TUBERCULOSIS IN NEW ZEALAND
ANNUAL REPORT 2007

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by

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SUMMARY

In 2007, there were 730 notifications of tuberculosis (TB), comprising 287 cases of TB disease (new and relapse/reactivation cases) and 443 cases of TB infection (latent infection and old disease on preventive treatment).

Annual TB disease notification rates have more than halved since 1980 and continue to decline with the 2007 notification rate (6.8 per 100 000 population) a third less than the 2003 rate (10.5 per 100 000 population).

Disease notification rates in 2007 were highest in those aged over 70 years (11.0 per 100 000 population, 40 cases) but the highest number of cases were reported in the 20 to 29 and 30 to 39 years age groups (53 and 52 cases respectively).

The highest rate of TB disease occurred in the "Other" ethnic group (59.0 per 100 000 population), followed by Asian (41.1 per 100 000 population). Case numbers were greatest in the Asian ethnic group (140 cases) with Maori cases the next highest (50 cases).

Almost half of the disease notifications (132 cases, 46.0%) were for cases from one of the three Auckland District Health Boards (DHB). However, at 11.1 per 100 000 and 9.7 per 100 000 population respectively, Hawke's Bay and Northland DHBs had the second and third highest TB disease notification rates after Auckland DHB at 12.2 per 100 000 population.

TB disease notifications were skewed towards those living in more socio-economic deprived areas with over 60% (160/256) of cases assigned to the four most deprived New Zealand Social Deprivation Index (NZDep06) deciles.

Being born overseas (189/271, 69.7%) and current or recent residence with a person born outside of New Zealand (170/240, 70.8%) were the most commonly reported risk factors amongst the cases. Almost 40% (82/209) had prior contact with a confirmed TB case.

Based on country of birth, the highest rate occurred in those born in Asia (50.6 per 100 000 population, 127 cases) followed by Sub-Saharan Africa (44.0 per 100 000 population, 26 cases) and the Pacific Islands (16.2 per 100 000 population, 22 cases).

For over 60% of the overseas-born cases (91/150) TB disease was reported less than five years after arriving in New Zealand.

Over three quarters (230/287, 80.1%) of the TB disease notifications in 2007 were culture positive, of which 227 (98.7%) were due to *Mycobacterium tuberculosis* and 3 (1.3%) were due to *M. bovis*.

The majority of cases had pulmonary disease (199/270, 73.7%). Among those with extra-pulmonary disease this was most commonly in a lymph node (excluding abdominal) (57 cases, 50.0%), followed by a bone or joint (22 cases, 19.3%).

Over 50% of cases were hospitalised (152/272), and the mortality rate was 3.6% (10/274). Four cases (1.4%) were co-infected with TB and HIV.

Four TB outbreaks were reported during 2007 the largest of which involved seven confirmed and 15 probable cases within an extended family.

The median interval between symptom onset in cases and starting treatment was six months, with over a third (53/149) commencing treatment within one month of symptom onset.

Based on 2006 TB disease notification data, 80.4% (263/327) completed their treatment course, four cases (1.2%) stopped treatment because of adverse effects, five (1.5%) refused to complete treatment and four (1.2%) were lost to follow up. The remaining 51 cases moved overseas or died while on treatment. Forty percent of the 2006 cases (113/290) received directly observed therapy throughout the course of their treatment.

Over the five year period 2003 to 2007, there were 1333 *M. tuberculosis* cases that had a TB molecular typing result of which 466 (35.0%) were non-unique. These 466 cases were associated with 140 molecular types. Cases with non-unique molecular types were significantly ($p \leq 0.05$) more likely to be less than one year, 1 to 4 years, 10 to 14 years, or 15 to 19 years; to be of Maori or Pacific ethnicity; and to reside in Northland, Counties Manukau, Taranaki, Hawke's Bay, Whanganui or Hutt Valley 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 New Zealand or a Pacific Island country; and pulmonary TB disease.

During the ten year period 1998 to 2007, there has been no significant change in resistance to the five routinely tested antimicrobials used to treat TB. In 2007, there were two cases (0.9%) of multidrug-resistant TB (MDR-TB), both TB relapses or reactivations, one of which developed during treatment in New Zealand. A total of 21 MDR-TB cases have been identified since 1998, all but two are assumed to have acquired their MDR-TB overseas. No cases of extensively drug resistant TB (XDR-TB) have ever 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 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 2006 statistics reported by the World Health Organization, 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).

1.1. Purpose

The purpose of this report is to summarise the descriptive epidemiology of TB notifications (disease and latent infections) in New Zealand for 2007 and examine trends from 2003 to 2007. This report includes TB drug susceptibility data, TB molecular typing data and may be used to monitor TB policy. The primary audience of 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, 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.

Once 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: 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 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 *Mycobacterium tuberculosis* and *M. bovis* isolates is undertaken in the three Mycobacteriology Reference Laboratories at LabPlus (Auckland City Hospital), Wellington Hospital, and Waikato Hospital. These laboratories use the BACTEC® 460 radiometric method or the BACTEC® MGIT 960 method of susceptibility testing. 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 tuberculosis disease case notifications recorded in EpiSurv.

2.1.3. TB molecular typing data

The national TB molecular typing database is maintained by LabPlus who undertakes all of the human TB molecular typing work in New Zealand. Isolates are primarily typed by restriction fragment length polymorphism (RFLP). For those isolates with less 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 is sent to ESR at periodic intervals. The molecular typing data is then integrated with TB disease case notifications recorded within EpiSurv.

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 2007 to 31 December 2007. 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, 2006 notification data is used for the sections on use of directly observed treatment and treatment outcomes. The notification data was extracted from EpiSurv on 30 June 2008 therefore any changes to EpiSurv data by PHS staff after this date will not be reflected in this report.

All disease rates have been calculated using 2007 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 one to ten, where one represents the areas with the least deprived scores and ten the areas with the most deprived 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 2007, there were a total of 730 notified cases of TB recorded in EpiSurv. Of these, 287 cases were TB disease (270 new cases and 17 relapse or reactivations of TB disease) and 443 cases were TB infection (430 treatment of latent infection and 13 on preventive treatment) (Table 1).

Table 1: TB notifications by status, 2007

Disease name	Status					
	Confirmed	Probable	Under investigation	Unknown	Not applicable	**Total**
TB disease – new case	212	47	10	1	-	**270**
TB disease – relapse or reactivation	14	1	2	-	-	**17**
TB – treatment of latent infection	-	-	-	-	430	**430**
TB infection – on preventive treatment	-	-	-	-	13	**13**
Total	**226**	**48**	**12**	**1**	**443**	**730**

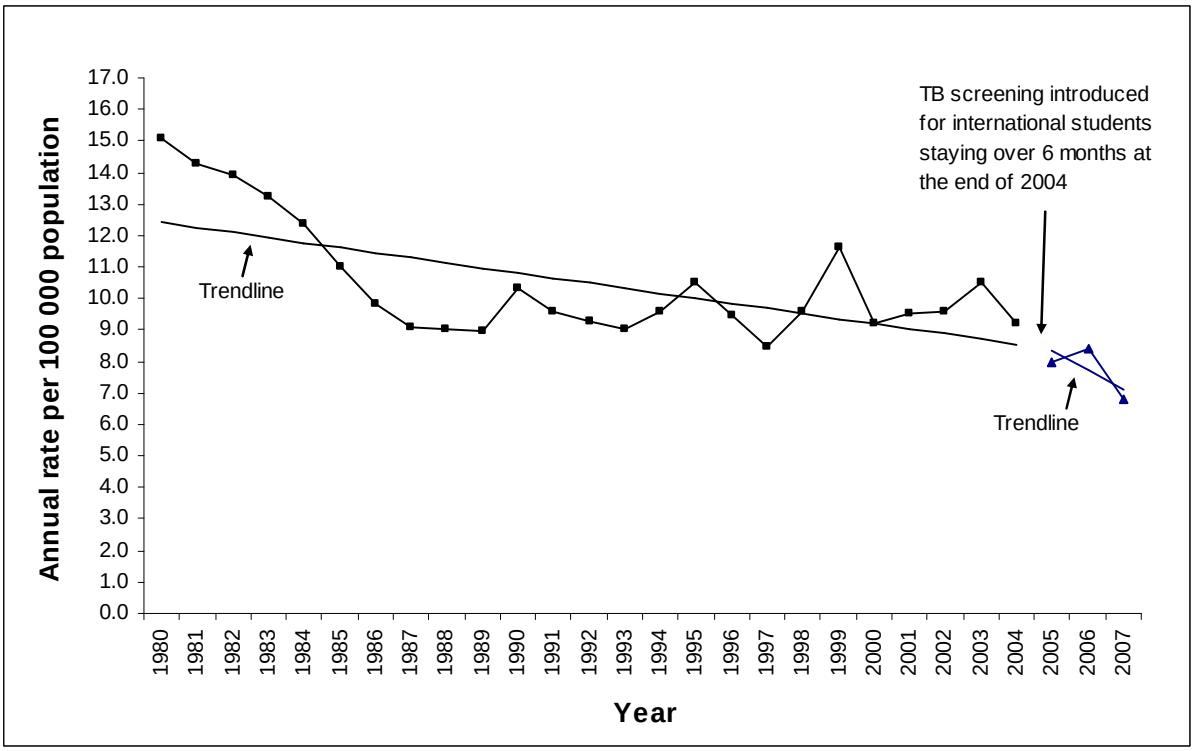
3.2. TB disease notifications

3.2.1. Trends

Long term trends (1980-2007)

The annual rate for TB disease notifications in New Zealand from 1980 to 2007 is shown in Figure 1. From 1980 to 2007 the annual notification rate per 100 000 population has decreased by 55.0% (15.1 in 1980 compared to 6.8 in 2007).

Figure 1: TB disease rate[1] by year, 1980 to 2007



[1] Rate per 100 000 population based on Census population data for (1980 to1990) and mid-year population estimate for each year (1991 to 2007)

Recent trends (2003-2007)

From 2003 to 2007, the annual number of notifications of TB disease decreased by 32.2% (423 in 2003 compared to 287 in 2007). The annual rate per 100 000 population also decreased by 35.2% (10.5 in 2003 compared to 6.8 in 2007) with a five year average rate of 8.6 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, 2003 to 2007

Year	Status				Total	Rate[1]
	Confirmed	Probable	Under investigation	Unknown		
2003	318	92	7	6	423	10.5
2004	282	73	11	9	375	9.2
2005	267	59	2	2	330	8.0
2006	276	74	3	-	353	8.4
2007	226	48	12	1	287	6.8
Total	**1369**	**346**	**35**	**18**	**1768**	**8.6**

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

3.2.2. Demographic information

In 2007, the annual notification rate of TB disease differed by age group, and sex (Table 3). The TB disease rate for females was slightly higher than for males (7.0 per 100 000 population compared to 6.5 per 100 000 population, respectively).

The highest age specific rate was reported in the over 70 years age group (11.0 per 100 000 population, 40 cases), followed by the 20 to 29 years (9.5 per 100 000 population, 53 cases), the 60 to 69 years (9.4 per 100 000 population, 34 cases) and the 30 to 39 years age groups (8.8 per 100 000 population, 52 cases). Overall for individuals aged less than 15 years the TB disease notification rate was 2.6 per 100 000.

The highest age specific rate for males was reported in the over 70 years age group (15.2 per 100 000 population, 24 cases), whereas for females it was the 20 to 29 years age group (10.3 per 100 000 population, 29 cases).

Table 3: TB disease notifications by age group and sex, 2007

Age group (years)	Male		Female		Total	
	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
<1	2	-	1	-	3	-
1 to 4	6	5.1	3	-	9	3.9
5 to 9	2	-	5	3.5	7	2.4
10 to 14	1	-	3	-	4	-
15 to 19	9	5.5	11	7.0	20	6.3
20 to 29	24	8.7	29	10.3	53	9.5
30 to 39	24	8.5	28	9.0	52	8.8
40 to 49	13	4.2	22	6.8	35	5.5
50 to 59	12	4.7	18	6.9	30	5.8
60 to 69	18	10.2	16	8.7	34	9.4
70+	24	15.2	16	7.8	40	11.0
Total	**135**	**6.5**	**152**	**7.0**	**287**	**6.8**

[1] Rate per 100 000 population

The highest rate of TB disease occurred in the "Other" ethnic group (59.0 per 100 000 population, 20 cases) followed by Asian (41.1 per 100 000 population, 140 cases), Pacific Peoples (11.9 per 100 000 population, 27 cases), Maori (8.8 per 100 000 population, 50 cases) and European (1.4 per 100 000 population, 39 cases). Table 4 shows the age group and ethnicity distribution of TB cases in 2007.

Table 4: TB disease notifications by age group and ethnicity[1], 2007

Age group (years)	Maori		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	0	-	1	-	1	-	0	-	1	-	0	-	3	-
1 to 4	1	-	2	-	6	36.0	0	-	0	-	0	-	9	4.1
5 to 9	2	-	1	-	4	-	0	-	0	-	0	-	7	2.4
10 to 14	1	-	0	-	1	-	1	-	0	-	1	-	4	-
15 to 19	4	-	1	-	11	35.9	2	-	0	-	2	-	20	6.7
20 to 29	7	8.7	0	-	34	44.9	6	91.0	4	-	2	-	53	10.3
30 to 39	6	7.7	3	-	31	56.0	5	76.1	5	1.3	2	-	52	9.0
40 to 49	5	7.2	4	-	17	31.2	1	-	7	1.6	1	-	35	5.8
50 to 59	7	16.3	6	35.2	7	23.4	4	-	3	-	3	-	30	6.2
60 to 69	10	43.5	5	51.6	15	99.7	0	-	4	-	0	-	34	10.4
70+	7	54.0	4	-	13	145.4	1	-	15	4.9	0	-	40	11.5
Total	**50**	**8.8**	**27**	**11.9**	**140**	**41.1**	**20**	**59.0**	**39**	**1.4**	**11**	**-**	**287**	**7.1**

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

3.2.3. Geographic information

Auckland District Health Board (DHB) had the highest TB disease rate (12.2 per 100 000 population, 53 cases) followed by Hawke's Bay DHB (11.1 per 100 000 population, 17 cases) and Northland DHB (9.7 per 100 000 population, 15 cases) (Table 5).

Table 5: TB disease notifications and rates by DHB, 2007

District health board	Number of cases	Rate[1]
Northland	15	9.7
Waitemata	40	7.8
Auckland	53	12.2
Counties Manukau	39	8.4
Waikato	21	5.9
Lakes	1	-
Bay of Plenty	8	3.9
Tairawhiti	0	-
Taranaki	3	-
Hawke's Bay	17	11.1
Whanganui	3	-
Mid Central	10	6.1
Hutt Valley	11	7.8
Capital and Coast	17	6.0
Wairarapa	1	-
Nelson Marlborough	4	-
West Coast	1	-
Canterbury	36	7.3
South Canterbury	4	-
Otago	2	-
Southland	1	-
Total	**287**	**6.8**

[1] Rate per 100 000 population

3.2.4. Risk factor information

For the 287 TB disease notifications in 2007, data completion varied for each risk/protective factor. Table 6 shows TB disease notification for 2007 by risk/protective factors.

For those cases where information was recorded 39.2% (82 cases) had contact with a confirmed case, 5.1% (11 cases) were exposed in a healthcare setting, 3.9% (9 cases) currently or recently resided in an institution, 70.8% (170 cases) currently or recently resided with a person born overseas, 18.1% (47 cases) had an immunosuppressive illness, 4.7 % (12 cases) were on immunosuppressive medication, and 68.6% (105 cases) had been vaccinated with BCG.

Table 6: TB disease notifications risk and protective factors, 2007

Category	**Yes**		**No**	
	No.	**%**	**No.**	**%**
Contact with a confirmed case (n=209)	82	39.2	127	60.8
Exposure in a healthcare setting (n=217)	11	5.1	206	94.9
Current/recent residence in an institution (n=231)	9	3.9	222	96.1
Current/recent residence with person born outside NZ (n=240)	170	70.8	70	29.2
Has immunosuppressive illness (n=259)	47	18.1	212	81.9
On immunosuppressive medication (n=255)	12	4.7	243	95.3
Vaccinated with BCG (n=153)	105	68.6	48	31.4

Birth country

Of the 267 cases that had birth country information recorded 69.3% (185 cases) were born outside of New Zealand. The highest rate was for those born in Asia 50.6 per 100 000 population (127 cases) followed by Sub-Saharan Africa 44.0 per 100 000 population (26 cases) and the Pacific Islands 16.2 per 100 000 population (22 cases) (Table 7).

Table 7: TB disease notifications by birth country, 2007

Birth country region (n=267)	**Number of cases**	**Rate**[1]
Asia	127	50.6
Australia	0	-
New Zealand	82	2.8
North Africa & the Middle East	2	-
North America	0	-
North West Europe	4	-
Pacific Islands	22	16.2
South & Central America	1	-
Southern & Eastern Europe	3	-
Sub-Saharan Africa	26	44.0

[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 287 TB disease notifications in 2007, information on cases being born in New Zealand or overseas was recorded for 94.4% (271 cases). Of these, 30.3% (82 cases) were born in New Zealand and 69.7% (189 cases) were born overseas. For cases born in New Zealand the largest proportion occurred among Maori (52.4%) followed by those of European (28.1%) ethnicity. For cases born overseas the largest proportion occurred among those of Asian ethnicity (67.7%) followed by Pacific Peoples (11.1%) and those of 'Other' ethnicity (10.6%).

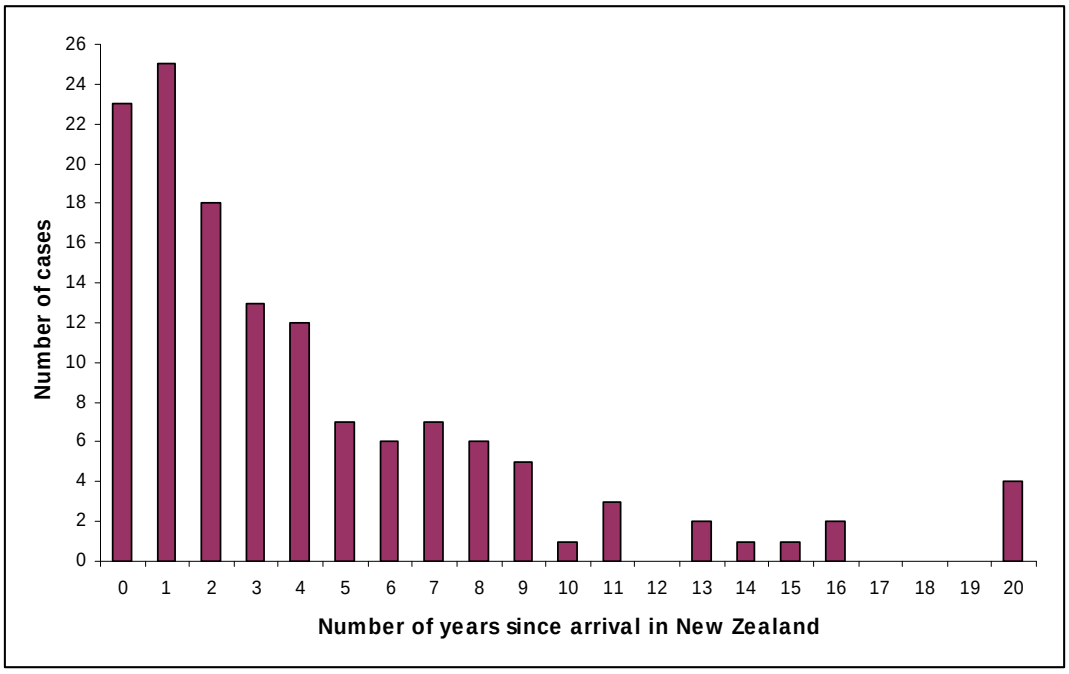
Table 8: New Zealand-born and overseas-born TB disease notifications by ethnicity, 2007

Ethnicity[1]	Born in New Zealand		Born overseas	
	No.	%	No.	%
Maori	43	52.4	0	-
Pacific Peoples	5	6.1	21	11.1
Asian	10	12.2	128	67.7
Other	0	-	20	10.6
European	23	28.1	12	6.4
Unknown	1	1.2	8	4.2
Total	**82**	**100.0**	**189**	**100.0**

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

The date of arrival in New Zealand was recorded for 79.4% (150/189) of the overseas-born TB disease notifications in 2007. Of these, the interval between date of arrival in New Zealand and TB disease notification date ranged from 18 days to 37 years, with a median of three years. For 61 percent 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 date of their disease notification.

Figure 2: Overseas-born TB disease notifications by number of years since arrival in New Zealand[1], 2007



[1] Excludes 14 cases with TB disease notification >20 years after arrival in New Zealand and 39 cases where no information on arrival date was recorded

Over the five year period 2003 to 2007, the median interval between arrival in NZ and TB disease notification fluctuated between three and four years (Table 9). Over the same time period, the mean interval to notification trended downwards but was highest in 2004 at 8.4 years and lowest in 2005 at 6.1 years.

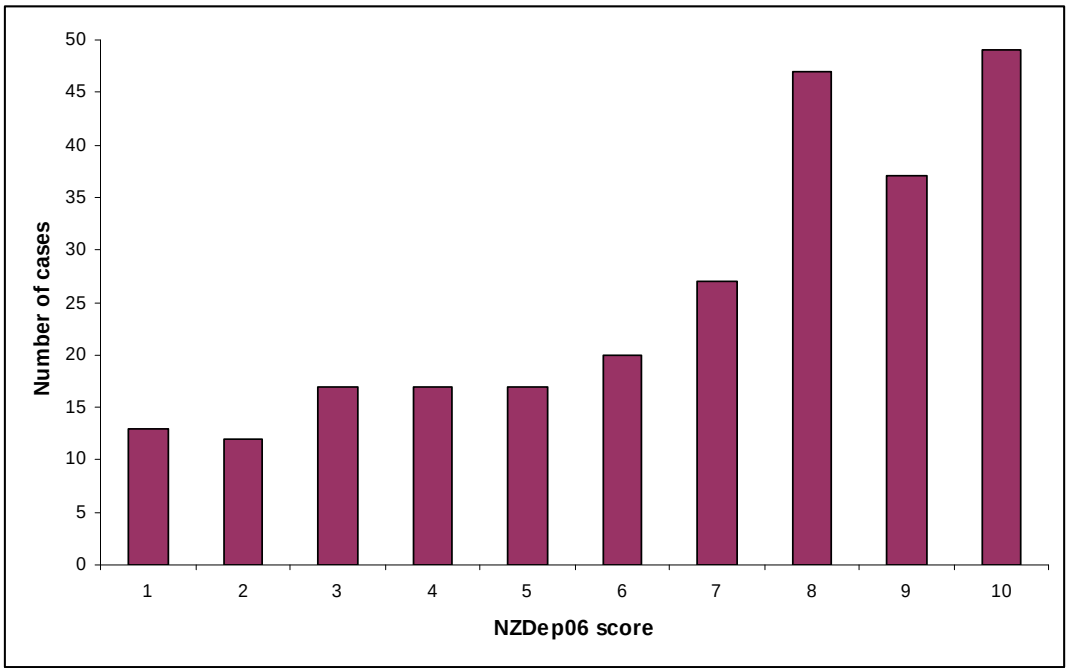
Table 9: Overseas-born TB disease notifications, mean and median time interval between arrival in NZ and TB disease notification, 2003 to 2007

Report Year	Mean interval (years)	Median interval (years)
2003	7.1	3
2004	8.4	4
2005	6.1	3
2006	6.9	4
2007	6.4	3
Total	**7.0**	**3**

3.2.5. Socio-economic deprivation

In 2007, 89.2% (256/287) of TB disease notifications had a residential address recorded that could be linked to NZDep06. Of these, the highest proportion 19.1% (49 cases) resided in NZDep06 decile 10 areas (most deprived areas), while the lowest proportion 4.7% (12 cases) resided in a NZDep06 2 areas (least deprived area). Over 60% of cases resided in an NZDep06 decile seven or higher area. Figure 3 shows the distribution of TB disease notifications in 2007 by NZDep06 decile scale.

Figure 3: TB disease notifications by NZDep06 decile scale, 2007



3.2.6. Basis of discovery

Information on how the case was discovered was available for 97.2% (279/287) of TB disease notifications in 2007 (Table 10). Most commonly TB disease was discovered when the case attended a practitioner with symptoms (62.4% of cases). Immigrant or refugee screening was the basis of discovery for 14.0% of cases, and 11.1% of cases were identified through contact follow-up.

Table 10: TB disease notifications by basis of discovery, 2007

Basis of discovery	No.	%
Contact follow-up	31	11.1
Immigrant/refugee screening	39	14.0
Attended practitioner with symptoms	174	62.4
Other	29	10.4
Unknown	6	2.2

3.2.7. Basis of diagnosis

Table 11 shows the basis of diagnosis for the 287 TB disease notifications recorded in 2007. Isolation of *M. tuberculosis or M. bovis* from a clinical specimen was recorded as the basis of diagnosis for 71.1% 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, 2007

Basis of diagnosis[1]	No.	%
Demonstration of acid-fast bacilli in a clinical specimen	103	35.9
Isolation of *M. tuberculosis or M. bovis* from a clinical specimen	204	71.1
Demonstration of *M. tuberculosis* nucleic acid (PCR of LCR only)	50	17.4
Histology strongly suggestive of tuberculosis	52	18.1

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

3.2.8. Mycobacterium species

Based on the antimicrobial susceptibility data received from the three mycobacteriology reference laboratories and molecular typing data from LabPlus, 230 (80.1%) of the 287 TB disease notifications in 2007 were culture positive. Note: this figure of 230 differs from the 204 cases that were reported, at the time of notification, to be diagnosed on the basis of isolation of *M. tuberculosis or M. bovis* (Table 11). Among the 230 culture-positive cases, 227 (98.7%) were due to *M. tuberculosis*, and three cases (1.3%) were due to *M. bovis.*

3.2.9. Site of infection

Site of infection was recorded for 97.9% (281/287) of TB disease notifications in 2007. Of these, 167 (59.4%) cases were pulmonary only, 32 (11.4%) cases were both pulmonary and extra-pulmonary and 82 (29.2%) cases were extra-pulmonary only. Table 12 shows the distribution of disease sites among the 114 cases with extra-pulmonary TB. Of the six cases with either tuberculous meningitis or miliary tuberculosis, none were aged less than 15 years.

Table 12: Extra-pulmonary TB disease notifications by site of infection, 2007

Site[1] of extra-pulmonary TB	No.	%
Node (excluding abdominal)	57	50.0
Intra-abdominal (excluding renal)	10	8.8
Pleural	15	13.2
Bone/joint	22	19.3
Renal/urinary tract	2	1.8
Tuberculous meningitis	2	1.8
Miliary tuberculosis	4	3.5
Other[2]	13	11.4
Not stated	1	0.9

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

3.2.10. Pulmonary cases

In 2007, 199 (73.7%) cases had pulmonary disease. Of these, 86.0% (171/199) of pulmonary TB disease notifications had information recorded for the demonstration of acid-fast bacilli in a clinical specimen. A total of 85 (49.7%) were smear positive i.e. demonstrated acid-fast bacilli in a clinical specimen. Of these, 59 (69.4%) were from sputum specimens.

3.2.11. Hospitalisations

Hospitalisation status was known for 94.8% (272/287) of TB disease notifications in 2007. Of these, 152 (55.9%) cases were hospitalised.

3.2.12. Mortality

Mortality status was known for 95.5% (274/287) of TB disease notifications in 2007. Of these, 10 deaths were reported giving a mortality rate of 3.6%.

3.2.13. Outbreaks

Of the 287 TB disease notifications in 2007, 31 (10.8%) were linked to outbreaks of TB disease recorded in EpiSurv. There were four TB outbreaks reported in 2007, with three outbreaks of *M. tuberculosis* involving 22, four and three cases respectively and one outbreak of *M. bovis* involving two cases. The largest outbreak occurred in the Hawke's Bay and included seven confirmed and 15 probable cases. The mode of transmission was person-to-person spread within an extended family.

3.2.14. Delay to treatment

The interval between onset of symptoms and commencement of treatment could be calculated for 149 (51.9%) of the 287 TB disease notifications in 2007. Of these, 53 (35.6%) cases started treatment within one month of the onset of symptoms. An additional 38 (25.5%) cases started treatment between one and three months. The median interval to start of treatment was six months.

3.2.15. Use of directly observed therapy

Of the 353 TB disease notifications in 2006, information on the use of directly observed therapy (DOT) was known for 290 (82.2%) cases. Of these, 113 (39.0%) received DOT throughout the course of treatment.

3.2.16. Treatment outcomes

Of the 353 TB disease notifications in 2006, treatment outcome information was recorded for 327 (92.6%) cases. Of these, 263 (80.4%) completed treatment to the satisfaction of the prescribing doctor, 33 (10.1%) went overseas, 18 (5.5%) died before completion of treatment, five (1.5%) refused to complete treatment, four (1.2%) stopped treatment because of adverse effects and four (1.2%) were lost for follow-up.

3.3. TB molecular typing

Of the 287 TB disease notifications in 2007, 229 (79.8%) had TB molecular typing results. Of the 98.7% (226/229) of cases due to *M. tuberculosis*, 31.0% (70/226) had a non-unique molecular type. These cases were associated with 45 separate molecular types. The remaining 69.0% (156/226) 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 2003 to 2007. This analysis is based on the proportions. Therefore, it is important to also refer to the actual number of cases reported in the tables when interpreting these results. Over the five year period, there were 1333 cases that had a TB molecular typing result of which 466 (35.0%) were non-unique. These 466 cases were associated with 140 molecular types.

Cases with non-unique molecular types were significantly ($p \leq 0.05$) more likely to be less than one year, 1 to 4 years, 10 to 14 years or 15 to 19 years; to be of Maori or Pacific ethnicity; and to reside in Northland, Counties Manukau, Taranaki, Hawke's Bay, Whanganui or Hutt Valley 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 New Zealand or a Pacific Island country; and pulmonary TB disease.

In contrast, cases with unique molecular types were significantly ($p \leq 0.05$) more likely to be aged between 30 to 39 years or aged 70 years and over, to be of Asian ethnicity, and to reside in Auckland or Nelson Marlborough DHBs. These cases were also significantly more likely to have the following risk factors: born outside New Zealand; born in Asia, North West Europe or South and Central America; current or recent residence with a person born outside New Zealand; and exposure to TB in a healthcare setting.

Table 13: Comparison of demographic factors of TB disease cases with unique and non-unique molecular types, 2003 to 2007

Category	Sub-category	Molecular type				χ^2	*p*-value
		Non-unique (n=466)		Unique (n=867)			
		No.	%	No.	%		
Age (years)	<1	10	2.1	1	0.1	15.3	0.000
	1 to 4	8	1.7	0	0.0	15.0	0.000
	5 to 9	4	0.9	7	0.8	0.0	0.922
	10 to 14	27	5.8	7	0.8	30.3	0.000
	15 to 19	45	9.7	33	3.8	18.8	0.000
	20 to 29	115	24.7	217	25.0	0.0	0.888
	30 to 39	75	16.1	186	21.5	5.5	0.019
	40 to 49	57	12.2	118	13.6	0.5	0.477
	50 to 59	50	10.7	87	10.0	0.2	0.690
	60 to 69	43	9.2	91	10.5	0.5	0.463
	70+	32	6.9	118	13.6	13.8	0.000
	Unknown	0	0.0	2	0.2	1.1	0.299
Sex	Male	225	48.3	432	49.8	0.3	0.591
	Female	240	51.5	427	49.3	0.6	0.433
	Unknown	1	0.2	8	0.9	2.3	0.132
Ethnicity (prioritised)[1]	Maori	146	31.3	69	8.0	122.4	0.000
	Pacific Peoples	121	26.0	84	9.7	61.7	0.000
	Asian	118	25.3	497	57.3	124.9	0.000
	Other	24	5.2	57	6.6	1.1	0.299
	European	38	8.2	89	10.3	1.6	0.211
	Unknown	19	4.1	71	8.2	8.1	0.004
District Health Board	Northland	33	7.1	28	3.2	10.3	0.001
	Waitemata	65	13.9	132	15.2	0.4	0.531
	Auckland	70	15.0	217	25.0	18.0	0.000
	Counties Manukau	107	23.0	150	17.3	6.2	0.012
	Waikato	27	5.8	60	6.9	0.6	0.427
	Lakes	1	0.2	9	1.0	2.8	0.097
	Bay of Plenty	11	2.4	19	2.2	0.0	0.843
	Tairawhiti	0	0.0	2	0.2	1.1	0.299
	Taranaki	9	1.9	6	0.7	4.2	0.041
	Hawke's Bay	27	5.8	13	1.5	19.2	0.000
	Whanganui	6	1.3	2	0.2	5.7	0.017
	MidCentral	17	3.6	29	3.3	0.1	0.772
	Hutt	20	4.3	18	2.1	5.4	0.020
	Capital and Coast	31	6.7	72	8.3	1.2	0.281
	Wairarapa	1	0.2	5	0.6	0.9	0.346
	Nelson Marlborough	1	0.2	12	1.4	4.3	0.038
	West Coast	1	0.2	2	0.2	0.0	0.953
	Canterbury	34	7.3	65	7.5	0.0	0.894
	South Canterbury	0	0.0	5	0.6	2.7	0.101
	Otago	5	1.1	14	1.6	0.6	0.426
	Southland	0	0.0	7	0.8	3.8	0.052

[1] Ethnic groups were prioritised in the following order: Maori; 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, 2003 to 2007

Category	Sub-category	Molecular type				χ^2	*p*-value
		Non-unique (n=466)		Unique (n=867)			
		No.	%	No.	%		
Contact with a confirmed case	Yes	159	34.1	111	12.8	85.3	0.000
	No	173	37.1	537	61.9	75.0	0.000
	Unknown	134	28.8	219	25.3	1.9	0.168
Exposure in a healthcare setting	Yes	18	3.9	65	7.5	6.9	0.009
	No	353	75.8	604	69.7	5.5	0.019
	Unknown	95	20.4	198	22.8	1.1	0.303
Born outside NZ	Yes	247	53.0	715	82.5	131.0	0.000
	No	186	39.9	119	13.7	117.8	0.000
	Unknown	33	7.1	33	3.8	6.9	0.009
Current or recent residence with person born outside NZ	Yes	236	50.6	564	65.1	26.2	0.000
	No	148	31.8	170	19.6	24.6	0.000
	Unknown	82	17.6	133	15.3	1.1	0.286
Birth country region	Asia	109	23.4	515	59.4	157.8	0.000
	Australian	0	0.0	3	0.3	1.6	0.204
	New Zealand	186	39.9	119	13.7	117.8	0.000
	North African & the Middle East	2	0.4	7	0.8	0.6	0.421
	North American	1	0.2	1	0.1	0.2	0.655
	NW Europe	3	0.6	18	2.1	4.0	0.045
	Pacific Island	93	20.0	76	8.8	34.3	0.000
	South & Central American	0	0.0	8	0.9	4.3	0.038
	Southern & Eastern Europe	1	0.2	6	0.7	1.3	0.250
	Sub-Saharan Africa	35	7.5	75	8.7	0.5	0.471
	Unknown	36	7.7	39	4.5	5.9	0.015
Current or recent residence in an institution	Yes	12	2.6	25	2.9	0.1	0.744
	No	362	77.7	679	78.3	0.1	0.790
	Unknown	92	19.7	163	18.8	0.2	0.677
Has immunosuppressive illness	Yes	77	16.5	144	16.6	0.0	0.968
	No	336	72.1	648	74.7	1.1	0.296
	Unknown	53	11.4	75	8.7	2.6	0.108
On immunosuppressive medication	Yes	18	3.9	45	5.2	1.2	0.276
	No	391	83.9	739	85.2	0.4	0.519
	Unknown	57	12.2	83	9.6	2.3	0.131
Vaccinated with BCG	Yes	172	36.9	364	42.0	3.2	0.072
	No	82	17.6	107	12.3	6.9	0.009
	Unknown	212	45.5	396	45.7	0.0	0.950
Pulmonary disease	Yes	332	71.2	519	59.9	17.0	0.000
	No	97	20.8	287	33.1	22.3	0.000
	Unknown	37	7.9	61	7.0	0.4	0.546

3.4. TB and HIV/AIDS co-infection

Of the 287 TB disease notifications in 2007, HIV and TB co-infection was noted in four (1.4%) cases.

3.5. TB drug susceptibility

Antimicrobial susceptibility data for the isolates from 225 of the culture-positive TB disease cases in 2007 was available. The proportion of isolates resistant to the five antimicrobials routinely tested is shown in Table 15. Overall, during the last 10 years, 1998 to 2007, 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, 2007

Antimicrobial	Resistant[1]					
	M. tuberculosis (n=222)		*M. bovis* (n=3)		All isolates (n=225)	
	No.	%	No.	%	No.	%
Isoniazid (0.1mg/L)	21	9.5	0	-	21	9.3
Isoniazid (0.4mg/L)[2]	7	3.2	0	-	7	3.1
Rifampicin	2	0.9	0	-	2	0.9
Ethambutol	1	0.5	0	-	1	0.4
Pyrazinamide	1	0.5	3[3]	100.0	4	1.8
Streptomycin	11	5.0	0	-	11	4.9

[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 2007, the majority (88.0%) of the isolates were susceptible to all five antimicrobials tested (Table 16). There were two cases (0.9%) of multidrug-resistant TB (MDR-TB, resistance to at least isoniazid and rifampicin). Both cases were TB relapses or reactivations. One case was a visitor from Indonesia. The other MDR-TB case appears to have developed resistance during treatment in New Zealand. Treatment of this case was interrupted during the Northland floods in early 2007 during which time the health services were not able to reach the patient.

MDR-TB remains relatively rare in New Zealand, with an average annual incidence among culture-positive TB disease cases of 0.8% and a total of 21 cases recorded during the last 10 years. All but two of these 21 MDR-TB cases were born overseas and assumed to have acquired their MDR-TB overseas.

Any MDR-TB isolates are now tested for susceptibility to an extended range of antibiotics. No cases of extensively drug-resistant TB (XDR-TB) have 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 16: Distribution of antimicrobial resistance patterns among TB isolates, 2007

Susceptibility	No.	%	Resistance pattern[1]	Isolates with each pattern	
				No.	%
Fully susceptible	198	88.0	-	-	-
Resistant to 1 agent	17	7.6	H	11	4.9
			Z	3[2]	1.3
			S	3	1.3
Resistant to 2 agents	8	3.6	HS	7	3.1
			HR[3]	1	0.4
Resistant to 3 agents	2	0.9	HRZ[3]	1	0.4
			HES	1	0.4

[1] H, isoniazid resistance at the standard concentration of 0.1 mg/L; R, rifampicin; E, ethambutol; Z, pyrazinamide; S, streptomycin
[2] The three *M. bovis* isolates
[3] MDR-TB, multidrug-resistant tuberculosis, that is, resistant to at least isoniazid and rifampicin

A comparison of resistance among isolates from cases born in New Zealand and cases born overseas is presented in Table 17. While, except for pyrazinamide, resistance was higher

among isolates from cases born overseas, none of the differences were significant ($p \leq 0.05$). In addition, when the analysis was confined to *M. tuberculosis*, as *M. bovis* are intrinsically resistant to pyrazinamide, pyrazinamide resistance was also higher among isolates from cases born overseas (0.7%) than among isolates from cases born in New Zealand (0.0%).

Table 17: Resistance by case's place of birth[1], 2007

Susceptibility	Born overseas (n=156)		Born in New Zealand (n=55)		*p*-value[2]
	No.	%	No.	%	
Fully susceptible	135	86.5	51	92.7	0.2220
Resistant to:[3]					
Isoniazid[4]	17	10.9	2	3.6	0.1682
Rifampicin	1	0.6	0	-	1.0000
Ethambutol	1	0.6	0	-	1.0000
Pyrazinamide	2	1.3	2	3.6	0.2789
Streptomycin	10	6.4	0	-	0.0665
MDR-TB[5]	1	0.6	0	-	1.0000

[1] Information on place of birth unknown or not reported for 14 cases which included one isoniazid- and rifampicin-resistant case (MDR-TB) and one isoniazid- and streptomycin-resistant case
[2] Rates compared by the Chi-square test or Fishers 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)

Resistance by ethnicity is shown in Table 18. Resistance, in particular, isoniazid and streptomycin resistance, was highest among cases of Asian or 'Other' ethnicity.

Table 18: Resistance by case's ethnicity[1], 2007

Susceptibility	Maori (n=37)		Pacific Peoples (n=21)		Asian (n=111)		Other (n=17)		European (n=30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Fully susceptible	34	91.9	20	95.2	94	84.7	13	76.5	28	93.3
Resistant[2] to:										
Isoniazid[3]	2	5.4	0	-	16	14.4	2	11.8	1	3.3
Rifampicin	1	2.7	0	-	1	0.9	0	-	0	-
Ethambutol	0	-	0	-	1	0.9	0	-	0	-
Pyrazinamide	1	2.7	1	4.8	1	0.9	0	-	1	3.3
Streptomycin	0	-	0	-	8	7.2	3	17.7	0	-
MDR-TB[4]	1	2.7	0	-	1	0.9	0	-	0	-

[1] Ethnicity was unknown or not reported for 9 cases which were all fully susceptible
[2] Includes resistance alone or in combination with other antimicrobials
[3] Isoniazid resistance at the standard concentration of 0.1 mg/L
[4] Multidrug-resistant tuberculosis (i.e. resistant to at least isoniazid and rifampicin)

Fourteen (6.2%) of the 225 culture-positive cases in 2007 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 relapses/reactivations covers the last five years, 2003 to 2007. During this period, 76 (5.6%) of the 1364 culture-positive tuberculosis cases were reported to be relapses/reactivations. Information on previous treatment was recorded for 62 of the 76 relapses/reactivations and of these, 55 (88.7%) were recorded as having received previous antituberculosis 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 and ethambutol; more likely to be MDR-TB; and less likely to be fully susceptible to all five antimicrobials.

Table 19: Resistance among new cases, relapses/reactivations and previously treated[1] cases, 2003-2007

Susceptibility	New cases (n=1 288)	Relapse/reactivation cases			
		All (n=76)		Previously treated (n=55[1])	
	%	%	*p*-value[2]	%	*p*-value[2]
Fully susceptible	84.6	71.1	0.0019	65.5	0.0002
Resistant to:[3]					
Isoniazid[4]	7.8	25.0	<0.0001	30.9	<0.0001
Rifampicin	0.4	10.5	<0.0001	12.7	<0.0001
Ethambutol	0.6	10.5	<0.0001	14.6	<0.0001
Pyrazinamide	3.7	7.9	0.1889	9.1	0.1325
Streptomycin	7.8	6.6	0.7065	9.1	0.6127
MDR-TB[5]	0.4	10.5	<0.0001	12.7	<0.0001

[1] Information on previous treatment reported for only 62 of the 76 relapse/reactivation cases
[2] Rate compared with that among new cases by the Chi-square test or Fishers 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 2007, there were a total of 443 cases of TB infection (430 treatment of latent infection and 13 on preventive treatment). The TB infection rate was highest in Auckland DHB (23.8 per 100 000 population, 103 cases) followed by Hutt Valley DHB (18.4 per 100 000 population, 26 cases) and Hawke's Bay DHB (18.3 per 100 000 population, 28 cases) (Table 20).

Table 20: TB infections - cases and rates by DHB, 2007

District health board	Number of cases	Rate[1]
Northland	10	6.5
Waitemata	79	15.4
Auckland	103	23.8
Counties Manukau	79	17.0
Waikato	28	7.9
Lakes	0	-
Bay of Plenty	2	-
Tairawhiti	0	-
Taranaki	9	8.4
Hawke's Bay	28	18.3
Whanganui	1	-
Mid Central	16	9.7
Hutt Valley	26	18.4
Capital and Coast	28	10.0
Wairarapa	0	-
Nelson Marlborough	5	3.7
West Coast	0	-
Canterbury	29	5.9
South Canterbury	0	-
Otago	0	-
Southland	0	-
Total	**443**	**10.5**

[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, 2003-2007

Category	Sub-category	2003		2004		2005		2006		2007	
		No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
Age group (years)	<1	8	14.3	1	-	2	-	3	-	3	-
	1 to 4	19	8.4	8	3.5	8	3.5	10	4.4	9	3.9
	5 to 9	15	5.1	9	3.1	6	2.1	4	-	7	2.4
	10 to 14	19	6.1	9	2.9	9	2.9	19	6.1	4	-
	15 to 19	31	10.5	17	5.7	17	5.6	21	6.7	20	6.3
	20 to 29	93	17.5	93	17.3	85	15.6	88	16.0	53	9.5
	30 to 39	97	11.1	76	12.6	61	10.1	58	9.7	52	8.8
	40 to 49	56	9.4	36	5.9	50	8.1	47	7.5	35	5.5
	50 to 59	33	7.1	42	8.8	30	6.1	33	6.5	30	5.8
	60 to 69	45	14.6	33	10.4	28	8.5	26	7.6	34	9.4
	70+	37	10.9	51	14.8	34	9.7	44	12.4	40	11.0
Sex	Male	210	10.6	187	9.3	170	8.4	178	8.7	135	6.5
	Female	213	10.4	185	8.9	160	7.6	171	8.0	152	7.0
	Unknown	0	-	3	-	0	-	4	-	0	-
Ethnicity (prioritised)[2,3]	Maori	62	11.0	74	13.1	46	8.1	62	11.0	50	8.8
	Pacific Peoples	107	47.3	63	27.8	48	21.2	48	21.2	27	11.9
	Asian	162	47.5	149	43.7	161	47.2	151	44.3	140	41.1
	Other	11	32.5	20	59.0	15	44.3	27	79.7	20	59.0
	European	39	1.4	40	1.5	39	1.4	52	1.9	39	1.4
	Unknown	42	-	29	-	21	-	13	-	11	-
District health board	Northland	12	8.1	5	3.3	18	11.9	30	19.7	15	9.7
	Waitemata	73	15.3	47	9.6	55	11.1	31	6.1	40	7.8
	Auckland	90	21.7	68	16.2	72	17.0	56	13.1	53	12.2
	Counties Manukau	80	19.0	71	16.4	53	11.9	67	14.7	39	8.4
	Waikato	19	5.6	27	7.9	24	6.9	33	9.4	21	5.9
	Lakes	4	-	4	-	5	4.9	4	-	1	-
	Bay of Plenty	15	7.9	8	4.1	4	-	7	3.5	8	3.9
	Tairawhiti	1	-	2	-	0	-	0	-	0	-
	Taranaki	10	9.4	4	-	4	-	4	-	3	-
	Hawke's Bay	22	41.7	26	17.2	6	4.0	8	5.2	17	11.1
	Whanganui	1	-	2	-	5	7.8	2	-	3	-
	MidCentral	9	5.6	16	9.8	8	4.9	31	18.9	10	6.1
	Hutt Valley	17	12.2	10	7.2	8	5.7	8	5.7	11	7.8
	Capital and Coast	41	15.4	43	15.9	30	11.0	32	11.5	17	6.0
	Wairarapa	1	-	4	-	2	-	2	-	1	-
	Nelson Marlborough	4	-	9	6.8	2	-	4	-	4	-
	West Coast	1	-	2	-	1	-	2	-	1	-
	Canterbury	13	2.8	19	4.1	23	4.8	21	4.3	36	7.3
	South Canterbury	2	-	1	-	2	-	2	-	4	-
	Otago	6	3.3	5	2.7	5	2.7	7	3.8	2	-
	Southland	2	-	2	-	3	-	2	-	1	-

[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: Maori; Pacific Peoples; Asian; Other; European; Unknown