

**The Epidemiology of  
Meningococcal Disease in  
New Zealand in 2008**

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## EXECUTIVE SUMMARY

### Introduction

- Reviews of meningococcal disease epidemiology in New Zealand have variously been published since 1991. This report provides 2008 data and some comparative historic data.

### Surveillance Methods

- Surveillance of meningococcal disease is based on the combination of disease notification and laboratory data. Isolates and/or meningococcal DNA from cases of disease are fully characterised enabling monitoring and reporting of disease incidence by group and strain type.

### Incidence and Distribution

- Cases of meningococcal disease notified in 2008 numbered 123, a rate of 3.1 per 100 000. This is the third lowest number of cases notified since 1991. Since 1991, the start of the epidemic, the total number of notified cases is 6251. The number of confirmed cases in 2008 was 110, giving a confirmation rate of 89.4% which is the second highest confirmation rate since 1991.
- The rate of disease of 3.1 per 100 000 population in 2008 is still higher (2.1 times) than the pre-epidemic rate of 1.5 per 100 000 (1989-1990) but is the third lowest since 1991. The highest rate of disease of 17.4 per 100 000 was recorded in 2001.
- The highest age-specific rates of disease continue to occur in children less than five years of age, although the rates in 2008 were less than that seen in preceding years; 33.6 per 100 000 for those aged less than one year and 15.1 per 100 000 for 1-4 year olds. Since the start of the Meningococcal B Immunisation Programme in 2004, the age-specific rates have shown a significant decrease across all age groups, other than the 40+ years age group ( $p=0.1069$ ).
- Although age-standardised rates have decreased significantly for all ethnic groups, Maori or Pacific Peoples continue to experience higher rates of disease than the European population. However, during the course of the epidemic of the total number of cases reported, 44% of cases identified as European, 32% as Maori and 20% Pacific Peoples.
- Throughout the epidemic, highest case numbers have consistently occurred in the upper North Island, particularly in the Counties Manukau, Auckland, Waikato and Waitemata District Health Boards (DHBs). Consistently West Coast and South Canterbury have experienced the lowest case numbers.
- Eight deaths occurred in 2008 giving a case-fatality rate of 6.5%. Since 1991 a total of 260 deaths have been recorded, an overall case-fatality rate of 4.2%. The policy of giving antibiotics prior to hospital admission, implemented in 1995, has been endorsed by a lower case-fatality rate occurring for those receiving antibiotics. Since 1991 the case-fatality rate for disease caused by group C has been consistently higher than for subjects infected with group B meningococci.
- The epidemic has been caused by a meningococcal B strain with the PorA type defined as P1.7b,4 (P1.7-2,4). This strain caused 18/78 cases in 1991 rising to a peak of 370/650 cases in 2001. In 2008 there were 44/123 total cases due to the epidemic strain.

- In 2001, the Ministry of Health contracted Chiron Vaccines to make a strain-specific vaccine for epidemic control. Following successful age-group trials the delivery of MeNZB™ to all those aged less than 20 years began in Counties Manukau DHB and some eastern suburbs of Auckland DHB in 2004 and was progressively introduced throughout New Zealand ending in June 2006.
- MeNZB™ vaccine is a strain-specific vaccine targeting the PorA P1.4 on the group B epidemic strain. Rates of disease caused by this strain have decreased while rates for all other meningococcal strains have continued at similar levels.

### **Discussion and Implications**

- Accurate disease surveillance data including strain confirmation have been vital for the evaluation of the effectiveness of the MeNZB™ vaccine in combating the meningococcal disease epidemic in New Zealand. The established historical dataset provided the information against which changes in disease epidemiology has been evaluated. Epidemic strain case numbers under the age of 20 years have significantly decreased from 129 in 2004 to 31 in 2008 ( $p < 0.0001$ ) while alternative strain types have remained relatively static.

## 1. INTRODUCTION

New Zealand's epidemic of group B meningococcal disease began in mid-1991. In the immediate years prior to 1991 a rate of disease of 1.5 per 100 000 population had occurred[1, 2]. With concern over the increasing rates of disease, a workshop was convened in 1995 by the Public Health Commission: *Meningococcal Disease in New Zealand: Where to from here?* Recommendations from this workshop formed the core of a national plan for the control and prevention of meningococcal disease[3]. In this plan the disease was to be passively managed through secondary prevention measures that included intensified epidemiologic surveillance, promotion of public awareness to encourage early diagnosis, treatment, notification of disease, and contact tracing to prevent secondary cases and provide prophylactic antibiotics[4]. However, with case numbers continuing to rise annually this new policy had little impact on the rates of disease mostly caused by group B meningococci with the P1.7b,4 PorA protein, renamed as P1.7-2,4[5, 6].

After a meeting held by the World Health Organization in Geneva in 1997, which followed a peak in cases, a strategy to control New Zealand's epidemic through the development and use of vaccine control was formulated[4, 7]. The decision to use a strain-specific vaccine was assisted by demonstration of the stability of the immunodominant P1.7-2,4 PorA protein of the epidemic strain[6, 8]. Thus in 2001, the year with the highest incidence rate, the Ministry of Health contracted Chiron Corporation, in collaboration with the Norwegian Institute of Public Health, to develop a strain-specific vaccine for the control of New Zealand's epidemic[4].

Clinical trials of this tailor-made vaccine, MeNZB™, commenced in May 2002. These trials were undertaken to assess the safety and immunogenicity of the MeNZB™ vaccine in different age-groups (adults, school children, toddlers, older infants and young infants)[9, 10]. The trial in the very young infant group also assessed if MeNZB™ interfered with immune responses to vaccines in the childhood immunisation schedule[9]. The vaccine trials were conducted by a team from the University of Auckland lead by Professor Diana Lennon, in conjunction with the Ministry of Health, Chiron Vaccines and ESR. Vaccination involved a 3-dose schedule and antibodies were measured by a validated serum bactericidal assay[11]. Data from the clinical trials demonstrated that with the exception of infants less than six months of age, ~ 75% of vaccinees achieved serum bactericidal antibody response levels of  $\geq 1:8$ , and 92% achieved levels  $\geq 1:4$  the level internationally considered to be indicative of a protective antibody response. For those infants vaccinated at age less than six months the protective serum antibody levels were lower (53% after 3 doses and 76% after 4 doses of vaccine)[9, 10].

Following regulatory approval, the Meningococcal B Immunisation Programme for those aged six months to 19 years began on 19 July 2004 in Counties Manukau District Health Board (DHB) and some eastern suburbs of Auckland DHB. In November 2004 the Programme began to be progressively implemented in the remainder of the country. In February 2005, regulatory approval was extended to include young infants aged from 6 weeks to 5 months of age.

The epidemiology of meningococcal disease in New Zealand has been summarised annually as unpublished reports to the Ministry of Health accessible on the website

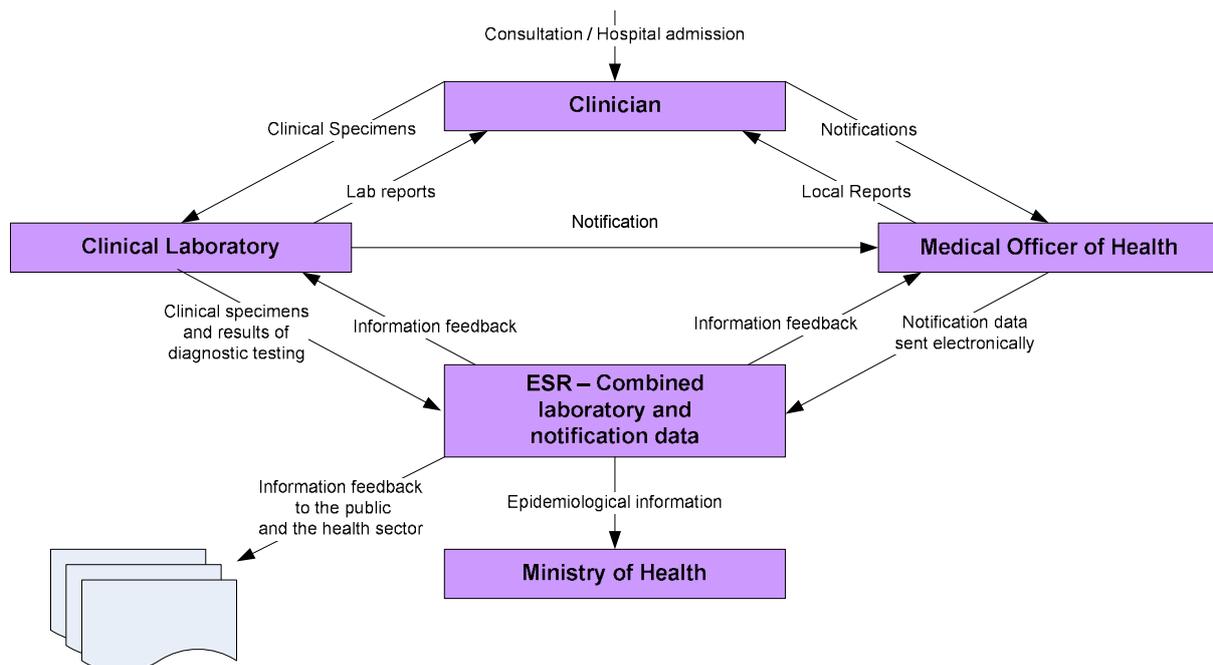
<http://www.moh.govt.nz> and variously in publications[2-7, 12]. This report summarises the epidemiology of meningococcal disease in 2008 and reviews the trends in disease patterns that have occurred since the recognised start of the epidemic in 1991. The report aims to provide historic and recent data against which the success of the Meningococcal B Immunisation Programme to control the epidemic strain of group B meningococcal disease can be measured.

## 2. METHODS

### 2.1. Surveillance Methods

Surveillance of meningococcal disease in New Zealand is based on a combination of notification and laboratory data (Figure 1). Meningococcal disease is notifiable to Medical Officers of Health under the Health Act 1956. Data on each case are recorded into the notifiable disease database (EpiSurv), which is installed in all Public Health Services (PHSs). These data are sent to ESR daily and collated on behalf of the Ministry of Health. Both patient specimens and meningococci or meningococcal DNA obtained from cases of disease are referred to the Meningococcus Reference Laboratory at ESR for confirmation of disease and for characterisation of the invading strain. Additionally, results from any diagnostic testing undertaken in clinical laboratories are actively sought for all notified cases. This information combined with group, and outer membrane PorB and PorA types determined at ESR on isolates and on meningococcal DNA from patient specimens, are entered into a laboratory database and merged with the EpiSurv database to provide a more complete picture of the disease epidemiology. Excel 97 was used to analyse the combined dataset. All maps were produced using ArcView 8.3. The Mantel-Haenszel chi-square test was used to determine statistical significance. P-values less than or equal to 0.05 are considered to be significant at the 95% level of confidence.

**Figure 1: New Zealand meningococcal disease surveillance system, showing main information flows and integration of laboratory and notification information sources**



Notification data are based on information recorded on EpiSurv as at 2 March 2009. Any changes made to EpiSurv data by PHS staff after this date are not reflected in this report. Disease rates were calculated using 1991 population census data as the denominator for the 1990-93 period, 1996 census data for the 1994-2000 period, 2001 census data for 2001-2003, and 2006 census data for 2004-2008. Shifts in the demographics of the New Zealand population mean the accuracy of these data in representing the true population rates lessen as the years become more distant from the census year. Ethnicity-specific rates have been generated for this report using a prioritised approach[13]. The order of prioritisation used was: Maori, Pacific Peoples, Other (other groups except European), and European.

This report also analyses the distribution of meningococcal disease by deprivation using the NZDep2006 index for 2001-2008 data. The index, measuring relative socioeconomic deprivation, is derived from a weighted combination of nine variables, each reflecting a different aspect of material and social deprivation. The deprivation score, which ranges from 1 (least deprived) to 10 (most deprived), is calculated for each geographical meshblock in New Zealand. Approximately equal numbers of people reside in areas associated with each of the ten deprivation levels[14].

For the purposes of this report, an associated case is defined as any case for whom the onset of symptoms in the index case was within 60 days of the onset of symptoms in the associated case. Cases occurring on the same day or within one day of the index case are classified as co-primary associated cases[15-18].

## Case Definition

The case definition in the Ministry of Health's Communicable Disease Control Manual[19] is 'Meningococcal disease presents as meningitis or meningococcal septicaemia. The disease presents as an acute fever, nausea, vomiting, and headache and may rapidly progress to shock and death. Petechial rash is seen in about 50 percent'. Cases with a clinically compatible illness are classified as confirmed or probable as follows:

**Confirmed case:** A clinically compatible illness with at least one of the following:

- isolation of *Neisseria meningitidis* from an otherwise sterile body site (blood, cerebrospinal fluid (CSF), aspirate or skin biopsy); or
- a positive nucleic acid test (NAT) using polymerase chain reaction (PCR) on CSF, blood, serum, or aspirate; or
- detection of Gram-negative intracellular diplococci in CSF, blood, aspirate or skin biopsy; or
- positive meningococcal antigen test on CSF.

**Probable case:**

- a clinically compatible illness and isolation of *N. meningitidis* from the throat; or
- a clinically compatible illness.

## 2.2. Laboratory Methods

All meningococci isolated and patient samples (blood and CSF) or DNA recovered from notified cases of meningococcal disease are referred from diagnostic laboratories in NZ to the Meningococcus Reference Laboratory (MRL) at ESR. The MRL then undertakes confirmation of the presence of a meningococcal or meningococcal DNA and characterisation to determine the strain type. This includes identification of the capsule group, PorB and PorA types.

**Strain typing:** The capsular group is identified either by the slide agglutination technique using commercial antisera specific for serogroups A, B, C, X, Y, Z, W135 and 29E or by PCR testing[20]. The PorB outer membrane protein (OMP) type, and the PorA OMP type are determined on isolates using the whole cell ELISA method of serotyping[21] or by PCR followed by sequence analysis[22]. For whole cell analysis the following monoclonal antibodies (RIVM, The Netherlands, NIBSC, England) are used for detecting PorB antigens 1, 2a, 2b, 4, 14 and 15; and for PorA: P1.1, P1.2, P1.4, P1.5, P1.6, P1.7, P1.9, P1.10, P1.12, P1.13, P1.14, P1.15 and P1.16. Note the sequencing of the PorB gene is not routinely undertaken.

The strain type is defined using the group, PorB, and PorA types. Thus using the epidemic strain B:4:P1.7-2,4 as an example, B is the group, 4 is the PorB type and P1.7-2,4 defines the PorA type. The PorA type has two epitopes known as variable regions, which are each identified. The 7-2 indicates there is a specific deletion in the VR1 epitope, otherwise defined as P1.7. Monoclonal antibodies do not necessarily recognise epitopes with deletions in the variable regions. Hence the epidemic strain is serologically defined as B:4:P1.4.

Multi-locus sequence typing[23] is used to further characterise isolates of interest and when needed restriction fragment length polymorphism (RFLP) analysis of isolates[24] is carried out for the purpose of defining clusters.

**Antimicrobial susceptibility testing:** The ceftriaxone, ciprofloxacin, penicillin and rifampicin susceptibilities of all culture-positive cases were determined by Etest. Minimum inhibitory concentrations (MICs) were interpreted according to Clinical and Laboratory Standard Institute criteria[25].

### **3. RESULTS**

Unless otherwise stated the analyses have been undertaken on all notified cases of meningococcal disease (confirmed and probable) except in sections where only confirmed cases are analysed.

Analyses of those cases which were caused by the epidemic strain type are detailed in the section labelled epidemic strain analysis.

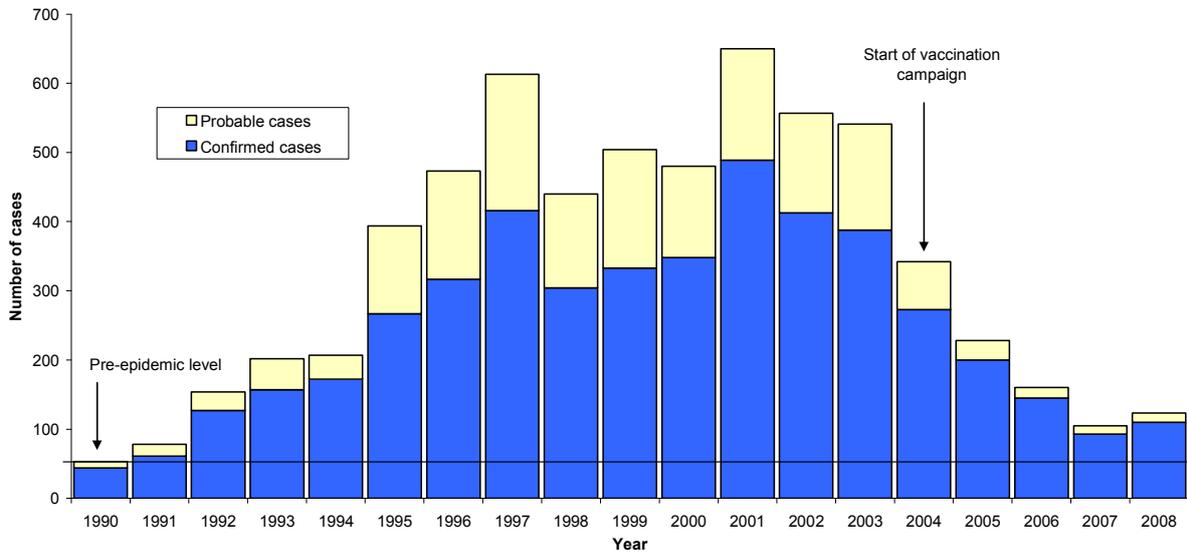
Data prior to 2002 may under-represent the number of epidemic strain cases due to changes in laboratory practices over the course of the epidemic. In the early 1990s strain confirmation was based on isolation of the organism only but the administration of antibiotics prior to hospitalisation, advocated from 1995, reduced the likelihood of isolation. PCR confirmation was gradually accepted as an alternative from 1997, but was not considered standard practice until 2004. Care is therefore required in the use of these data.

#### **3.1. Incidence and Distribution**

##### **3.1.1. Incidence and Rates by Year**

The total number of cases reported since the epidemic began in 1991 to the end of 2008 is 6251. This is an excess of 5333 cases over the number that would have occurred had the pre-epidemic (1989-90) average of 51 cases per annum (incidence rate 1.5 per 100 000) continued. Case numbers increased from 78 in 1991 to a peak of 613 in 1997 and, following a decrease during 1998 to 2000 period to an average of 475 cases, numbers increased again to 650 notified cases in 2001 (Figure 2). Although case numbers decreased in 2002 to 557, a similar number of cases occurred in 2003. The Meningococcal B Immunisation Programme started in July 2004. In 2004, 342 cases were recorded, reducing to 228 in 2005, 160 in 2006, 105 in 2007 and increased to 123 in 2008 (Figure 2). There was a significant year to year reduction from 2004 to 2007 and a non-significant increase between 2007 and 2008.

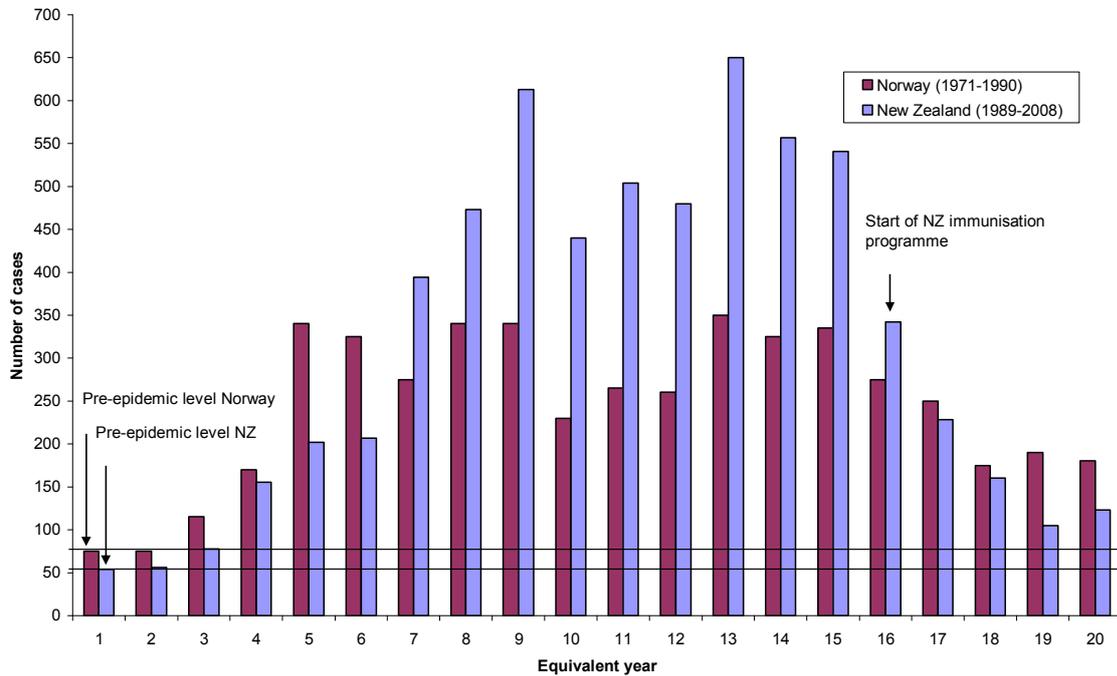
**Figure 2: Total cases (Confirmed and probable) notified meningococcal cases, 1990-2008**



The 2008 rate of disease of 3.1 per 100 000 population (123 cases) was significantly higher ( $p < 0.0001$ ) than the pre-epidemic rate of 1.5 per 100 000 that occurred during the years 1989 and 1990 and is the third lowest since 1991 (2.3 per 100 000 population, 78 cases). The highest rate of disease of 17.4 per 100 000 population was recorded in 2001.

The annual number of cases in New Zealand for the two years (1989-1990) preceding the epidemic and those occurring from 1991-2008 have been overlaid on the published numbers of cases in equivalent years for Norway's group B epidemic from 1971-1990[26]. For the period 1995-2004 case numbers were higher in New Zealand than for the equivalent year of the Norwegian epidemic. However, over the last four years New Zealand case numbers have dropped below the Norwegian case numbers for the equivalent year since the start of each epidemic (Figure 3). While a vaccine was trialled in Norway there was no mass immunisation programme as occurred in New Zealand.

**Figure 3: Meningococcal disease cases by equivalent year for Norway and New Zealand**

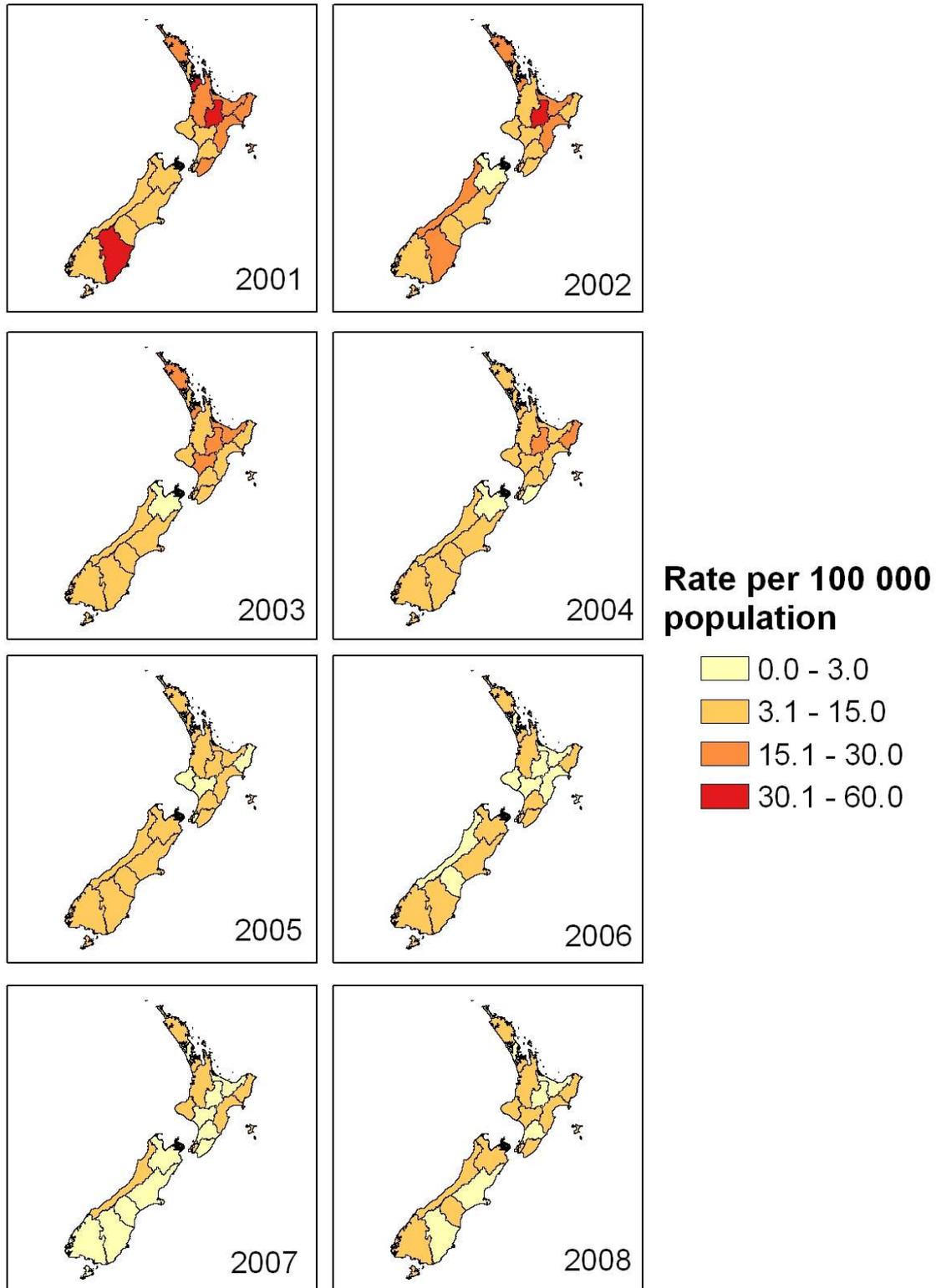


### 3.1.2. Incidence by Place

A marked geographic variation in the number of notified cases and rates of meningococcal disease has occurred since 1991 and 2008 was no exception. A comparison of rates compared to the peak year 2001 is shown in Figure 4; Appendix: Tables 4 & 5.

In 2008, Counties Manukau DHB had the highest number of cases (16). Hawke’s Bay had the second highest number of cases (12) followed by Waikato (11) and Auckland (10). However, the highest rate of disease was in Hawke’s Bay (8.1, 12 cases) followed by Whanganui (8.0, 5 cases) and Northland (5.4, 8 cases) DHBs.

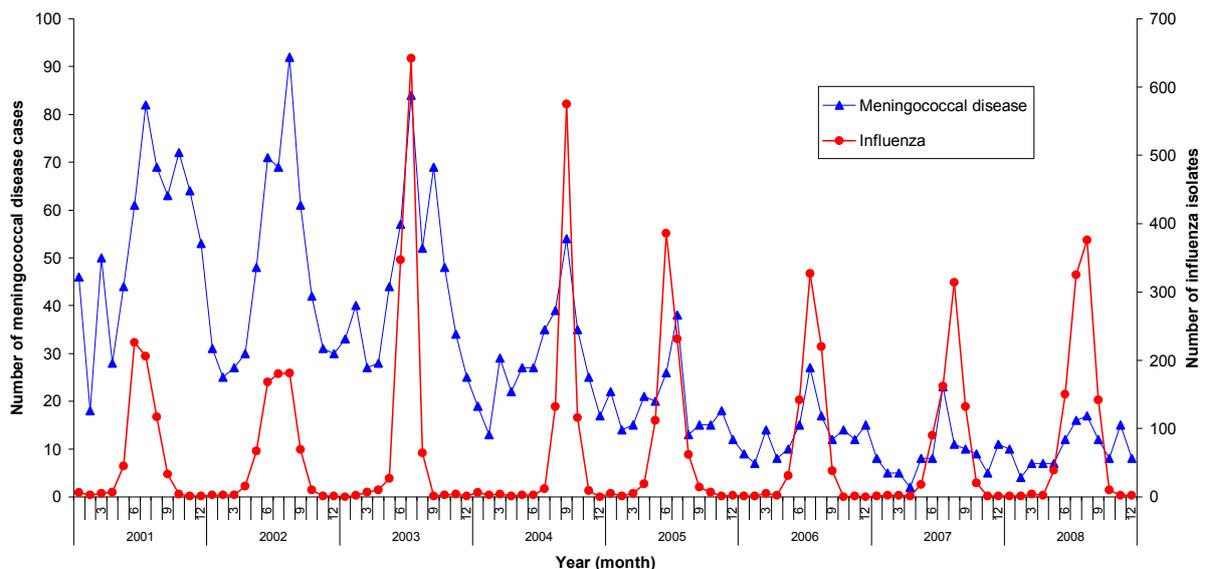
Figure 4: Meningococcal disease rates per 100 000 by District Health Board, 2001-2008



### 3.1.3. Incidence of Disease by Month

In each year of the epidemic the monthly distribution has been dominated by a greater number of cases of disease occurring in the winter/spring months (June through November), though the height of the winter peak has varied from year to year. In most years the peak in case numbers of meningococcal disease has coincided with the influenza peak as ascertained by influenza surveillance (Figure 5). In 2008 meningococcal disease cases had two peaks, one in August (the same as the influenza peak) and another one in November.

Figure 5: Meningococcal disease cases and influenza isolates by month, 2001-2008



### 3.1.4. Incidence by Age

The rate for the less than one year age group peaked in 1997 at 212.0 per 100 000, and was followed by a second peak in 2001 of 205.0. Since 2001, the rate in this age group has decreased significantly by 84% to 33.6 per 100 000 ( $p < 0.001$ ) (Figure 6). The rate for the less than one year old age group had a 37% significant decrease from 2004 to 2005 ( $p = 0.0496$ ), 17% non-significant increase from 2005 to 2006 ( $p = 0.5286$ ) 44% significant decrease from 2006 to 2007 ( $p = 0.0393$ ) and no decrease from 2007 to 2008.

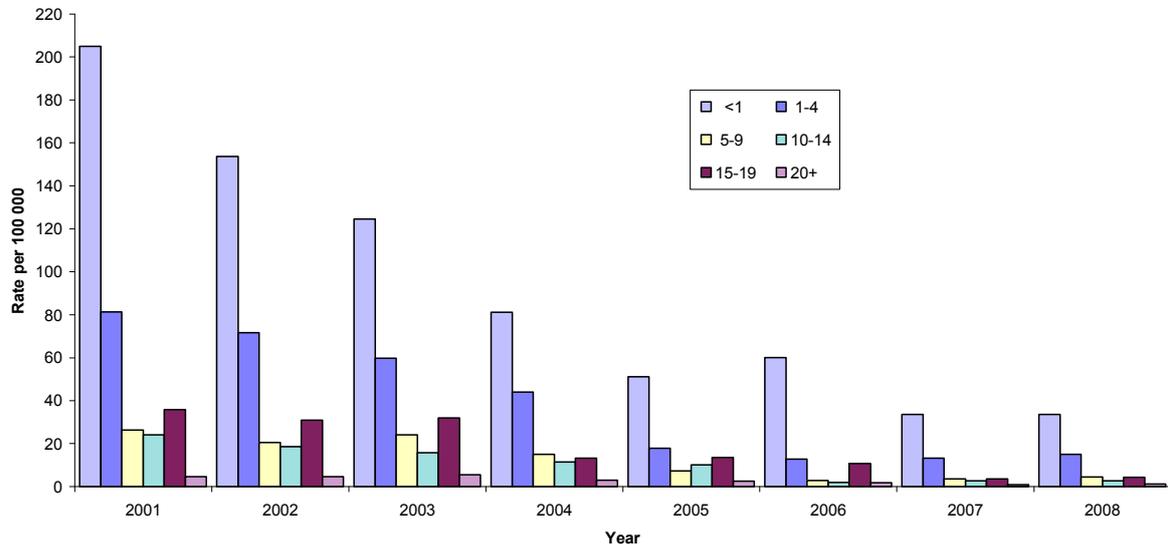
The rate for the 1-4 years age group also peaked in 1997 when it was 96.9 per 100 000. From 2001 to 2006 the rate for the 1-4 years age group steadily decreased, followed by non-significant increases from 2006 to 2007 and from 2007 to 2008.

The 2008 age-specific rates were significantly lower across all of the reported age groups compared with the age-specific rates in the peak epidemic year of 2001. Since the start of the Meningococcal B Immunisation Programme in 2004, the age-specific rates have shown a significant decrease across all age groups, other than the other than the 40+ years age group ( $p = 0.1069$ ).

In 2008, the percentage of cases aged less than five years was 42.3%, which was lower than the peak of 56.7% in 1999 and in 2007 (45.7%) but higher than in 2004 (41.5%), 2005 (29.8%) and 2006 (38.8%). In 2008, 47.4% (9/19) of infants aged less than one year were

less than six months old at the time of disease. This was lower than the average 50.0% (196/392) of cases occurring in the period 2001-2007 [Appendix: Tables 8 & 9].

**Figure 6: Meningococcal disease rates by age group, 2001- 2008**



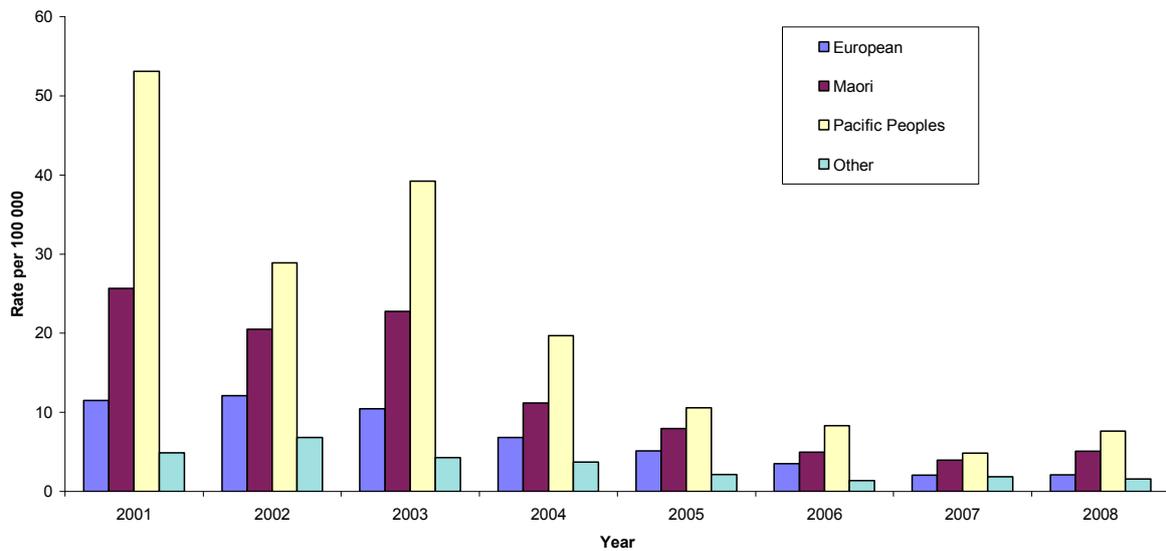
### 3.1.5. Incidence by Ethnicity

Over the last eight years age-standardised rates by ethnicity for meningococcal disease have consistently demonstrated higher rates in Maori and Pacific Peoples compared with the European population, with the highest rates observed for Pacific Peoples (Figure 7). The age-standardised rate for Pacific Peoples in 2008 (7.6 per 100 000) decreased by 86% compared with 2001 (53.1 per 100 000). Similarly, for Maori, the 2008 rate (5.1 per 100 000) decreased by 80% when compared with the 2001 rate (25.7).

As in previous years, age-standardised rates for Maori and Pacific Peoples continue to be significantly ( $p < 0.0001$ ) higher than that for Europeans (2.9 and 3.6 times respectively). The rate differences for Maori and Pacific Peoples when compared with Europeans are now 2.9 and 5.5 per 100 000 respectively, compared with a peak rate difference of 15.3 for Maori and 58.7 for Pacific Peoples, both in 1997. The age-standardised rates for ‘Other’ ethnicity has also come down from 14.6 per 100 000 in 1997 to 1.6 per 100 000 in 2008.

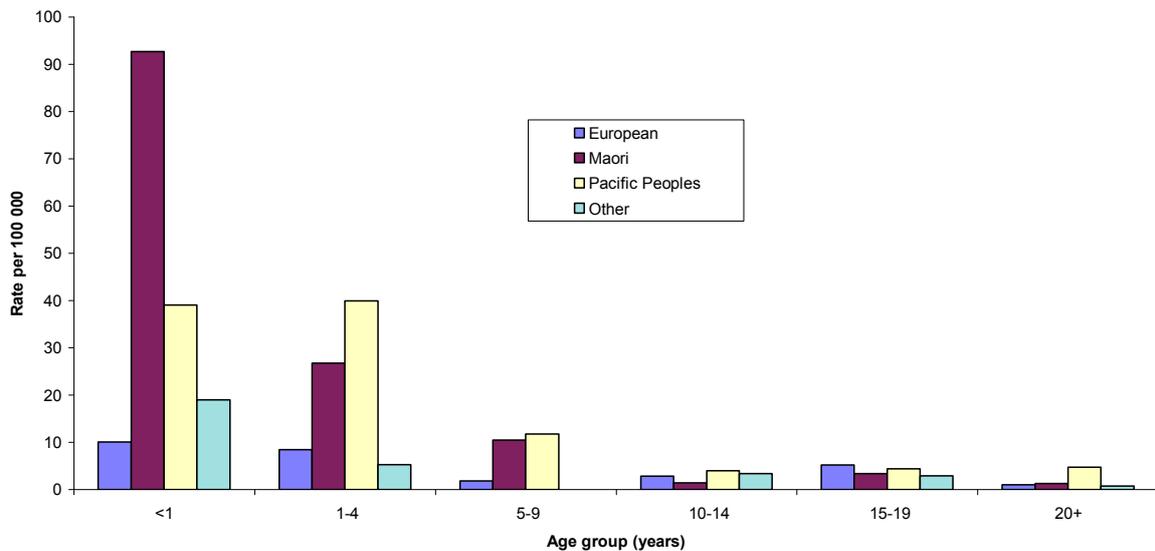
Although, relatively speaking, Maori and Pacific Peoples bear a disproportionate burden of meningococcal disease, due to its size, the European population has experienced a greater number of cases. Between 1991 and 2008, 44% of the cases were European, 32% Maori, 20% Pacific Peoples, 3% Other ethnicity, and the remaining 3% were of unknown ethnicity.

**Figure 7: Age standardised rates for total meningococcal disease cases by ethnicity, 2001-2008**



Since 1991, in all ethnic groups rates of disease were consistently highest among those less than one year of age, other than in 2008 when the rate in the Pacific Peoples' <1 and 1-4 years age groups was similar. The highest rate in 2008 was observed in Maori aged less than one year (92.7 per 100 000 population) (Figure 8). This rate, based on 13 cases, is higher than the rate of 57.0 in 2007 (8 cases). In 2008, the rate for children of Pacific Peoples ethnicity aged less than one year was 39.1 per 100 000 population (2 cases), lower than the 2007 rate of 58.6 per 100 000 (3 cases) and considerably lower than the 2004 rate of 175.7 (9 cases) [Appendix: Tables 13 & 14]. In comparison the European rate for those aged less than one year was 10.1 per 100 000 (3 cases).

**Figure 8: Meningococcal disease rates by age group and ethnicity, 2008**



The median age for cases of meningococcal disease by ethnicity were markedly different in 2008, being 1.0 year for Maori and 5.0 years for Pacific Peoples, compared with 16.5 years among the European population.

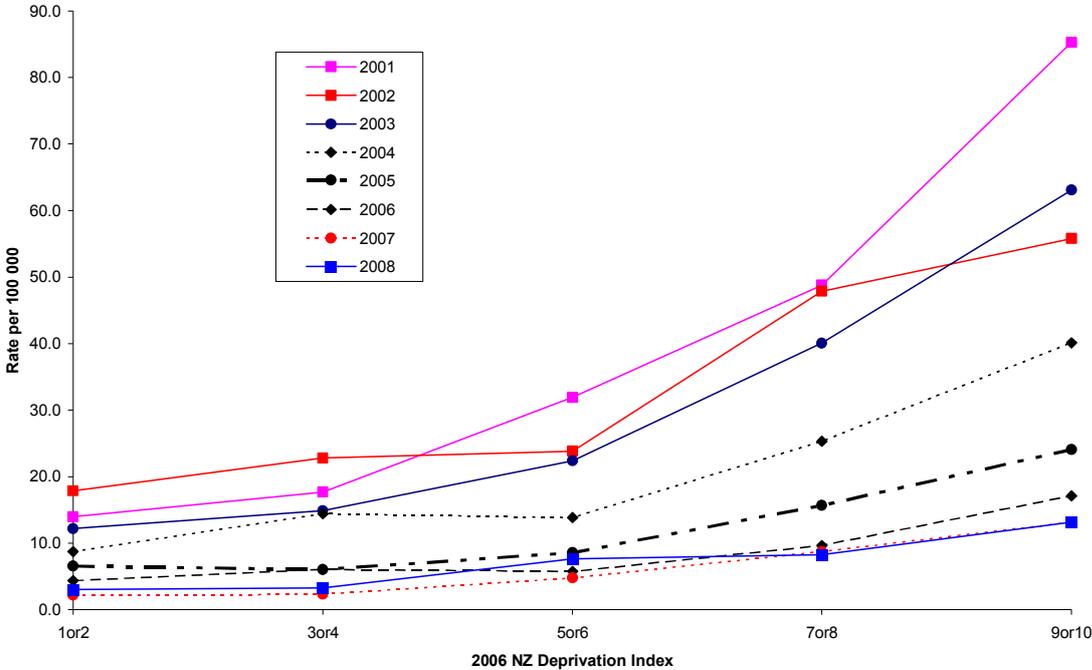
**3.1.6. Incidence by Sex**

Other than in 1998 when they were equal, the rate of meningococcal disease has consistently been higher in males than in females [Appendix: Tables 16 & 17]. Over the last five years the male to female rate ratio has fluctuated from year to year, 1.2 in 2004, 1.3 in 2005, 1.1 in 2006, 1.2 in 2007 and 1.5 in 2008. The difference between male and female rates in 2008 is statistically significant (p=0.0306).

**3.1.7. Incidence by Deprivation for Cases under 20 years old**

Inequalities in meningococcal disease rates by socio-economic status have decreased between 2001 and 2008 (Figure 9). Since 2001, the rate of meningococcal disease has dropped significantly (p<0.0001) for each quintile of NZDep06, and the relative burden experienced by more deprived groups has decreased. In 2001 for those aged 0-19 years, individuals from the most deprived quintile had six times the rate of meningococcal disease (85.3 per 100 000) compared with individuals from the least deprived quintile (13.9 per 100 000). From 2001 to 2007, the ratio of these two rates fluctuated between 3.7 and 6.1:1 and in 2008 was 4.3:1. The rate of disease for 0-19 year olds in the most deprived quintile in 2008 was 13.1 per 100 000 slightly lower than that experienced by the least deprived quintile in 2001 (13.9 per 100 000). Between 2001 and 2008 the difference in rates between these quintiles has decreased from 71.4 to 10.1 per 100 000.

**Figure 9: Meningococcal disease rates by quintiles of NZDep06 for cases under 20 years, 2001-2008**



### **3.2. Basis for Diagnosis**

Notifiable disease data include information on presenting symptoms i.e. meningitis, septicaemia, petechial or purpuric rash, and septic arthritis. However, New Zealand has no standardised criteria for classifying the clinical features of meningococcal disease cases. Therefore, the assessment and assignment of presenting symptoms may vary between clinicians. From 1997-2008, around 52% of notified cases are described as having meningitis, 55% septicaemia, 76% petechial rash and less than 1% septic arthritis.

#### **3.2.1. Confirmation of Disease Based on Laboratory Testing**

Confirmation of disease is based on a hierarchical system where each case is represented in the following table (Table 1) only once, starting with the isolation of *N. meningitidis* from CSF, blood or other sterile site followed by PCR/sequencing analysis. Observation of gram-negative diplococci in a sterile site as the sole means of confirmation is now rare. Recovery of a meningococcus from the throat provides presumptive evidence only. The case is categorised as probable because invasive disease cannot be confirmed. If a meningococcus is recovered from the eye, and a clinician notifies the case, then the case is included as confirmed invasive disease.

Following intensified efforts by the Ministry of Health from 1995 to get general practitioners to use pre-hospital antibiotics, the proportion of cases confirmed by isolation decreased from 83% in 1994 to a low of 41% in 2002 but has averaged around 56% over the last six years (2003-2008). PCR technology to confirm the existence of meningococcal DNA in patient specimens as an alternative to laboratory culture has increased the disease confirmation rate. An average of 73.8% of cases was confirmed in the years 2001 through 2003, with an increase to 79.8% in 2004 (when the Ministry of Health encouraged laboratory confirmation of cases to assist with the monitoring of MeNZB vaccine breakthroughs), 87.7% in 2005, 90.6% in 2006, 88.6% in 2007 and 89.4% in 2008. In the four years 2005-2008, just one case (2008) has been notified with a throat isolate as the basis of suspected meningococcal disease (probable category).

**Table 1: Meningococcal disease, basis for diagnosis, 2001-2008<sup>1</sup>**

	2001		2002		2003		2004		2005		2006		2007		2008	
	No.	%														
<b>Basis for diagnosis</b>																
Isolation of <i>N. meningitidis</i> from blood and/or CSF or any other sterile site	319	49.1	229	41.1	242	44.7	180	52.6	130	57.0	86	53.8	66	62.9	78	63.4
PCR/DNA analysis	159	24.5	177	31.8	142	26.2	93	27.2	70	30.7	59	36.9	27	25.7	32	26.0
Gram-negative diplococci in CSF	11	1.7	7	1.3	4	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Confirmed – subtotal</b>	<b>489</b>	<b>75.2</b>	<b>413</b>	<b>74.1</b>	<b>388</b>	<b>71.7</b>	<b>273</b>	<b>79.8</b>	<b>200</b>	<b>87.7</b>	<b>145</b>	<b>90.6</b>	<b>93</b>	<b>88.6</b>	<b>110</b>	<b>89.4</b>
Clinical criteria and a positive throat swab	4	0.6	4	0.7	6	1.1	3	0.9	0	0.0	0	0.0	0	0.0	1	0.8
Clinical criteria	157	24.2	140	25.1	147	27.2	66	19.3	28	12.3	15	9.4	12	11.4	12	9.8
<b>Probable – subtotal</b>	<b>161</b>	<b>24.8</b>	<b>144</b>	<b>25.9</b>	<b>153</b>	<b>28.3</b>	<b>69</b>	<b>20.2</b>	<b>28</b>	<b>12.3</b>	<b>15</b>	<b>9.4</b>	<b>12</b>	<b>11.4</b>	<b>13</b>	<b>10.6</b>
<b>Total</b>	<b>650</b>	<b>100</b>	<b>557</b>	<b>100</b>	<b>541</b>	<b>100</b>	<b>342</b>	<b>100</b>	<b>228</b>	<b>100</b>	<b>160</b>	<b>100</b>	<b>105</b>	<b>100</b>	<b>123</b>	<b>100</b>

1 Each case is represented only once in the table.

### 3.2.2. Confirmation of Disease Following Antibiotic Usage

Of the 78 cases confirmed by culture in 2008, 11 (15.1%) had been given antibiotics prior to hospitalisation. A further nine cases given antibiotics were culture negative but were able to be confirmed by PCR (Table 2). These results support the value of PCR testing in cases where antibiotics have been given prior to admission.

**Table 2: Pre-hospital antibiotic treatment of meningococcal disease cases by basis of laboratory confirmation, 2008**

Basis of diagnosis <sup>1</sup>	No. of cases	Pre-hospital antibiotic treatment			
		Yes	No	Unknown	% treated <sup>2</sup>
Isolation of <i>N. meningitidis</i> from blood and/or CSF or any other normally sterile site	78	11	62	5	15.1
PCR	32	9	18	5	33.3
Gram-negative diplococci in CSF	0	0	0	0	-
Meningococcal antigen test	0	0	0	0	-
<b>Confirmed –subtotal</b>	<b>110</b>	<b>20</b>	<b>80</b>	<b>10</b>	<b>20.0</b>
Clinical Criteria and a positive throat swab	1	0	1	0	0.0
Clinical criteria only	12	5	6	1	45.5
<b>Probable –subtotal</b>	<b>13</b>	<b>5</b>	<b>7</b>	<b>1</b>	<b>41.7</b>
<b>Total</b>	<b>123</b>	<b>25</b>	<b>87</b>	<b>11</b>	<b>22.3</b>

1 Each case is represented only once in the table

2 Percentage (%) of cases for whom this information was available

### 3.3. Characteristics of Meningococci Causing New Zealand's Disease

#### 3.3.1. Meningococcal Disease Cases by Strain Type

Since 1991, the increase in disease has been attributable largely to serogroup B meningococci expressing the P1.7b,4 (P1.7-2,4) PorA protein. In 2001, the peak year for disease incidence, 80.1% (370/462) of confirmed cases able to be strain typed were caused by the epidemic strain. An even higher proportion was reported in 2000 when 84.3% (269/319) confirmed cases were caused by the epidemic strain. Since the introduction of MeNZB<sup>TM</sup>, the percentage of confirmed cases with the epidemic strain type has fallen significantly from 72.7% (184/253) in 2004 to 55.2% (74/134,  $p=0.0005$ ) in 2006, 52.2% (47/90,  $p=0.0004$ ) in 2007 and 43.6% (44/101,  $p<0.0001$ ) in 2008. The rate of epidemic strain in 2008 (1.1 per 100 000) is significantly lower than the peak rate of 9.9 in 2001 ( $p<0.001$ ).

There has been no statistically significant change in the rate of meningococcal disease due to alternative group B (not epidemic strain) and group C strains from 2004 to 2008 ( $p$ -value=0.9068 & 0.0679). The number of cases due to alternative B strains was 37 in 2008 compared with 36 in 2004 and for group C disease there were 10 cases in 2008 compared with 20 in 2004 (Figure 10). Since the introduction of MeNZB<sup>TM</sup> vaccine, the number of cases due to other (non-B, non-C) strains has remained small, ranging from 6 to 12 cases per year.

### 3.3.2. Epidemic Strain Analysis

As indicated in Section 3.3.1, in 2008, there were 44 cases confirmed as due to the epidemic strain, compared with 47 in 2007, 74 in 2006, 113 in 2005, 184 in 2004, and 370 in the peak year 2001 (Figure 10). The incidence rate of confirmed epidemic strain cases peaked at 9.9 per 100 000 in 2001. The rate of epidemic strain in 2008 (1.1 per 100 000) is significantly lower than the peak rate of 9.9 in 2001 ( $p < 0.001$ ).

For all meningococcal disease regardless of strain type, the rate of epidemic strain disease has consistently been highest in those aged less than five, particularly in those aged less than one year. For this youngest age group (<1 year), the 2008 rate of 17.7 per 100 000 (10 cases) was higher than 2007 rate (12.4, 7 cases,  $p = 0.4668$ ) and lower than all other preceding years since 2001.

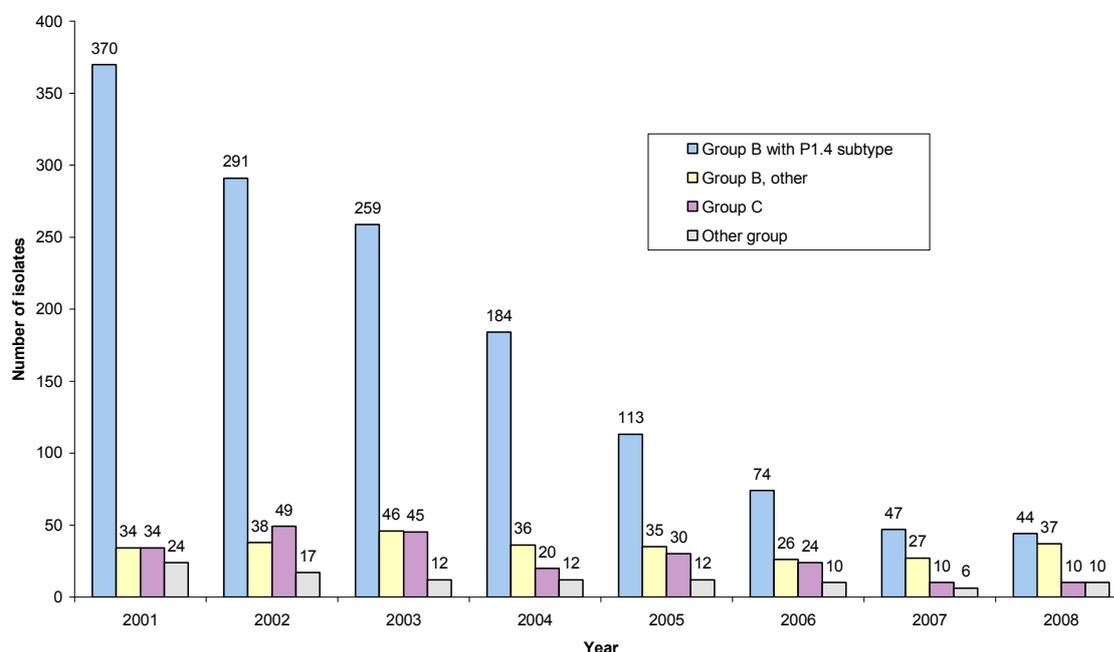
Restricting the analysis to those aged <20 years, epidemic strain case numbers decreased from 129 in 2004 to 81 in 2005, 47 in 2006, 38 in 2007 to 31 in 2008. In 2001, the peak year, there were 296 cases confirmed as epidemic strain in those aged <20 years (Appendix: Table 21). The rate of epidemic strain was 11.9 per 100 000 in 2004, 7.3 in 2005, 4.0 in 2006, 3.3 in 2007 and 2.7 in 2008. The rate of epidemic strain decreased in this age group by 37% from 2004 to 2005 ( $p = 0.0009$ ), 42% from 2005 to 2006 ( $p = 0.0010$ ), 19% from 2006 to 2007 ( $p = 0.3290$ ) and 18% from 2007 to 2008 ( $p = 0.3994$ ).

The crude rate of epidemic strain cases for those aged <20 years old has decreased for all ethnic groups from the peak year in 2001. The rate for Pacific Peoples was 7.1 per 100 000 in 2008 (9.2 in 2007, 8.1 in 2006, 15.3 in 2005, 17.3 in 2004 and 75.2 in 2001). The rate for Maori was 5.8 in 2008 (6.6 in 2007, 8.1 in 2006, 9.7 in 2005, 16.6 in 2004 and 46.7 in 2001). The rate for European was 1.1 in 2008 (1.5 in 2007, 2.8 in 2006, 6.0 in 2005, 10.1 in 2004 and 16.4 in 2001).

Since 2004, across all age groups there have been 22 deaths due to the epidemic strain: 2004 (5 deaths), 2005 (6 deaths), 2006 (4 deaths), 2007 (3 deaths) and 2008 (4 deaths). Of the 22 deaths, 14 (63.6%) were in the under 20 years of age group, six were in the 40+ years age group and two were in 30-39 years age group.

The impact of MeNZB<sup>TM</sup> on the numbers of cases occurring is shown in Figure 10. Although epidemic disease case numbers decreased from 2001, there was a greater decrease from 2004-2005 (39%) than there was for 2001-2002 (21%), 2002-2003 (11%) and 2003-2004 (29%). The decrease also continued for 2005-2006 (35%), 2006-2007 (36%) and 2007-2008 (6 %).

**Figure 10: Meningococcal disease isolate group and dominant subtype, isolation and PCR-positive cases, 2001-2008**



### 3.3.3. Antimicrobial Susceptibility

The antimicrobial susceptibility of all 79 viable meningococcal isolates received at ESR from cases of invasive disease in 2008 was tested (Table 3). Note, this number of isolates is one more than the 78 culture-positive cases included in other analyses in this report. This difference is due to one culture-positive case only having a ‘probable’ case status at the time data was downloaded from EpiSurv for the other analyses in this report.

All isolates were susceptible to ceftriaxone, ciprofloxacin and rifampicin. 26.6% (21/79) of isolates had reduced penicillin susceptibility (MIC  $\geq$  0.12 mg/L): 66.7% (4/6) of serogroup W135 isolates, 27.1% (16/59) of all serogroup B isolates, 18.2% (6/33) of isolates of the NZ epidemic strain, and 20.0% (1/5) of serogroup Y isolates.

**Table 3: MIC range and MIC<sub>90</sub> of isolates, 2008**

Antimicrobial	MIC <sup>1</sup> range (mg/L)	MIC <sub>90</sub> <sup>2</sup> (mg/L)
Penicillin	0.016-0.5	0.25
Ceftriaxone	0.002-0.004	0.002
Rifampicin	0.004-0.25	0.06
Ciprofloxacin	0.004-0.008	0.008

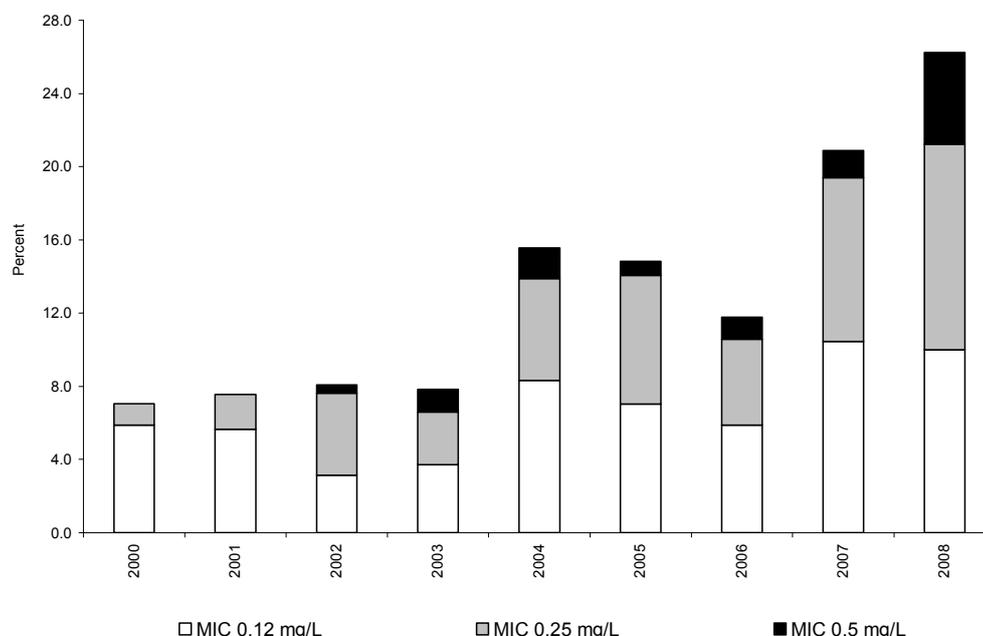
1 Minimum inhibitory concentration

2 Concentration that inhibits at least 90% of the isolates

Over the last 10 years there has been a general trend of an increasing proportion of isolates with reduced penicillin susceptibility (Figure 11). There has also been a shift to higher

penicillin MICs. Until 2002, the majority of isolates with reduced penicillin susceptibility had MICs of 0.12 mg/L. Since then, isolates with penicillin MICs of 0.25 mg/L have formed a larger proportion of the isolates with reduced susceptibility, and isolates with penicillin MICs of 0.5 mg/L have emerged. Meningococcal infections due to isolates with reduced susceptibility are still treatable with penicillin.

**Figure 11: Prevalence of reduced penicillin susceptibility among *Neisseria meningitidis* from invasive disease, 2000-2008**



No resistance to ceftriaxone or ciprofloxacin has been confirmed among meningococci isolated from cases of invasive disease in New Zealand. Only four rifampicin-resistant isolates have been confirmed: one serogroup B (B:4:P1.4) isolate in 2003, one serogroup C (C:2b:P1.2) isolate in 1997, one serogroup B (B:15:P1.7,16) isolate in 1992, and one serogroup A isolate in 1986.

### 3.4. Clinical Outcome

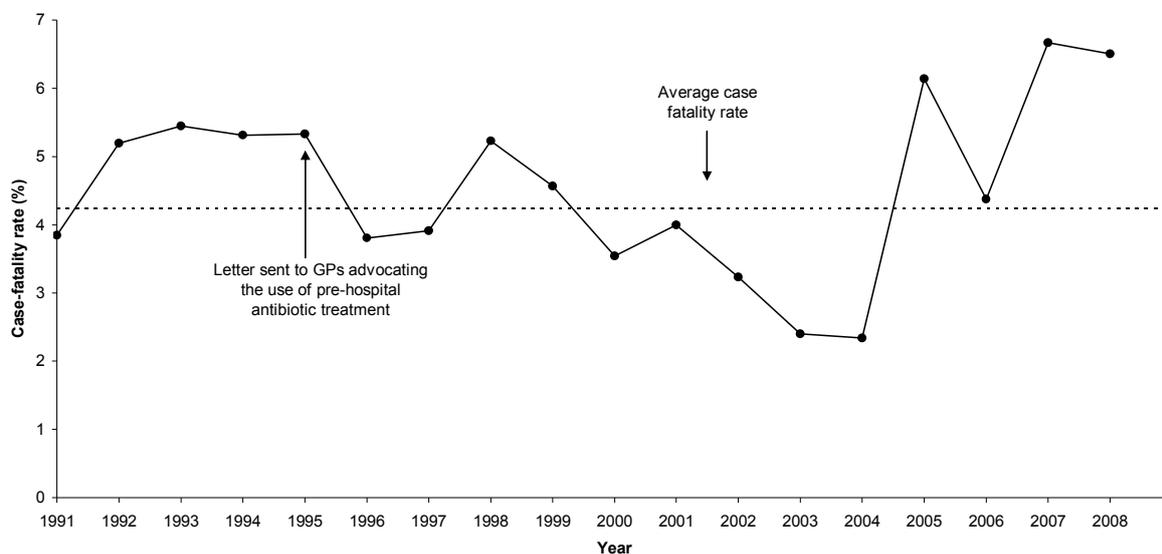
The total number of fatalities since the epidemic began in 1991 is 260, giving an average case-fatality rate for the epidemic of 4.2% per annum. This total is an excess of 204 deaths over the number that would have occurred had the pre-epidemic incidence and case-fatality (3.1%) rates continued during this 18-year period. The 2008 case-fatality rate of 6.5% (eight cases) was higher than the average of 4.2% for 1991-2008 (Figure 12).

Of the eight fatalities in 2008, four were cases of the epidemic strain type, two B other and one was due to C. The other fatality in 2008 was a probable case (strain type undefined). The 2001-2008 eight-year case-fatality rate for group C is 11.2% (25 deaths), compared to 3.9% (54 deaths) for the epidemic strain.

The case-fatality rate for the last eight years (2001-2008) was greatest for those aged over 40 years (9.9%, 28 deaths) and least for those aged 10-14 years (1.2%, 3 deaths). By ethnicity, the case-fatality rate for 2001 to 2008 is greatest for "Other" ethnicity (14.1%, 12 deaths)

followed by Europeans (3.7%, 47 deaths), Pacific Peoples (3.1%, 16 deaths), and Maori (3.1%, 26 deaths).

**Figure 12: Meningococcal disease case-fatality rates, 1991-2008**



### 3.5. Case Management

#### 3.5.1. Hospitalisation

Information on hospitalisation was recorded for 98.4% (121/123) of meningococcal disease cases reported in 2008. A total of 118 (97.5%) cases were hospitalised. This is similar to the 98.1% in 2007. Two of the cases which were not hospitalised died before being admitted to hospital.

#### 3.5.2. Pre-hospital Visit to Doctor and Antibiotic Treatment

Since 1993, the Ministry of Health has advocated the administration of antibiotics prior to admission to hospital, with additional instructions provided to general practitioners in a letter in 1995. It is difficult to interpret the impact of this policy from the data collected due to incompleteness and potential confounding factors within the data (eg, disease severity at presentation). However, the available data indicates that since 1997, the proportion of cases seen by a doctor before going to hospital that were given antibiotics prior to admission has not increased. The proportion has fluctuated between 30 and 40%. In 2008, 38.1% (24/63) of such cases were given pre-hospital antibiotics.

The annual number of deaths in meningococcal disease cases seen by doctors prior to hospital admission is generally too small for reliable case-fatality estimates by year to be generated (eg, there were two such cases in 2008). By combining data for several years a more reliable estimate of the impact of the pre-hospital antibiotic policy can be obtained. The fatality rate of cases seen by a doctor and given pre-hospital antibiotics was lower overall for 2001-2008 (2.2%, 12/553) compared with those seen and not given antibiotics (3.0%, 32/1080), but this difference is not statistically significant ( $p=0.3491$ ).

### **3.6. Risk Factors**

#### **3.6.1. Contact with a Case**

In 2008, 'contact with a case' was unknown for four cases. Of the 119 cases for whom these details were known, through case reports or laboratory testing, two (1.7%) were recorded as contacts, i.e. as possible associated cases. The cases were siblings with onset date within one day of each other. Both were infected with the same strain (B:4:P1.7,-2.4).

## 4. DISCUSSION

The meningococcal B strain causing most disease was first identified in New Zealand in 1991. Since then meningococcal disease caused by the epidemic strain has been one of the most devastating outbreaks to have occurred recently in New Zealand. The disease has resulted in considerable personal costs, particularly for those losing limbs, or left with neuronal disabilities as a consequence[27]. In the years immediately prior to 1991 around 50 cases of meningococcal disease were reported annually giving a rate of 1.5 per 100 000[1] a rate consistent with annual rates of disease recorded in most industrialised countries of the world[26, 28]. The increase in meningococcal disease cases in the second half of 1991 was followed in subsequent years with a continuing upward trend in case numbers. The disease appeared to peak in 1997 when 613 cases were reported, giving a rate of 16.9 per 100 000[29]. A drop in case numbers the following few years signalled the possible natural decline in disease numbers. However, consistent with protracted epidemics of group B meningococcal disease reported internationally[26, 30] an even higher peak of disease occurred in 2001 with 650 cases reported giving a rate of 17.4 per 100 000[29].

Disease statistics in this report are based on notified cases of meningococcal disease that fulfil the clinical criteria. The total of cases reported from 1991 through 2008 was 6251, an excess of 5333 cases had the 1989/1990 case levels persisted. For a number of reasons not all cases are always confirmed. These reasons included failure to grow the meningococcus due to the use of antibiotics prior to admission to hospital. For strain analysis, cases identified only on the basis of their clinical presentation were considered as probable. Confirmed cases were those where a laboratory culture, or a DNA result confirmed meningococcal involvement and the specimen was able to be subjected to strain typing.

Since 1991 a total of 260 deaths were recorded, giving an overall case-fatality rate of 4.2%. The policy of giving antibiotics prior to hospital admission, advocated by the Ministry of Health since 1993, resulted in a lower case-fatality rate in those receiving antibiotics. The early use of antibiotics was stressed in a recent study[31] that showed a high bacterial load was a major predictor of death post-admission to hospital (OR 7.5 per log<sub>10</sub> cfu/mL increase; 95% CI 2.2-25.3; p=0.001). The case-fatality rate for group C disease has been consistently higher than for subjects infected with group B disease throughout the epidemic.

Throughout the epidemic, highest case numbers consistently occurred in the upper North Island, particularly in the Counties Manukau, Auckland, Waikato and Waitemata District Health Boards (DHBs). West Coast and South Canterbury DHB have experienced the lowest case numbers.

Annually highest age-specific rates of disease occurred in children less than five years of age. The rate for children less than one year of age peaked in 1997 at 212 per 100 000 population. The year 1997 was also a peak year for the 1-4 year age group at 96.9 per 100 000 population. However, following the start of the vaccination campaign in 2004 a statistically significant decrease (p<0.001) in the number of cases in the 1-4 age group occurred.

Age-standardised rates of disease for Maori and Pacific Peoples have continuously been higher than those for the European population. However considering case numbers over the course of the epidemic, 44% of the cases were European, 32% Maori and 20% Pacific Peoples with 3% of Other ethnicity. Highest rates of disease in 2008 occurred in the 1-4 year age group in Pacific Peoples (39.1 per 100 000 population, 8 cases), and in the less than one

year in Maori (92.7 per 100 000, 13 cases). Note these rates are considerably less than the rates observed for the same groups in 2001 which were 276.4 per 100 000 population (53 cases) and 428.8 per 100 000 (60 cases) respectively[29].

New Zealand's meningococcal epidemic strain was defined as a B strain with the PorA type defined as P1.7-2,4 (previously described as P1.7b,4). The first recognition of this 'epidemic' strain type occurred in 1991 when 14 confirmed cases of epidemic strain disease occurred. Only five cases of this strain-type were retrospectively identified among 1990 case isolates and none prior to this. By 2001 a total of 370 (75.7%) out of 489 confirmed cases were caused by the epidemic strain. The overall case numbers of confirmed and probable cases in 2001 was 650 giving a rate of 17.4 per 100 000 population[29]. In that same year an agreement between New Zealand's Ministry of Health and Chiron Vaccines (now Novartis Vaccines) was signed to enable development of a strain-specific vaccine for epidemic control (MeNZB™). A strategy for trialling the vaccine in different age-groups was developed[4, 7]. In 2002 and 2003 case numbers had declined to 557 and 541 respectively with associated rates of 14.9 and 14.5 per 100 000. However, these rates did not indicate the epidemic was waning, particularly since a similar fluctuation had occurred between 1997 and 2001 and the rates of disease were still 10 times greater than those of most industrialised countries.

Age-group vaccine trials were conducted in South Auckland, the area where highest case numbers had consistently occurred. Evaluated first in adults the primary 3-dose course of MeNZB™ vaccine was then trialled in school children, toddlers, older infants and finally in younger infants. The results showed that there were no significant safety concerns with the use of the vaccine[9, 32]. Following the 3-dose courses of vaccine 53% of younger infants, 74% of older infants, 75% of toddlers, and 76% of school children showed fourfold rises in serum bactericidal antibodies defined as a level of  $\geq 1:8$ [9, 32-34]. Following a 4<sup>th</sup> dose of vaccine the proportion of young infants achieving serum antibody level of  $\geq 1:8$  was comparable with those of older infants and toddlers[9].

The Meningococcal B immunisation programme for delivery of vaccine to all under 20 years of age began in July 2004 in Counties Manukau DHB and the eastern suburbs of Auckland DHB. The programme was gradually introduced across the rest of New Zealand from November 2004 and by mid-2005 was being delivered in all DHBs. MeNZB™ vaccine required three doses of vaccine, the programme was completed at the end of 2006 with the exception of infants under six months of age for whom the vaccination programme was ongoing with a fourth dose also being given.

Since the introduction of the vaccine in 2004, a statistically significant decrease ( $p < 0.01$ ) in the overall meningococcal disease rate has occurred in addition to the age-standardised rates for all ethnic groups, and for the majority of age-groups. An improvement in health inequalities in the burden of meningococcal disease experienced by Maori and Pacific Peoples, and in individuals living in more socio-economically deprived areas has also been observed.

The number of epidemic strain cases under the age of 20 years decreased from 129 in 2004 to 31 in 2008 while the numbers of cases caused by other group B strains have remained relatively static. The decline in epidemic strain cases post-vaccination has also been demonstrated by vaccine effectiveness measurements. A statistical model was developed to estimate vaccine effectiveness while controlling for confounding variables such as disease progression over time, age, ethnicity, socioeconomic status, seasonality and geographic

region. Using data from January 2001 to June 2006, the model demonstrated a statistically significant ( $p < 0.0001$ ) vaccine effect with estimated disease rates 3.7 times higher in the unvaccinated group than the vaccinated group (95% CI: 2.1, 6.8) and a vaccine effectiveness of 73% (95% CI: 52%, 85%)[35]. Continued monitoring of the epidemic strain is vital particularly as the MeNZB<sup>TM</sup> vaccine programme has ceased.

## APPENDIX

**Table 4: Numbers and rates for cases of meningococcal disease by District Health Board, 2001-2008**

District Health Board	2001		2002		2003		2004		2005		2006		2007		2008	
	No.	Rate <sup>1</sup>	No. <sup>3</sup>	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>2</sup>								
Northland	37	26.4	29	20.7	37	26.4	21	14.1	5	3.4	9	6.1	5	3.4	8	5.4
Waitemata	37	8.6	35	8.1	55	12.8	45	9.3	21	4.4	6	1.2	6	1.2	7	1.5
Auckland	79	21.5	45	12.2	68	18.5	38	9.4	16	4.0	15	3.7	8	2.0	10	2.5
Counties Manukau	126	33.6	87	23.2	107	28.5	49	11.3	30	6.9	25	5.8	16	3.7	16	3.7
Waikato	72	22.7	38	12.0	42	13.2	23	6.8	33	9.7	27	8.0	12	3.5	11	3.2
Lakes	39	40.6	53	55.2	26	27.1	16	16.3	7	7.1	2	2.0	1	1.0	0	0.0
Bay of Plenty	32	18.0	51	28.6	43	24.1	12	6.2	12	6.2	3	1.5	4	2.1	3	1.5
Tairāwhiti	11	25.0	6	13.7	4	9.1	13	29.2	1	2.2	3	6.7	4	9.0	2	4.5
Taranaki	10	9.7	10	9.7	6	5.8	7	6.7	3	2.9	3	2.9	4	3.8	4	3.8
Hawke's Bay	29	20.2	31	21.6	18	12.5	15	10.1	13	8.8	4	2.7	10	6.7	12	8.1
Whanganui	7	11.0	6	9.4	18	28.3	6	9.6	0	0.0	0	0.0	0	0.0	5	8.0
MidCentral	20	12.9	10	6.5	9	5.8	16	10.1	15	9.4	7	4.4	2	1.3	2	1.3
Hutt	16	12.1	12	9.1	13	9.9	5	3.7	1	0.7	6	4.4	6	4.4	5	3.7
Capital and Coast	24	9.8	28	11.4	21	8.5	17	6.4	10	3.8	7	2.6	6	2.3	8	3.0
Wairarapa	11	28.8	3	7.9	2	5.2	1	2.6	5	13.0	2	5.2	1	2.6	2	5.2
Nelson																
Marlborough	12	9.8	3	2.4	1	0.8	3	2.3	6	4.6	5	3.8	1	0.8	6	4.6
West Coast	3	9.9	8	26.4	1	3.3	2	6.4	2	6.4	0	0.0	1	3.2	1	3.2
Canterbury	18	4.2	33	7.7	33	7.7	27	5.8	25	5.4	18	3.9	11	2.4	9	1.9
South Canterbury	3	5.7	6	11.4	3	5.7	2	3.7	3	5.6	1	1.9	0	0.0	2	3.7
Otago	54	31.6	49	28.7	23	13.5	18	10.0	15	8.3	11	6.1	5	2.8	5	2.8
Southland	10	9.7	14	13.5	11	10.6	6	5.6	5	4.7	6	5.6	2	1.9	5	4.7
<b>New Zealand total</b>	<b>650</b>	<b>17.4</b>	<b>557</b>	<b>14.9</b>	<b>541</b>	<b>14.5</b>	<b>342</b>	<b>8.5</b>	<b>228</b>	<b>5.7</b>	<b>160</b>	<b>4.0</b>	<b>105</b>	<b>2.6</b>	<b>123</b>	<b>3.1</b>

1 Rate per 100 000 population based on 2001 census data.

2 Rate per 100 000 population based on 2006 census data

3 Number of 2002 cases for Waikato, West Coast, Taranaki and MidCentral differ by 1 from those published in 2002 Annual Meningococcal Report.

**Table 5: Geographic distribution by District Health Board of confirmed cases of meningococcal disease and proportion of confirmed to total cases, 2001-2008**

District Health Board	2001			2002			2003			2004			2005			2006			2007			2008		
	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>	No. <sup>4</sup>	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>2</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>
Northland	27	19.3	73.0	22	15.7	75.9	20	14.3	54.1	15	10.1	71.4	4	2.7	80.0	7	4.7	77.8	5	3.4	100	6	4.0	75.0
Waitemata	18	4.2	48.6	19	4.4	54.3	31	7.2	56.4	34	7.1	75.6	16	3.3	76.2	4	0.8	66.7	6	1.2	100	6	1.2	85.7
Auckland	45	12.2	57.0	20	5.4	44.4	34	9.2	50.0	21	5.2	55.3	13	3.2	81.3	13	3.2	86.7	8	2.0	100	10	2.5	100
Counties Manukau	77	20.5	61.1	42	11.2	48.3	65	17.3	60.7	41	9.5	83.7	30	6.9	100	24	5.5	96.0	15	3.5	93.8	16	3.7	100
Waikato	62	19.5	86.1	34	10.7	89.5	41	12.9	97.6	22	6.5	95.7	31	9.1	93.9	25	7.4	92.6	12	3.5	100	10	2.9	90.9
Lakes	39	40.6	100	51	53.1	96.2	22	22.9	84.6	14	14.2	87.5	5	5.1	71.4	2	2.0	100	1	1.0	100	0	0.0	-
Bay of Plenty	27	15.2	84.4	48	26.9	94.1	36	20.2	83.7	10	5.1	83.3	8	4.1	66.7	3	1.5	100	3	1.5	75.0	3	1.5	100
Tairāwhiti	8	18.2	72.7	5	11.4	83.3	4	9.1	100	12	27.0	92.3	1	2.2	100	3	6.7	100	3	6.7	75.0	1	2.2	50.0
Taranaki	9	8.7	90.0	9	8.7	90.0	4	3.9	66.7	7	6.7	100	3	2.9	100	3	2.9	100	4	3.8	100	4	3.8	100
Hawke's Bay	19	13.2	65.5	18	12.5	58.1	12	8.4	66.7	10	6.7	66.7	9	6.1	69.2	3	2.0	75.0	6	4.0	60.0	11	7.4	91.7
Whanganui	7	11.0	100	4	6.3	66.7	17	26.7	94.4	5	8.0	83.3	0	0.0	-	0	0.0	-	0	0.0	-	4	6.4	80.0
MidCentral	16	10.3	80.0	7	4.5	70.0	7	4.5	77.8	12	7.6	75.0	15	9.4	100	7	4.4	100	2	1.3	100	2	1.3	100
Hutt	12	9.1	75.0	10	7.6	83.3	12	9.1	92.3	5	3.7	100	1	0.7	100	6	4.4	100	6	4.4	100	4	2.9	80.0
Capital and Coast	21	8.5	87.5	26	10.6	92.9	20	8.1	95.2	15	5.6	88.2	8	3.0	80.0	7	2.6	100	5	1.9	83.3	8	3.0	100
Wairarapa	11	28.8	100	3	7.9	100	2	5.2	100	1	2.6	100	4	10.4	80.0	1	2.6	50.0	1	2.6	100	1	2.6	50.0
Nelson Marlborough	10	8.2	83.3	3	2.4	100	0	0.0	0.0	3	2.3	100	5	3.8	83.3	4	3.1	80.0	1	0.8	100	5	3.8	83.3
West Coast	2	6.6	66.7	6	19.8	75.0	0	0.0	0.0	2	6.4	100	1	3.2	50.0	0	0.0	-	1	3.2	100	1	3.2	100
Canterbury South	16	3.7	88.9	26	6.1	78.8	29	6.8	87.9	24	5.1	88.9	24	5.1	96.0	15	3.2	83.3	8	1.7	72.7	6	1.3	66.7
Canterbury	3	5.7	100	5	9.5	83.3	3	5.7	100	2	3.7	100	3	5.6	100	1	1.9	100	0	0.0	-	2	3.7	100
Otago	50	29.3	92.6	45	26.4	91.8	19	11.1	82.6	13	7.2	72.2	14	7.8	93.3	11	6.1	100	4	2.2	80.0	5	2.8	100
Southland	10	9.7	100	10	9.7	71.4	10	9.7	90.9	5	4.7	83.3	5	4.7	100	6	5.6	100	2	1.9	100	5	4.7	100
<b>New Zealand total</b>	<b>489</b>	<b>13.1</b>	<b>75.2</b>	<b>413</b>	<b>11.1</b>	<b>74.1</b>	<b>388</b>	<b>10.4</b>	<b>71.7</b>	<b>273</b>	<b>6.8</b>	<b>79.8</b>	<b>200</b>	<b>5.0</b>	<b>87.7</b>	<b>145</b>	<b>3.6</b>	<b>90.6</b>	<b>93</b>	<b>2.3</b>	<b>88.6</b>	<b>110</b>	<b>2.7</b>	<b>89.4</b>

1 Rate per 100 000 population based on 2001 census data.

2 Proportion (%) of total cases who were confirmed.

3 Rate per 100 000 population based on 2006 census data.

4 Number of 2002 cases for Waikato, West Coast, Taranaki and MidCentral differ by 1 from those published in 2002 Annual Meningococcal Report.

**Table 6: Age distribution of meningococcal disease cases, 2001-2008**

Age group (years)	2001		2002		2003		2004		2005		2006		2007		2008	
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>2</sup>								
<1	112	205.0	84	153.7	68	124.4	46	81.2	29	51.2	34	60.0	19	33.6	19	33.6
1-4	176	81.4	155	71.7	129	59.7	96	43.9	39	17.9	28	12.8	29	13.3	33	15.1
5-9	75	26.2	59	20.6	69	24.1	43	15.0	21	7.3	8	2.8	10	3.5	13	4.5
10-14	70	24.1	54	18.6	46	15.8	35	11.4	31	10.1	6	2.0	8	2.6	8	2.6
15-19	95	35.8	82	30.9	85	32.0	40	13.3	41	13.7	32	10.7	11	3.7	13	4.3
20-29	57	11.7	53	10.9	63	12.9	31	6.0	27	5.3	17	3.3	9	1.8	7	1.4
30-39	25	4.3	21	3.6	25	4.3	12	2.1	10	1.7	4	0.7	6	1.0	4	0.7
40+	40	2.6	49	3.1	56	3.6	39	2.2	30	1.7	31	1.8	13	0.7	26	1.5
<b>Total</b>	<b>650</b>	<b>17.4</b>	<b>557</b>	<b>14.9</b>	<b>541</b>	<b>14.5</b>	<b>342</b>	<b>8.5</b>	<b>228</b>	<b>5.7</b>	<b>160</b>	<b>4.0</b>	<b>105</b>	<b>2.6</b>	<b>123</b>	<b>3.1</b>
<5	288	106.3	239	88.3	197	72.7	142	51.6	68	24.7	62	22.5	48	17.4	52	18.9
≥5	362	10.4	318	9.2	344	9.9	200	5.3	160	4.3	98	2.6	57	1.5	71	1.9

<sup>1</sup> Rate per 100 000 population based on 2001 census data.

<sup>2</sup> Rate per 100 000 population based on 2006 census data.

**Table 7: Age group distribution for confirmed cases of meningococcal disease and proportion of confirmed to total cases, 2001-2008**

Age group (years)	2001			2002			2003			2004			2005			2006			2007			2008		
	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>2</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>	No.	Rate <sup>3</sup>	% <sup>2</sup>
<1	75	137.2	75	63	115.3	75.0	45	82.3	66.2	34	60.0	73.9	24	42.4	82.8	34	60.0	100	17	30.0	89.5	16	28.3	84.2
1-4	127	58.7	127	99	45.8	63.9	76	35.2	58.9	74	33.9	77.1	38	17.4	97.4	23	10.5	82.1	24	11.0	82.8	30	13.7	90.9
5-9	48	16.8	48	37	12.9	62.7	45	15.7	65.2	33	11.5	76.7	16	5.6	76.2	7	2.4	87.5	8	2.8	80.0	13	4.5	100
10-14	54	18.6	54	36	12.4	66.7	32	11.0	69.6	31	10.1	88.6	25	8.2	80.6	5	1.6	83.3	6	2.0	75.0	8	2.6	100
15-19	78	29.4	78	71	26.8	86.6	74	27.9	87.1	34	11.3	85.0	40	13.3	97.6	30	10.0	93.8	11	3.7	100	12	4.0	92.3
20-29	47	9.7	47	44	9.0	83.0	53	10.9	84.1	23	4.5	74.2	25	4.9	92.6	14	2.7	82.4	9	1.8	100	5	1.0	71.4
30-39	23	4.0	23	19	3.3	90.5	17	2.9	68.0	9	1.6	75.0	8	1.4	80.0	2	0.3	50.0	6	1.0	100	2	0.3	50.0
40+	37	2.4	37	44	2.8	89.8	46	2.9	82.1	35	2.0	89.7	24	1.4	80.0	30	1.7	96.8	12	0.7	92.3	24	1.4	92.3
<b>Total</b>	<b>489</b>	<b>13.1</b>	<b>489</b>	<b>413</b>	<b>11.1</b>	<b>74.1</b>	<b>388</b>	<b>10.4</b>	<b>71.7</b>	<b>273</b>	<b>6.8</b>	<b>79.8</b>	<b>200</b>	<b>5.0</b>	<b>87.7</b>	<b>145</b>	<b>3.6</b>	<b>90.6</b>	<b>93</b>	<b>2.3</b>	<b>88.6</b>	<b>110</b>	<b>2.7</b>	<b>89.4</b>
<5	202	74.6	202	162	59.8	67.8	121	44.7	61.4	108	39.3	76.1	62	22.5	91.2	57	20.7	91.9	41	14.9	85.4	46	16.7	88.5
≥5	287	8.3	287	251	7.2	78.9	267	7.7	77.6	165	4.4	82.5	138	27.3	86.3	88	17.4	89.8	52	10.3	91.2	64	12.7	90.1

1 Rate per 100 000 population based on 2001 census data.

2 Proportion (%) of cases who were confirmed.

3 Rate per 100 000 population based on 2006 census data.

**Table 8: Meningococcal disease cases, less than five year olds versus those age five years and over, 1990-2008**

Year	Age group		Total	% <5 years
	<5 years	≥5 years		
1990	27	26	53	<b>50.9</b>
1991	34	44	78	<b>43.6</b>
1992	62	93	155	<b>40.0</b>
1993	98	104	202	<b>48.5</b>
1994	96	112	208	<b>46.2</b>
1995	180	214	394	<b>45.7</b>
1996	242	231	473	<b>51.2</b>
1997	334	279	613	<b>54.5</b>
1998	217	223	440	<b>49.3</b>
1999	286	218	504	<b>56.7</b>
2000	239	241	480	<b>49.8</b>
2001	288	362	650	<b>44.3</b>
2002	239	318	557	<b>42.9</b>
2003	197	344	541	<b>36.4</b>
2004	142	200	342	<b>41.5</b>
2005	68	160	228	<b>29.8</b>
2006	62	98	160	<b>38.8</b>
2007	48	57	105	<b>45.7</b>
2008	52	71	123	<b>42.3</b>

**Table 9: Age distribution by months for total and confirmed cases of meningococcal disease aged 0-24 months, 2008 and 2001-2007**

Age (months)	2008				2001-2007			
	Total cases		Confirmed cases		Total cases		Confirmed cases	
	No.	Cum % <sup>1</sup> (n=123)	No.	Cum % <sup>1</sup> (n=110)	No.	Cum % <sup>1</sup> (n=2583)	No.	Cum % <sup>1</sup> (n=2001)
<1	0	0.0	0	0.0	13	0.5	11	0.5
1	2	1.6	1	0.9	15	1.1	13	1.2
2	2	3.3	2	2.7	35	2.4	24	2.4
3	2	4.9	2	4.5	35	3.8	24	3.6
4	2	6.5	2	6.4	53	5.8	39	5.5
5	1	7.3	1	7.3	45	7.6	40	7.5
6	1	8.1	1	8.2	35	8.9	30	9.0
7	3	10.6	2	10.0	34	10.3	25	10.3
8	3	13.0	2	11.8	29	11.4	20	11.3
9	1	13.8	1	12.7	38	12.9	18	12.2
10	1	14.6	1	13.6	31	14.1	24	13.4
11	1	15.4	1	14.5	29	15.2	24	14.6
12	2	17.1	2	16.4	26	16.2	17	15.4
13	4	20.3	3	19.1	20	17.0	16	16.2
14	1	21.1	1	20.0	23	17.8	17	17.1
15	1	22.0	1	20.9	19	18.6	10	17.6
16	3	24.4	3	23.6	23	19.5	19	18.5
17	0	24.4	0	23.6	26	20.5	16	19.3
18	1	25.2	1	24.5	20	21.3	15	20.1
19	1	26.0	1	25.5	19	22.0	12	20.7
20	1	26.8	1	26.4	14	22.5	14	21.4
21	1	27.6	1	27.3	16	23.2	13	22.0
22	0	27.6	0	27.3	24	24.1	16	22.8
23	2	29.3	1	28.2	11	24.5	6	23.1
24	0	29.3	0	28.2	9	24.9	9	23.6
<b>Total</b>	<b>36</b>		<b>26</b>		<b>642</b>		<b>472</b>	

1 Cumulative percentage of cases in all age groups.

**Table 10: Numbers and rates for cases of meningococcal disease by age group and District Health Board, 2008**

District Health Board	0-4 years		5-19 years		20+ years	
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>
Northland	3	29.2	2	5.7	3	2.9
Waitemata	4	12.2	2	1.9	1	0.3
Auckland	4	15.4	3	3.8	3	1.0
Counties						
Manukau	6	16.6	7	6.3	3	1.1
Waikato	7	28.7	2	2.5	2	0.8
Lakes	0	0.0	0	0.0	0	0.0
Bay of Plenty	1	7.5	1	2.3	1	0.7
Tairāwhiti	1	27.4	0	0.0	1	3.4
Taranaki	4	58.2	0	0.0	0	0.0
Hawke's Bay	6	57.3	2	5.8	4	3.9
Whanganui	4	99.5	1	7.0	0	0.0
MidCentral	0	0.0	1	2.8	1	0.9
Hutt	1	10.0	2	6.4	2	2.1
Capital and Coast	2	11.4	1	1.9	5	2.6
Wairarapa	1	41.2	0	0.0	1	3.6
Nelson						
Marlborough	2	25.7	2	7.5	2	2.1
West Coast	0	0.0	0	0.0	1	4.4
Canterbury	2	6.8	2	2.1	5	1.5
South Canterbury	0	0.0	2	18.0	0	0.0
Otago	1	10.2	3	7.9	1	0.8
Southland	3	43.3	1	4.5	1	1.3
<b>New Zealand total</b>	<b>52</b>	<b>18.9</b>	<b>34</b>	<b>3.8</b>	<b>37</b>	<b>1.3</b>

<sup>1</sup> Rate per 100 000 population based on 2006 census data.

**Table 11: Numbers and age-standardised incidence rates by ethnicity for cases of meningococcal disease, 2001-2008**

Ethnicity	2001		2002		2003		2004		2005		2006		2007		2008	
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>2</sup>								
European	264	11.5	280	12.1	245	10.4	162	6.8	122	5.1	86	3.5	48	2.0	52	2.1
Maori <sup>3</sup>	211	25.7	160	20.5	171	22.7	104	11.2	63	7.9	44	4.9	35	3.9	41	5.1
Pacific <sup>4</sup>	155	53.1	90	28.9	113	39.2	61	19.7	34	10.5	24	8.3	15	4.8	21	7.6
Other	13	4.9	19	6.8	12	4.3	14	3.7	9	2.1	6	1.4	6	1.9	6	1.6
Unknown	7	-	8	-	0	-	1	-	0	-	0	-	1	-	3	-
<b>Total</b>	<b>650</b>	<b>17.4</b>	<b>557</b>	<b>14.9</b>	<b>541</b>	<b>14.5</b>	<b>342</b>	<b>8.5</b>	<b>228</b>	<b>5.7</b>	<b>160</b>	<b>4.0</b>	<b>105</b>	<b>2.6</b>	<b>123</b>	<b>3.1</b>

1 Rate per 100 000 direct standardised to age distribution of the total NZ population (based on 2001 census data).

2 Rate per 100 000 direct standardised to age distribution of the total NZ population (based on 2006 census data).

3 Rate is calculated using mixed Maori ethnicity.

4 Rate is calculated using mixed Pacific people ethnicity (excluding Maori).

**Table 12: Ethnicity distribution of confirmed cases of meningococcal disease and proportion of confirmed to total cases, 2001-2008**

Ethnicity	2001			2002			2003			2004			2005			2006			2007			2008		
	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>2</sup>	% <sup>2</sup>	No.	Rate <sup>2</sup>	% <sup>3</sup>	No.	Rate <sup>2</sup>	% <sup>3</sup>	No.	Rate <sup>2</sup>	% <sup>3</sup>	No.	Rate <sup>2</sup>	% <sup>3</sup>
European	221	9.5	83.7	227	9.7	81.1	196	8.3	80.0	132	5.5	81.5	103	4.3	84.4	76	3.1	88.4	44	1.8	91.7	46	1.9	88.5
Maori <sup>4</sup>	160	19.5	75.8	125	16.5	78.1	123	16.6	71.9	85	9.2	81.7	58	7.2	92.1	41	4.6	93.2	29	3.3	82.9	36	4.3	87.8
Pacific <sup>5</sup>	93	33.4	60.0	41	13.3	45.6	59	21.3	52.2	43	14.4	70.5	30	9.4	88.2	22	7.7	91.7	14	4.6	93.3	19	6.9	90.5
Other	8	3.1	61.5	13	4.4	68.4	10	3.8	83.3	12	3.3	85.7	9	2.1	100	6	1.4	100	5	1.5	83.3	6	1.6	100
Unknown <sup>6</sup>	7	-	100	7	-	87.5	0	-	N/A	1	-	79.8	0	4.3	-	0	-	N/A	1	-	100	3	-	100
<b>Total</b>	<b>489</b>	<b>13.1</b>	<b>75.2</b>	<b>413</b>	<b>11.1</b>	<b>74.1</b>	<b>388</b>	<b>10.4</b>	<b>71.7</b>	<b>273</b>	<b>6.8</b>	<b>81.5</b>	<b>200</b>	<b>5.0</b>	<b>87.7</b>	<b>145</b>	<b>3.6</b>	<b>90.6</b>	<b>93</b>	<b>2.3</b>	<b>88.6</b>	<b>110</b>	<b>2.7</b>	<b>89.4</b>

- 1 Rate per 100 000 standardised to age distribution of the total NZ population (based on 2001 census data).
- 2 Rate per 100 000 standardised to age distribution of the total NZ population (based on 2006 census data).
- 3 Proportion (%) of total cases who were confirmed.
- 4 Rate is calculated using mixed Maori ethnicity.
- 5 Rate is calculated using mixed Pacific ethnicity (excluding Maori).
- 6 No rate can be calculated.

**Table 13: Numbers and crude incidence rates for cases of meningococcal disease by age group and ethnicity, 2008**

Age group (years)	European		Maori		Pacific		Other		Unknown		Total	
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>
<1	3	10.1	13	92.7	2	39.1	1	19.0	0	0	19	33.6
1-4	10	8.5	14	26.7	8	39.9	1	5.3	0	0	33	15.1
5-9	3	1.9	7	10.5	3	11.8	0	0.0	0	0	13	4.5
10-14	5	2.9	1	1.5	1	4.0	1	3.4	0	0	8	2.6
15-19	9	5.2	2	3.4	1	4.4	1	2.9	0	0	13	4.3
20-29	4	1.4	0	0.0	1	2.9	1	1.2	1	1	7	1.4
30-39	2	0.5	0	0.0	2	5.9	0	0.0	0	0	4	0.7
40+	16	1.2	4	2.7	3	5.0	1	0.9	2	2	26	1.5
<b>Total</b>	<b>52</b>	<b>1.9</b>	<b>41</b>	<b>7.3</b>	<b>21</b>	<b>9.3</b>	<b>6</b>	<b>1.6</b>	<b>3</b>	<b>3</b>	<b>123</b>	<b>3.1</b>

<sup>1</sup> Crude rate per 100 000 population based on 2006 census data.

**Table 14: Age group and ethnicity distribution for confirmed cases of meningococcal disease by age group and ethnicity, 2008**

Age group (years)	European		Maori		Pacific		Other		Unknown		Total	
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>
<1	2	6.7	11	78.4	2	39.1	1	19.0	0	0	16	28.3
1-4	9	7.6	13	24.8	7	34.9	1	5.3	0	0	30	13.7
5-9	3	1.9	7	10.5	3	11.8	0	0.0	0	0	13	4.5
10-14	5	2.9	1	1.5	1	4.0	1	3.4	0	0	8	2.6
15-19	9	5.2	1	1.7	1	4.4	1	2.9	0	0	12	4.0
20-29	2	0.7	0	0.0	1	2.9	1	1.2	1	1	5	1.0
30-39	1	0.3	0	0.0	1	3.0	0	0.0	0	0	2	0.3
40+	15	1.1	3	2.0	3	5.0	1	0.9	2	2	24	1.4
<b>Total</b>	<b>46</b>	<b>1.7</b>	<b>36</b>	<b>6.4</b>	<b>19</b>	<b>8.4</b>	<b>6</b>	<b>1.6</b>	<b>3</b>	<b>3</b>	<b>110</b>	<b>2.7</b>

<sup>1</sup> Crude rate per 100 000 population based on 2006 census data.

**Table 15: Numbers and rates for cases of meningococcal disease by ethnicity for District Health Board, 2008**

District Health Board	European		Maori		Pacific		Other		Unknown
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.
Northland	2	2.2	6	13.8	0	0.0	0	0.0	0
Waitemata	3	1.0	2	4.7	2	6.6	0	0.0	0
Auckland	3	1.4	1	3.4	6	13.2	0	0.0	0
Counties Manukau	1	0.5	5	7.4	9	10.9	1	1.3	0
Waikato	4	1.7	5	7.4	1	13.8	1	5.3	0
Lakes	0	0.0	0	0.0	0	0.0	0	0.0	0
Bay of Plenty	1	0.7	2	4.4	0	0.0	0	0.0	0
Tairāwhiti	0	0.0	1	5.1	0	0.0	0	0.0	1
Taranaki	1	1.2	3	19.0	0	0.0	0	0.0	0
Hawke's Bay	6	5.9	6	17.7	0	0.0	0	0.0	0
Whanganui	2	4.6	3	20.8	0	0.0	0	0.0	0
MidCentral	1	0.9	0	0.0	0	0.0	0	0.0	1
Hutt	2	2.2	1	4.7	0	0.0	2	18.9	0
Capital and Coast	3	1.6	3	11.3	1	5.3	0	0.0	1
Wairarapa	2	6.5	0	0.0	0	0.0	0	0.0	0
Nelson Marlborough	4	3.6	0	0.0	1	75.6	1	38.7	0
West Coast	1	3.7	0	0.0	0	0.0	0	0.0	0
Canterbury	6	1.6	1	3.0	1	11.1	1	3.2	0
South Canterbury	2	4.1	0	0.0	0	0.0	0	0.0	0
Otago	4	2.6	1	8.7	0	0.0	0	0.0	0
Southland	4	4.5	1	8.8	0	0.0	0	0.0	0
<b>New Zealand total</b>	<b>52</b>	<b>1.9</b>	<b>41</b>	<b>7.3</b>	<b>21</b>	<b>9.3</b>	<b>6</b>	<b>1.6</b>	<b>3</b>

<sup>1</sup> Rate per 100 000 population based on 2006 census data.

**Table 16: Sex distribution of meningococcal disease cases, 2001-2008**

Sex	2001			2002			2003			2004			2005			2006			2007			2008		
	No.	Rate <sup>1</sup>	% <sup>2</sup>																					
Male	370	20.3		305	16.7		293	16.1		180	9.2		126	6.4		82	4.2		56	2.9		72	3.7	
Female	277	14.5		247	12.9		244	12.7		159	7.7		101	4.9		77	3.7		49	2.4		51	2.5	
Unknown	3	-		5	-		4	-		3	-		1	-		1	-		0	-		0	-	
<b>Total</b>	<b>650</b>	<b>17.4</b>		<b>557</b>	<b>14.9</b>		<b>541</b>	<b>14.5</b>		<b>342</b>	<b>8.5</b>		<b>228</b>	<b>5.7</b>		<b>160</b>	<b>4.0</b>		<b>105</b>	<b>2.6</b>		<b>123</b>	<b>3.1</b>	

1 Rate per 100 000 population based on 2001 census data.

2 Rate per 100 000 population based on 2006 census data.

**Table 17: Sex distribution of confirmed cases of meningococcal disease and proportion of confirmed to total cases, 2001-2008**

Sex	2001			2002			2003			2004			2005			2006			2007			2008		
	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>	No.	Rate <sup>1</sup>	% <sup>2</sup>															
Male	267	14.6	26.7	230	12.6	75.4	209	11.5	71.3	144	7.3	80.0	108	5.5	85.7	74	3.8	90.2	47	2.4	83.9	63	3.2	87.5
Female	221	11.5	22.1	180	9.4	72.9	176	9.2	72.1	126	6.1	79.2	91	4.4	90.1	70	3.4	90.9	46	2.2	93.9	47	2.3	92.2
Unknown	1	-	1	3	-	60.0	3	-	75.0	3	-	100	1	-	100	1	-	100	0	-	-	0	-	-
<b>Total</b>	<b>489</b>	<b>13.1</b>	<b>48.9</b>	<b>413</b>	<b>11.1</b>	<b>74.1</b>	<b>388</b>	<b>10.4</b>	<b>71.7</b>	<b>273</b>	<b>6.8</b>	<b>79.8</b>	<b>200</b>	<b>5.0</b>	<b>87.7</b>	<b>145</b>	<b>3.6</b>	<b>90.6</b>	<b>93</b>	<b>2.3</b>	<b>88.6</b>	<b>110</b>	<b>2.7</b>	<b>89.4</b>

1 Rate per 100 000 population based on 2001 census data.

2 Proportion (%) of cases who were confirmed.

3 Rate per 100 000 population based on 2006 census data.

**Table 18: Cases of meningococcal disease by District Health Board for PCR and other means of confirmation, 2008**

District Health Board	2008							
	No. total cases	No. confirmed cases	% total cases confirmed	No. cases confirmed by PCR	% of total cases confirmed by PCR	No. cases confirmed by means other than PCR	% of total cases confirmed by means other than PCR	No. probable cases
Northland	8	6	75.0	1	12.5	5	62.5	2
Waitemata	7	6	85.7	4	57.1	2	28.6	1
Auckland	10	10	100	3	30.0	7	70.0	0
Counties Manukau	16	16	100	4	25.0	12	75.0	0
Waikato	11	10	90.9	3	27.3	7	63.6	1
Lakes	0	0	-	0	-	0	-	0
Bay of Plenty	3	3	100	0	0.0	3	100	0
Tairāwhiti	2	1	50.0	1	50.0	0	0.0	1
Taranaki	4	4	100	0	0.0	4	100	0
Hawke's Bay	12	11	91.7	3	25.0	8	66.7	1
Whanganui	5	4	80.0	0	0.0	4	80.0	1
MidCentral	2	2	100	1	50.0	1	50.0	0
Hutt	5	4	80.0	3	60.0	1	20.0	1
Capital and Coast	8	8	100	3	37.5	5	62.5	0
Wairarapa	2	1	50.0	0	0.0	1	50.0	1
Nelson Marlborough	6	5	83.3	2	33.3	3	50.0	1
West Coast	1	1	100	0	0.0	1	100	0
Canterbury	9	6	66.7	1	11.1	5	55.6	3
South Canterbury	2	2	100	1	50.0	1	50.0	0
Otago	5	5	100	0	0.0	5	100	0
Southland	5	5	100	2	40.0	3	60.0	0
<b>New Zealand total</b>	<b>123</b>	<b>110</b>	<b>89.4</b>	<b>32</b>	<b>26.0</b>	<b>78</b>	<b>63.4</b>	<b>13</b>

**Table 19: Distribution of meningococcal isolate and PCR results defined by serotyping or DNA sequence analysis, 2008**

Group	PorA type	Number	Percentage of Group B	Percentage of total
B	P1.4	44	54.3	43.6
B	Other PorA	37	45.7	36.6
<b>Total B</b>		<b>81</b>	<b>100</b>	<b>80.2</b>
C		10		9.9
W135		5		5.0
Y		5		5.0
Z		0		0.0
<b>TOTAL</b>		<b>101</b>		<b>100</b>

**Table 20: Distribution of meningococcal isolate and PCR results defined by serotyping or DNA sequence analysis by DHB, 2008**

District Health Board	Epidemic strain (P1.4)		B other		C		W		Y		Total	
	No.	%	No.	%	No.	%	No.	No.	%	%	No.	%
Northland	2	4.5	2	5.4	2	20.0	0	0.0	0	0.0	6	5.9
Waitemata	1	2.3	4	10.8	1	10.0	0	0.0	0	0.0	6	5.9
Auckland	5	11.4	3	8.1	1	10.0	1	20.0	0	0.0	10	9.9
Counties Manukau	4	9.1	6	16.2	0	0.0	2	40.0	2	40.0	14	13.9
Waikato	5	11.4	4	10.8	0	0.0	0	0.0	1	20.0	10	9.9
Lakes	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bay of Plenty	1	2.3	0	0.0	1	10.0	1	20.0	0	0.0	3	3.0
Tairāwhiti	0	0.0	1	2.7	0	0.0	0	0.0	0	0.0	1	1.0
Taranaki	2	4.5	1	2.7	0	0.0	0	0.0	1	20.0	4	4.0
Hawke's Bay	6	13.6	2	5.4	0	0.0	0	0.0	0	0.0	8	7.9
Whanganui	3	6.8	1	2.7	0	0.0	0	0.0	0	0.0	4	4.0
MidCentral	1	2.3	1	2.7	0	0.0	0	0.0	0	0.0	2	2.0
Hutt	2	4.5	1	2.7	1	10.0	0	0.0	0	0.0	4	4.0
Capital and Coast	3	6.8	1	2.7	1	10.0	0	0.0	1	20.0	6	5.9
Wairarapa	1	2.3	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
Nelson Marlborough	1	2.3	3	8.1	0	0.0	1	20.0	0	0.0	5	5.0
West Coast	1	2.3	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
Canterbury	2	4.5	3	8.1	0	0.0	0	0.0	0	0.0	5	5.0
South Canterbury	0	0.0	1	2.7	1	10.0	0	0.0	0	0.0	2	2.0
Otago	3	6.8	1	2.7	1	10.0	0	0.0	0	0.0	5	5.0
Southland	1	2.3	2	5.4	1	10.0	0	0.0	0	0.0	4	4.0
<b>New Zealand total</b>	<b>44</b>	<b>100</b>	<b>37</b>	<b>100</b>	<b>10</b>	<b>100</b>	<b>5</b>	<b>100</b>	<b>5</b>	<b>100</b>	<b>101</b>	<b>100</b>

**Table 21: Number of epidemic strain cases by year, 2001-2008**

Age group (years)	2001		2002		2003		2004		2005		2006		2007		2008	
	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>1</sup>	No.	Rate <sup>2</sup>	No.	Rate <sup>2</sup>	No.	Rate <sup>2</sup>	No.	Rate <sup>2</sup>	No.	Rate <sup>2</sup>
<1	55	100.6	42	76.9	30	54.9	19	33.6	11	19.4	15	26.5	7	12.4	10	17.7
1-4	100	46.3	77	35.6	46	21.3	46	21.1	24	11.0	15	6.9	18	8.2	13	6.0
5-9	43	15.0	25	8.7	38	13.3	24	8.4	10	3.5	4	1.4	4	1.4	3	1.0
10-14	40	13.8	27	9.3	22	7.6	20	6.5	15	4.9	2	0.7	2	0.7	4	1.3
15-19	58	21.9	47	17.7	54	20.4	20	6.7	21	7.0	11	3.7	7	2.3	1	0.3
20-29	35	7.2	30	6.2	34	7.0	21	4.1	13	2.5	10	1.9	4	0.8	3	0.6
30-39	18	3.1	18	3.1	11	1.9	9	1.6	5	0.9	1	0.2	4	0.7	1	0.2
40+	21	1.3	25	1.6	24	1.5	25	1.4	14	0.8	16	0.9	1	0.1	9	0.5
<b>Total</b>	<b>370</b>	<b>9.9</b>	<b>291</b>	<b>7.8</b>	<b>259</b>	<b>6.9</b>	<b>184</b>	<b>4.6</b>	<b>113</b>	<b>2.8</b>	<b>74</b>	<b>1.8</b>	<b>47</b>	<b>1.2</b>	<b>44</b>	<b>1.1</b>
<b>Male</b>	197	10.8	166	9.1	145	8.0	100	5.1	58	3.0	33	1.7	27	1.4	26	1.3
<b>Female</b>	173	9.0	123	6.4	111	5.8	82	4.0	54	2.6	40	1.9	20	1.0	18	0.9
<b>Unknown</b>	0	-	2	-	3	-	2	-	1	-	1	-	0	-	0	-
<b>European</b>	157	6.0	152	5.8	129	4.9	111	4.1	60	2.2	37	1.4	15	0.6	14	0.5
<b>Maori</b>	131	24.9	94	17.9	82	15.6	43	7.6	30	5.3	23	4.1	19	3.4	16	2.8
<b>Pacific</b>	74	36.9	33	16.5	42	21.0	23	10.2	19	8.4	12	5.3	10	4.4	9	4.0
<b>Other</b>	6	2.4	8	3.2	6	2.4	7	1.9	4	1.1	2	0.5	2	0.5	3	0.8
<b>Unknown</b>	2	1.3	4	2.7	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	2	1.2

1 Rate per 100 000 population based on 2001 census data.

2 Rate per 100 000 population based on 2006 census data.

**Table 22: Number of epidemic strain cases by DHB by age group, 2008**

District Health Board	Age group (years)								Total
	<1	1-4	5-9	10-14	15-19	20-29	30-39	40+	
Northland	0	0	0	0	0	0	0	2	2
Waitemata	0	0	0	1	0	0	0	0	1
Auckland	1	2	0	1	0	0	1	0	5
Counties Manukau	1	2	1	0	0	0	0	0	4
Waikato	1	2	1	0	0	1	0	0	5
Lakes	0	0	0	0	0	0	0	0	0
Bay of Plenty	0	1	0	0	0	0	0	0	1
Tairāwhiti	0	0	0	0	0	0	0	0	0
Taranaki	1	1	0	0	0	0	0	0	2
Hawke's Bay	3	1	1	0	0	0	0	1	6
Whanganui	1	1	0	1	0	0	0	0	3
MidCentral	0	0	0	0	0	0	0	1	1
Hutt	0	0	0	1	0	0	0	1	2
Capital and Coast	0	1	0	0	0	1	0	1	3
Wairarapa	0	0	0	0	0	0	0	1	1
Nelson									
Marlborough	0	1	0	0	0	0	0	0	1
West Coast	0	0	0	0	0	0	0	1	1
Canterbury	0	1	0	0	0	1	0	0	2
South Canterbury	0	0	0	0	0	0	0	0	0
Otago	1	0	0	0	1	0	0	1	3
Southland	1	0	0	0	0	0	0	0	1
<b>New Zealand total</b>	<b>10</b>	<b>13</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>9</b>	<b>44</b>

**Table 23: Case-fatality rates for meningococcal disease cases by age, gender, ethnicity, serogroup, clinical description and basis, 2001-2008**

Features of case and infecting organism	Number of fatalities								Total fatalities 01-08	Total cases 01-08	Case-fatality rate (%)
	01	02	03	04	05	06	07	08			
<1 year	3	3	2	3	2	1	2	3	19	411	4.6
1-4 years	7	3	2	1	0	1	1	4	19	685	2.8
5-9 years	0	1	0	1	1	0	1	0	4	298	1.3
10-14 years	2	0	1	0	0	0	0	0	3	258	1.2
15-19 years	5	5	3	0	0	1	0	1	15	399	3.8
20-29 years	4	0	2	0	1	0	1	0	8	264	3.0
30-39 years	1	0	0	1	3	0	0	0	5	107	4.7
40+ years	4	6	3	2	7	4	2	0	28	284	9.9
<b>Male</b>	16	8	5	6	5	3	4	6	53	1484	3.6
<b>Female</b>	10	10	8	2	9	4	3	2	48	1205	4.0
<b>European</b>	12	10	5	2	8	3	4	3	47	1259	3.7
<b>Maori</b>	9	5	2	3	1	1	1	4	26	829	3.1
<b>Pacific</b>	4	2	3	3	1	2	1	0	16	513	3.1
<b>Other</b>	1	1	3	0	4	1	1	1	12	85	14.1
<b>Unknown</b>	0	0	0	0	0	0	0	0	0	20	0.0
<b>Group A</b>	0	0	0	0	0	0	0	0	0	0	-
<b>Epidemic strain</b>	18	9	5	5	6	4	3	4	54	1382	3.9
<b>Group B other</b>	2	1	2	0	1	0	0	2	8	277	2.9
<b>Group C</b>	3	6	6	2	4	1	2	1	25	224	11.2
<b>Group W</b>	0	0	0	0	2	0	1	0	3	39	7.7
<b>Group Y</b>	1	0	0	0	0	0	0	0	1	22	4.5
<b>Group Z</b>	0	0	0	0	0	0	0	0	0	5	0.0
<b>Serogroup not determined*</b>	0	0	0	0	1	2	0	0	3	162	1.9
<b>Probable</b>	2	2	0	1	0	0	1	1	7	595	1.2
<b>Meningitis only</b>	4	2	1	0	2	0	0	1	10	683	1.5
<b>Septicaemia only</b>	16	6	7	5	7	7	6	5	59	843	7.0
<b>Meningitis and septicaemia*</b>	3	7	5	0	2	0	1	1	19	477	4.0
<b>Isolation</b>	22	10	9	6	9	3	5	5	69	1330	5.2
<b>PCR</b>	2	6	4	1	5	4	1	2	25	759	3.3
<b>Gramneg</b>	0	0	0	0	0	0	0	0	0	22	0.0
<b>Latex</b>	0	0	0	0	0	0	0	0	0	0	-
<b>Throat</b>	0	0	0	0	0	0	0	0	0	18	0.0
<b>Probable</b>	2	2	0	1	0	0	1	1	7	577	1.2
<b>Total</b>	<b>26</b>	<b>18</b>	<b>13</b>	<b>8</b>	<b>14</b>	<b>7</b>	<b>7</b>	<b>8</b>	<b>101</b>	<b>2706</b>	<b>3.7</b>

\* Information on clinical features not available for all cases

**Table 24: Case-fatality rates for confirmed cases meningococcal disease by age, gender, ethnicity and clinical description, 2001-2008**

Features of case and infecting organism	Number of fatalities								Total fatalities 01-08	Total cases 01-08	Case-fatality rate (%)
	01	02	03	04	05	06	07	08			
<1 year	3	3	2	2	2	1	2	3	18	308	5.8
1-4 years	6	2	2	1	0	1	1	3	16	491	3.3
5-9 years	0	1	0	1	1	0	0	0	3	207	1.4
10-14 years	2	0	1	0	0	0	0	0	3	197	1.5
15-19 years	5	5	3	0	0	1	0	1	15	350	4.3
20-29 years	3	0	2	0	1	0	1	0	7	220	3.2
30-39 years	1	0	0	1	3	0	0	0	5	86	5.8
40+ years	4	5	3	2	7	4	2	0	27	252	10.7
<b>Male</b>	15	6	5	5	5	3	3	5	47	1142	4.1
<b>Female</b>	9	10	8	2	9	4	3	2	47	957	4.9
<b>European</b>	11	9	5	2	8	3	3	3	44	1045	4.2
<b>Maori</b>	8	4	2	2	1	1	1	3	22	657	3.3
<b>Pacific</b>	4	2	3	3	1	2	1	0	16	321	5.0
<b>Other</b>	1	1	3	0	4	1	1	1	12	69	17.4
<b>Unknown</b>	0	0	0	0	0	0	0	0	0	19	0.0
<b>Meningitis only</b>	4	2	1	0	2	0	0	1	10	536	1.9
<b>Septicaemia only</b>	14	4	7	5	7	7	6	4	54	618	8.7
<b>Meningitis and septicaemia*</b>	3	7	4	0	2	0	0	1	17	397	4.3
<b>Total</b>	<b>24</b>	<b>16</b>	<b>13</b>	<b>7</b>	<b>14</b>	<b>7</b>	<b>6</b>	<b>7</b>	<b>94</b>	<b>2111</b>	<b>4.5</b>

\* Information on clinical features not available for all cases

**Table 25: Follow-up of contacts of meningococcal disease cases, 2008**

Type of contact	Number of cases for whom contacts were identified	Number of cases for whom contacts were counselled	Number of cases for whom contacts were offered antibiotics	Number of cases for whom contacts were offered vaccination
Household contacts	108	84	102	2
Day-care contacts	7	5	4	0
Room-mates in institutions	6	2	2	0
Contact with oral secretions	24	17	24	0
Other	53	44	30	2

**Table 26: Total number of contacts identified and offered counselling, antibiotics and vaccination, 2008**

Type of contact	Total number identified (range per case)	Total number counselled (range per case)	Total number offered antibiotics (range per case)	Total number offered vaccination (range per case)
Household contacts	637 (1-26)	528 (1-26)	598 (1-26)	4 (1-3)
Day-care contacts	360 (1-153)	206 (2-140)	58 (1-38)	0
Room-mates in institutions	123 (1-80)	32 (7-25)	8 (1-7)	0
Contact with oral secretions	106 (1-15)	79 (1-22)	96 (1-15)	0
Other	426 (1-107)	343 (1-105)	135 (1-19)	5 (1-4)
<b>Total</b>	<b>1652</b>	<b>1188</b>	<b>895</b>	<b>9</b>

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