13	3.3	16	2.2	1.2	0.278
Current or recent residence in an institution	Yes	16	4.0	19	2.6	1.7	0.191
	No	313	78.8	577	79.4	0.0	0.836
	Unknown	68	17.1	20	2.7	73.6	0.000
Has immunosuppressive illness	Yes	68	17.1	129	17.7	0.1	0.795
	No	293	73.8	547	75.2	0.3	0.596
	Unknown	36	9.1	51	7.0	1.5	0.218
On immunosuppressive medication	Yes	19	4.8	39	5.4	0.2	0.675
	No	342	86.1	626	86.1	0.0	0.986
	Unknown	36	9.1	62	8.5	0.1	0.759
Vaccinated with BCG	Yes	144	36.3	295	40.6	2.0	0.157
	No	75	18.9	95	13.1	6.8	0.009
	Unknown	178	44.8	337	46.3	0.2	0.625
Pulmonary disease	Yes	307	77.3	480	66.0	15.6	0.000
	No	80	20.2	221	30.4	13.8	0.000
	Unknown	10	2.6	26	3.6	0.9	0.336

3.4. TB and HIV Co-infection

Of the 300 TB disease notifications in 2009, HIV and TB co-infection was noted in three (1.0%) cases.

3.5. TB Drug Susceptibility

Antimicrobial susceptibility data for the isolates from 245 culture-positive TB disease cases in 2009 were available. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 15. Overall, during the last 10 years, 2000 to 2009, there has been no significant change ($p \leq 0.05$) in resistance to any of these five antimicrobials.

Table 15: Resistance to each antimicrobial, by mycobacterial species, 2009

Antimicrobial	Resistant[1]					
	M. tuberculosis (n=240)		***M. bovis*** (n=5)		**All isolates** (n=245)	
	No.	**%**	**No.**	**%**	**No.**	**%**
Isoniazid (0.1 mg/L)	20	8.3	2	40.0	22	9.0
Isoniazid (0.4 mg/L)[2]	14	5.8	0	-	14	5.7
Rifampicin	6	2.5	0	-	6	2.5
Ethambutol	1	0.4	0	-	1	0.4
Pyrazinamide	6	2.5	5	100[3]	11	4.5
Streptomycin	16	6.7	0	-	16	6.5

[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

Table 16 shows that in 2009, the majority (87.4%) of the isolates were fully susceptible to all five antimicrobials tested. However, there were six cases of multidrug-resistant TB (MDR-TB, defined as resistance to at least isoniazid and rifampicin) – the highest number of MDR-TB cases identified in any one year since anti-tuberculosis drug resistance surveillance began in 1995. In the last 10 years there has been a total of 22 cases of MDR-TB – an average annual rate of 0.8% among culture-positive TB disease cases. All but two of these 22 MDR-TB cases were born overseas and assumed to have acquired their MDR-TB overseas.

Table 16: Distribution of antimicrobial resistance patterns among TB isolates, 2009

	Percent (number)	Resistance pattern[1]	Percent (number) of isolates with each pattern
Fully susceptible	87.4 (214)		
Resistant to 1 agent	6.5 (16)	H Z S	2.9 (7) 2.0 (5) 1.6 (4)
Resistant to 2 agents	3.7 (9)	HS HZ HR	2.5 (6) 0.8 (2) 0.4 (1)[2]
Resistant to 3 agents	1.2 (3)	HRS HZS	0.8 (2)[2] 0.4 (1)
Resistant to 4 agents	0.8 (2)	HRZS	0.8 (2)[2]
Resistant to 5 agents	0.4 (1)	HREZS	0.4 (1)[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

Any MDR-TB isolates are now tested for susceptibility to an extended range of antibiotics. Up until the end of 2009, no cases of extensively drug-resistant TB (XDR-TB) had been identified in New Zealand. XDR-TB is MDR-TB with additional resistance to any fluoroquinolone and at least one of the following second-line drugs capreomycin, kanamycin or amikacin.

Table 17 shows a comparison of resistance among isolates from cases born in New Zealand and cases born overseas is presented. Isoniazid and streptomycin resistance was significantly higher ($p \leq 0.05$) among isolates from cases born overseas.

Table 17: Resistance by place of birth, 2009[1]

Susceptibility	Born in New Zealand (n=60)		Born overseas (n=183)		*p*-value[2]
	No.	%	No.	%	
Fully susceptible	56	93.3	157	85.8	0.1233
Resistant to:[3]					
Isoniazid[4]	1	1.7	20	10.9	0.0267
Rifampicin	0	-	6	3.3	0.3408
Ethambutol	0	-	1	0.6	1.0000
Pyrazinamide	4	6.7	7	3.8	0.4722
Streptomycin	0	-	16	8.7	0.0142

[1] Place of birth not known for two 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

Table 18 shows the resistance by ethnicity. Isoniazid, rifampicin and streptomycin resistance was most frequent among cases of Asian ethnicity, with 68.2% (15/22) of isoniazid-resistant isolates, 66.7% (4/6) of rifampicin-resistant isolates and 81.3% (13/16) of streptomycin-resistant isolates being from cases of Asian ethnicity. Four of the six cases of MDR-TB were of Asian ethnicity, one was of "Other" ethnicity and one of unknown ethnicity.

Table 18: Resistance by ethnicity, 2009

Susceptibility	Māori (n=44)		Pacific Peoples (n=30)		Asian (n=126)		Other (n=11)		European (n=26)		Unknown (n=8)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fully susceptible	42	95.5	29	96.7	107	84.9	9	81.8	21	80.8	6	75.0
Resistant to:[1]												
Isoniazid[2]	1	2.3	1	3.3	15	11.9	1	9.1	2	7.7	2	25.0
Rifampicin	0	-	0	-	4	3.2	1	9.1	0	-	1	12.5
Ethambutol	0	-	0	-	1	0.8	0	-	0	-	0	-
Pyrazinamide	2	4.6	0	-	3	2.4	1	9.1	4	15.4	1	12.5
Streptomycin	0	-	0	-	13	10.3	2	18.2	0	-	1	12.5

[1] Includes resistance alone or in combination with other antimicrobials
[2] Isoniazid resistance at the standard concentration of 0.1 mg/L

Eight (3.3%) of the 245 culture-positive cases, for which antimicrobial susceptibility data were available in 2009, were reported to be tuberculosis disease relapses or reactivations. This category of disease could also include cases of re-infection. As the number of cases notified as tuberculosis disease relapses/reactivations in any one year is small, the following analysis of drug resistance among relapses/reactivations covers the last five years, 2005 to 2009. During this period, 64 (5.2%) of the 1242 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 53 of these 64 relapses/reactivations and of these, 45 (84.9%) were recorded as having received previous anti-tuberculosis drug treatment.

Resistance among new cases of tuberculosis, cases reported to be relapses/reactivations, and cases that were reported to have been previously treated, is shown in Table 19. Compared with new cases, previously treated cases were significantly more resistant to isoniazid, rifampicin, ethambutol and pyrazinamide, more likely to be MDR-TB and less likely to be fully susceptible to all antimicrobials tested.

Table 19: Resistance among new cases, relapses/reactivations and previously treated[1] cases, 2005-2009

Susceptibility	New cases (n=1178)	Relapse/reactivation cases			
		All (n=64)		Previously treated (n=45)	
	%	%	*p*-value[2]	%	*p*-value[2]
Fully susceptible	87.4	76.6	0.0130	68.9	0.0003
Resistant to:[3]					
Isoniazid[4]	6.7	17.2	0.0047	22.2	<0.0001
Rifampicin	0.6	10.9	<0.0001	15.6	<0.0001
Ethambutol	0.3	4.7	0.0039	6.7	<0.0001
Pyrazinamide	3.1	7.8	0.1285	11.1	0.0155
Streptomycin	6.5	7.8	0.6032	11.1	0.2152
MDR-TB[5]	0.6	9.4	<0.0001	13.3	<0.0001

[1] Information on previous treatment reported for only 53 of the 64 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 (i.e. resistant to at least isoniazid and rifampicin)

3.6. TB Infection Notifications

During 2009, a total of 371 cases of TB infection (367 treatment of latent infection and four on preventive treatment) were notified. The TB infection rate was highest in Hutt Valley DHB (19.6 per 100 000 population, 28 cases), followed by Capital and Coast (17.4 per 100 000 population, 50 cases) and Auckland DHB (14.6 per 100 000 population, 65 cases) (Table 20).

Table 20: TB infections - cases and rates by DHB, 2009

District Health Board	Number of cases	Rate[1]
Northland	5	3.2
Waitemata	65	12.3
Auckland	65	14.6
Counties Manukau	64	13.3
Waikato	19	5.3
Lakes	2	-
Bay of Plenty	16	7.7
Tairawhiti	0	-
Taranaki	2	-
Hawke's Bay	21	13.6
Whanganui	0	-
Mid Central	14	8.4
Hutt Valley	28	19.6
Capital and Coast	50	17.4
Wairarapa	1	-
Nelson Marlborough	0	-
West Coast	0	-
Canterbury	19	3.8
South Canterbury	0	-
Otago	0	-
Southland	0	-
Total	**371**	**8.6**

[1] Rate per 100 000 population

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2. Salmond, C., Crampton, P., Atkinson, J. (2007). NZDep2006 Index of Deprivation User's Manual. University of Otago, Wellington.

APPENDIX

TB disease notifications demographic and geographic factors, 2005-2009

Category	Sub-category	2005		2006		2007		2008		2009	
		No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
Age group (years)	<1	2	-	3	-	3		1	-	3	-
	1 to 4	8	3.5	9	4	9	3.9	3	-	9	3.7
	5 to 9	6	2.1	4	-	7	2.4	6	2.1	6	2.1
	10 to 14	9	2.9	19	6.1	4	-	6	2	3	-
	15 to 19	17	5.6	20	6.4	20	6.3	15	4.7	15	4.6
	20 to 29	85	15.6	88	16	53	9.5	59	10.4	64	10.9
	30 to 39	61	10.1	58	9.7	51	8.6	58	9.9	53	9.2
	40 to 49	50	8.1	47	7.5	33	5.2	29	4.6	48	7.6
	50 to 59	30	6.1	33	6.5	29	5.7	35	6.7	39	7.3
	60 to 69	28	8.5	26	7.6	34	9.4	39	10.3	30	7.6
	70+	34	9.7	43	12.1	39	10.7	42	11.3	30	7.9
	Unknown	0	-	0	-	0	-	0	-	0	-
Sex	Male	170	8.4	176	8.6	133	6.4	156	7.5	153	7.2
	Female	160	7.6	171	8	149	6.9	137	6.3	147	6.7
	Unknown	0	-	3	-	0	-	0	-	0	-
Ethnicity (prioritised)[2,3]	Māori	46	8.1	62	11	48	8.5	45	8	53	9.4
	Pacific Peoples	48	21.2	48	21.2	27	11.9	52	23	32	14.1
	Asian	161	47.2	152	44.6	140	41.1	145	42.5	158	46.4
	Other	16	47.2	28	82.7	22	64.9	12	35.4	13	38.4
	European	39	1.4	50	1.9	37	1.4	31	1.2	40	1.5
	Unknown	20	11.9	10	6	8	4.8	8	4.8	4	-
District Health Board	Northland	18	11.9	30	19.7	15	9.7	7	4.5	8	5.1
	Waitemata	55	11.1	31	6.1	40	7.8	49	9.4	49	9.3
	Auckland	72	17	56	13.1	52	12	54	12.3	63	14.2
	Counties Manukau	53	11.9	67	14.7	39	8.4	57	12	66	13.7
	Waikato	24	6.9	33	9.4	21	5.9	18	5.1	14	3.9
	Lakes	5	4.9	3	-	1	-	4	-	6	5.9
	Bay of Plenty	4	-	7	3.5	8	3.9	8	3.9	12	5.8
	Tairawhiti	0	-	0	-	0	-	1	-	6	13
	Taranaki	4	-	3		3	-	3	-	0	-
	Hawke's Bay	6	4	8	5.2	17	11.1	5	3.3	9	5.8
	Whanganui	5	7.8	2	-	3	-	3	-	0	-
	MidCentral	8	4.9	31	18.9	10	6.1	7	4.3	6	3.6
	Hutt Valley	8	5.7	8	5.7	11	7.8	17	12	10	7
	Capital and Coast	30	11	32	11.5	17	6	25	8.8	18	6.2
	Wairarapa	2	-	2	-	1	-	0	-	0	-
	Nelson Marlborough	2	-	4	-	3	-	5	3.7	4	-
	West Coast	1	-	2	-	1	-	0	-	2	-
	Canterbury	23	4.8	21	4.3	36	7.3	28	5.6	22	4.4
	South Canterbury	2	-	1	-	1	-	0	-	2	-
	Otago	5	2.7	7	3.8	2	-	1	-	1	-
	Southland	3	-	2	-	1	-	1	-	2	-

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

[2] Rate per 100 000 population based on 2001 & 2006 Census data

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