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SURVEILLANCE REPORT

The epidemiology of meningococcal disease in New Zealand

2013

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SUMMARY

SUMMARY

Surveillance of meningococcal disease in 2013 revealed these key findings:

- 68 cases of meningococcal disease were notified. This equates to a notification rate of 1.5 per 100 000 population, the lowest rate of meningococcal disease in New Zealand in more than two decades.
- The number of confirmed cases was 61, giving a confirmation rate of 89.7%. 44 cases were confirmed by the isolation of *N. meningitidis* and a further 17 by the detection of meningococcal DNA by PCR.
- The strain type was determined for 57 (93.4%) of the 61 confirmed cases. Over 50% of cases were group B strains and 30% were group C strains, with 19.3% due to group B:P1.7-2,4 and 26.3% due to group C:P1.5-1,10-8.
- Counties Manukau District Health Board (DHB) had the highest number of cases (12), followed by Canterbury (8), Waitemata (7) and Southern (7) DHBs. The highest rates of disease were in Counties Manukau (2.3 per 100 000 population, 12 cases) and Southern (2.3 per 100 000 population, 7 cases) DHBs.
- The highest age-specific rates of meningococcal disease continued to occur in children younger than five years: 18.4 per 100 000 population for those aged less than one year and 5.2 per 100 000 population for those aged 1–4 years. As in previous years, a secondary peak in the notification rate was observed for the 15–19 years age group (3.9 per 100 000 population). The 2013 rates of disease for the <1 year and 1–4 year age groups were slightly lower the previous year's rates (19.8 per 100 000 and 5.6 per 100 000, respectively, in 2012).
- Although age-standardised disease rates decreased for all ethnic groups between 2009 and 2013, Māori and Pacific Peoples continued to experience higher rates of disease than the European or Other ethnic group in 2013. The highest rate was in the Pacific Peoples ethnic group (3.1 per 100 000 population, 9 cases), followed by Māori (2.6 per 100 000 population, 23 cases) and European or Other (1.2 per 100 000 population, 34 cases) ethnic groups.
- Hospitalisation status was recorded for all notified cases, and 67 of the 68 cases (98.5%) were hospitalised. For the hospitalised cases, pre-hospital management information was recorded for 65 (97.0%) cases. Of these, 28 cases (43.8%) were seen by a doctor prior to hospital admission and four (6.3%) were given intravenous or intramuscular antibiotics before admission.
- Four fatalities occurred, giving a case-fatality rate of 5.9%. Three of the four fatalities were confirmed cases, one group W135 and one group Y; the other the strain was not identified.
- The antimicrobial susceptibility of 43 viable meningococcal isolates received by ESR from cases of invasive disease in 2013 was tested. All isolates were susceptible to ceftriaxone, rifampicin and ciprofloxacin. More than 30% (14/43) had reduced susceptibility to penicillin, with minimum inhibitory concentrations (MICs) of 0.12–0.5 mg/L.

INTRODUCTION

INTRODUCTION

Invasive meningococcal disease is a serious disease caused by infection with the bacterium *Neisseria meningitidis* that can rapidly progress from a mild flu-like illness to death [1].

A large epidemic of meningococcal disease due to a single group B strain, B:P1.7-2,4, occurred in New Zealand between 1991 and 2007 [2, 3]. This led to the development of a strain-specific vaccine, MeNZB™ [4], and a vaccination programme between 2004 and 2008. Smaller, localised outbreaks of meningococcal disease have also occurred in New Zealand, including a group A disease outbreak in Auckland in 1985/86 [5] and several group C regional outbreaks, most recently in Northland in 2012 [6].

The epidemiology of meningococcal disease in New Zealand has been summarised annually in reports to the Ministry of Health since the mid-1990s. These are accessible for 2005 onwards on the websites http://www.health.govt.nz (for 2005–2007) and http://www.surv.esr.cri.nz (for 2008 onwards). This report summarises the epidemiology of meningococcal disease in 2013 and reviews the trends in disease patterns from 2009 onwards, with a focus on the period following the B:P1.7-4 epidemic. This report provides historic and recent data, against which the current rates of meningococcal disease in New Zealand can be assessed.

METHODS

METHODS

Data sources

Surveillance of meningococcal disease in New Zealand is based on a combination of notification and laboratory-based surveillance.

Case definition

On 31 May 2012, a revised case definition was released by the Ministry of Health. The impact of the change in case definition since May 2012 on trends in the meningococcal disease notification rates will be negligible. The main changes were a more detailed clinical description and a modification of the probable case definition, where a redundant description was dropped.

In the *Communicable Disease Control Manual* (2012) [1], the updated clinical description of *Neisseria meningitidis* invasive disease is:

> Meningococcal disease is a serious invasive disease with an acute onset and may start as a mild flu-like illness and rapidly progress to fulminant septicaemia and death. Cases typically experience acute fever, malaise, nausea, myalgia, arthralgia and prostration. A rash occurs in about two-thirds of cases – this may be ill-defined and macular, petechial or purpuric. More severe infection leads to shock, disseminated intra-vascular coagulation (DIC), acrocyanosis and multi-organ failure. Approximately 75 percent of cases with invasive disease have meningitis (typically causing headache, photophobia and neck stiffness). Infants present with less-specific features. Other locations of invasive disease with *N. meningitidis* are possible though rare, such as orbital cellulitis, septic arthritis, and pericarditis.

Probable case: a clinically compatible illness.

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

- isolation of *Neisseria meningitidis* bacteria or detection of *N. meningitidis* nucleic acid from blood, CSF or other normally sterile site (eg, pericardial or synovial fluid)
- detection of gram negative intracellular diplococci in blood, CSF or skin petechiae
- detection of meningococcal antigen (ie, latex agglutination test) in CSF.

EpiSurv, the national notifiable disease surveillance system

Meningococcal disease is notifiable to Medical Officers of Health under the Health Act 1956. Data relating to each case is entered onto the EpiSurv database by the respective public health unit (PHU) via a secure web-based portal. This near real-time data is collated and analysed on behalf of the Ministry of Health by the Institute of Environmental Science and Research Ltd (ESR).

The notification data contained in this report is based on information recorded on EpiSurv as at 7 February 2014. Updates or additions made to EpiSurv data after this date are not reflected in this report. Consequently, future data analysis may produce revised results. Notification data from 2009 to 2013 presented in this report has been updated to reflect EpiSurv data as at 7 February 2014.

Reference Laboratories at ESR

Diagnostic laboratories routinely refer invasive samples from cases of meningococcal disease to the Invasive Pathogens Laboratory at ESR for characterisation to determine the strain type.

Antimicrobial resistance data in this report is taken from the national surveillance of antimicrobial resistance among human pathogens conducted by the Antibiotic Reference Laboratory at ESR.

Laboratory methods

Strain characterisation

Strain characterisation is carried out by the Invasive Pathogens Laboratory at ESR. Routine characterisation of referred samples includes determining the group, serotype (for isolates only, not DNA samples) and subtype (PorA type).

The group is identified either serologically or by PCR. Serology is used to determine the serotype, and DNA sequence analysis of the *porA* gene is used to determine the PorA type. The nomenclature used for types is explained here.

Using B:4:P1.7-2,4, as an example, 'B' is the group, '4' is the serotype and 'P1.7-2,4' is the PorA type. In this report, the strain responsible for the New Zealand epidemic (1991–2007) is defined as NZ B:P1.7-2,4. A serotype is not specified, since the serotype cannot be determined from the DNA samples submitted to ESR for strain typing. For this reason, serotypes are also not included in the analyses of dominant circulating strains in this report.

Because the MeNZB^{TM} vaccine targeted the P1.4 variable region of the PorA protein of the meningococcus causing the epidemic [7], it was expected to be effective against all meningococci that have this variable region. Therefore, for the purpose of these analyses, any meningococci or meningococcal DNA PorA typed as P1.n-n,4-n (where n can be any number or be missing) conforms to the P1.4 type, and is described as being targeted by the MeNZB^{TM} vaccine. For example, the strain responsible for the New Zealand epidemic, B:P1.7-2,4, has a P1.4 variable region.

Antimicrobial resistance determination

Ceftriaxone, ciprofloxacin, penicillin and rifampicin minimum inhibitory concentrations (MICs) were determined by Etest on Mueller-Hinton agar + 5% sheep blood. MICs were interpreted according to the Clinical and Laboratory Standards Institute's criteria [8].

Analytical methods

Population data used to determine all disease rates, except for those relating to ethnicity, was derived from the 2013 mid-year population estimates published by Statistics New Zealand. The denominator data used to determine disease rates for ethnic groups was based on the proportion of people in each ethnic group (accounting for differences in these proportions in age and sex groups) from the estimated resident 2006 census population applied to the 2013 mid-year population estimates from Statistics New Zealand. For different ethnic groups, numbers and rates are based on a prioritised classification of ethnicity, with the Māori ethnic group at the top of the hierarchy, followed by Pacific Peoples, Asian, Middle Eastern/Latin American/African (MELAA) and European or Other Ethnicity (including New Zealander) ethnic groups. The 'European or Other Ethnicity' ethnic group is presented as European or Other ethnic group in this report.

Disease rates were not calculated if there were fewer than five notified cases in any category, since calculating population rates from fewer than five cases produces unstable rates.

This report analyses the distribution of meningococcal disease by deprivation using the New Zealand Deprivation Index 2006 (NZDep06) [9]. The index, measuring relative socioeconomic deprivation, is derived from a weighted combination of nine variables from the 2006 census, 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 10 deprivation levels [10].

Fisher's exact tests were used to determine statistical significance. Results are considered to be statistically significant when the value of P is less than or equal to 0.05.

RESULTS

RESULTS

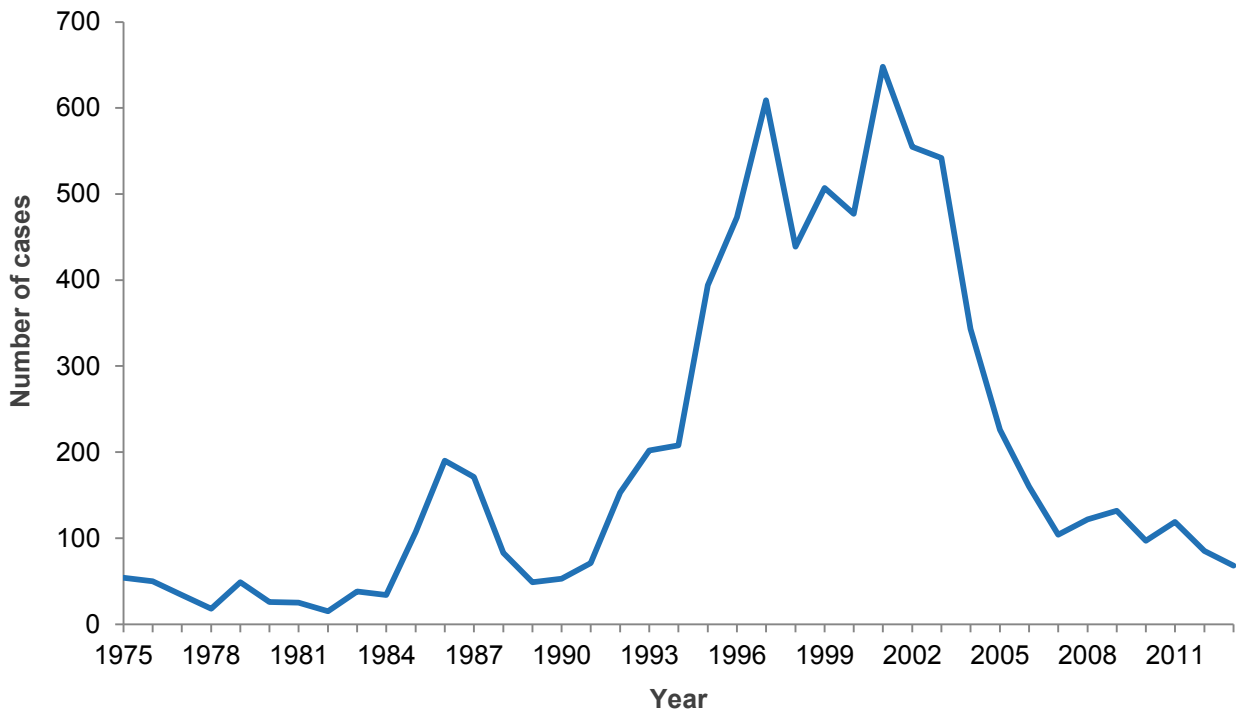
These analyses include all notified cases of meningococcal disease, both confirmed and probable, unless indicated otherwise.

Case characteristics

Incidence and rates by year

Figure 1 shows the number of notified cases of meningococcal disease between 1975 and 2013. Three peaks in the notification counts were observed over this period. They correspond to the 190 cases observed in 1986, driven by the outbreak of group A disease in Auckland, and the 609 and 648 cases observed in 1997 and 2001 respectively, as part of the B:P1.7-2,4 disease epidemic.

Figure 1. Notified cases of meningococcal disease, 1975–2013



In 2013, a total of 68 cases of meningococcal disease were notified, which equates to a rate of 1.5 per 100 000 population (Table 1). This is the lowest rate of meningococcal disease for two decades. Between 2009 and 2012, the number of cases ranged from 97 to 132, with an annual average rate of 2.5 per 100 000 population. Of the 68 cases notified in 2013, 61 (89.7%) were confirmed, giving a rate of 1.4 per 100 000 population for confirmed disease.

Table 1. Notified cases and rate of meningococcal disease, 2009–2013

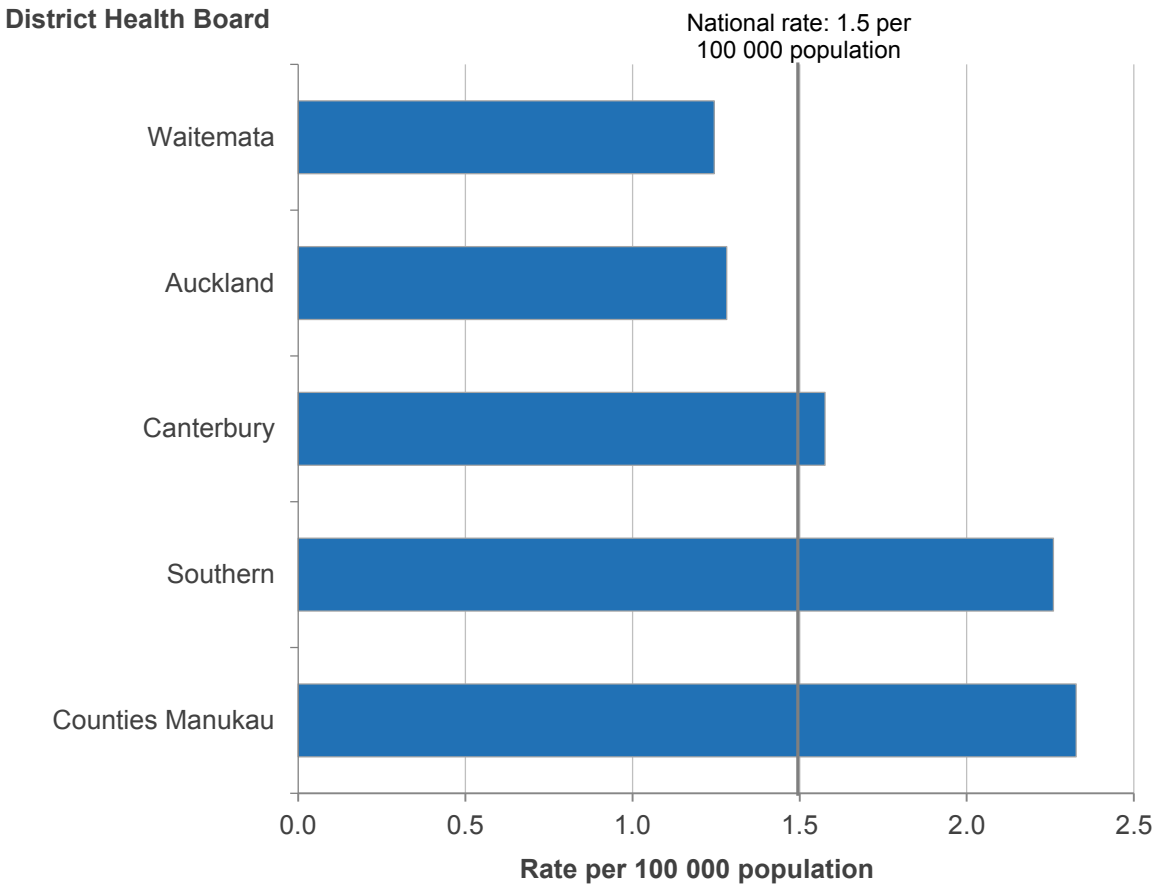
Year	No.	Rate[1]
2009	132	3.1
2010	97	2.2
2011	119	2.7
2012	85	1.9
2013	68	1.5

[1] Rate per 100 000 population

Geographic variation

A marked geographic variation in the numbers of notified cases and rates of meningococcal disease has been observed since at least 1991, and 2013 was no exception. In 2013, cases of meningococcal disease were spread through 17 of the 20 DHBs with 1–12 cases per DHB. DHBs with more than five cases are shown in Figure 2. No cases were reported in Wairarapa, Nelson Marlborough, and West Coast DHBs. The highest rates of disease were in Counties Manukau (2.3 per 100 000 population, 12 cases) and Southern (2.3 per 100 000 population, 7 cases) DHBs (Figure 2).

Figure 2. Meningococcal disease rates by District Health Board, 2013



Note: The graph shows data for the five DHBs with more than five cases. Rates have not been calculated for the other DHBs as small number of cases produces unstable rates.

A comparison of cases by DHB for the last five years is shown in Table 2. Tairawhiti (4.7 per 100 000), Lakes (4.5 per 100 000), and Northland (4.1 per 100 000) DHBs have the highest average annualised five-year rates.

Table 2. Meningococcal disease cases by DHB, 2009–2013

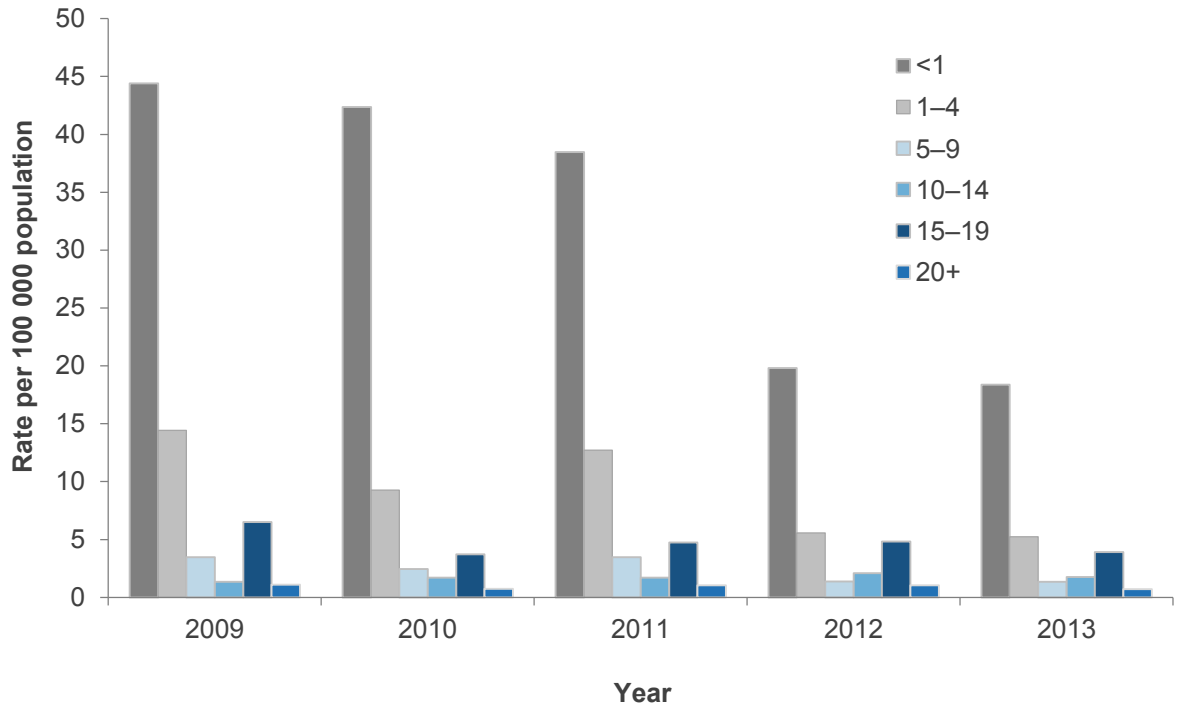
District Health Board	Year					Total	Average annual rate[1]
	2009	2010	2011	2012	2013		
Northland	6	6	13	3	4	32	4.1
Waitemata	6	9	9	9	7	40	1.5
Auckland	11	7	7	8	6	39	1.7
Counties Manukau	19	16	17	7	12	71	2.8
Waikato	9	7	13	5	4	38	2.1
Lakes	5	3	7	5	3	23	4.5
Bay of Plenty	9	6	4	5	2	26	2.5
Tairawhiti	7	1	1	1	1	11	4.7
Taranaki	3	1	3	6	3	16	2.9
Hawke's Bay	7	7	4	2	3	23	3.0
Whanganui	1	0	3	1	1	6	1.9
MidCentral	10	5	3	3	2	23	2.7
Hutt Valley	6	8	5	1	1	21	2.9
Capital & Coast	10	5	7	9	3	34	2.3
Wairarapa	1	0	2	0	0	3	1.5
Nelson Marlborough	0	1	2	2	0	5	0.7
West Coast	1	1	1	0	0	3	1.8
Canterbury	12	7	9	10	8	46	1.8
South Canterbury	0	0	1	3	1	5	1.8
Southern	9	7	8	5	7	36	2.4
Total	**132**	**97**	**119**	**85**	**68**	**501**	**2.3**

[1] Rate per 100 000 population

Incidence by age

In 2013, the highest age-specific disease rates were among those aged less than one year (18.4 per 100 000 population, 11 cases) and 1–4 years (5.2 per 100 000 population, 13 cases), which is consistent with rates observed previously (Figure 3 and Table 13). As in previous years, there was also a secondary peak in the notification rate for the 15–19 years age group (3.9 per 100 000 population, 12 cases).

Figure 3. Meningococcal disease rates by age group, 2009–2013



Incidence by ethnic group

Ethnic group was recorded for all notified meningococcal disease cases in 2013. The highest disease rate was for the Māori ethnic group (3.4 per 100 000 population, 23 cases), followed by the Pacific Peoples (3.3 per 100 000 population, 9 cases) and European or Other (1.1 per 100 000 population, 34 cases) ethnic groups.

In 2013, the age-standardised meningococcal disease rates for the Pacific Peoples (3.1 per 100 000 population, 9 cases) and Māori (2.6 per 100 000 population, 23 cases) ethnic groups were also higher than the rate for the European or Other ethnic group (1.2 per 100 000 population, 34 cases) (Table 3, Figure 4).

For the ethnic groups for which the rate was calculated, the highest disease rate by age group in 2013 was in the Māori ethnic group for those aged less than one year (32.3 per 100 000 population, 5 cases) (Table 14). Prior to 2004, the highest rate was consistently observed in the Pacific Peoples ethnic group for those aged less than one year. Since then, however, Māori aged less than one year have recorded the highest rate, as was also seen in 2005, 2008, 2009, and 2012.

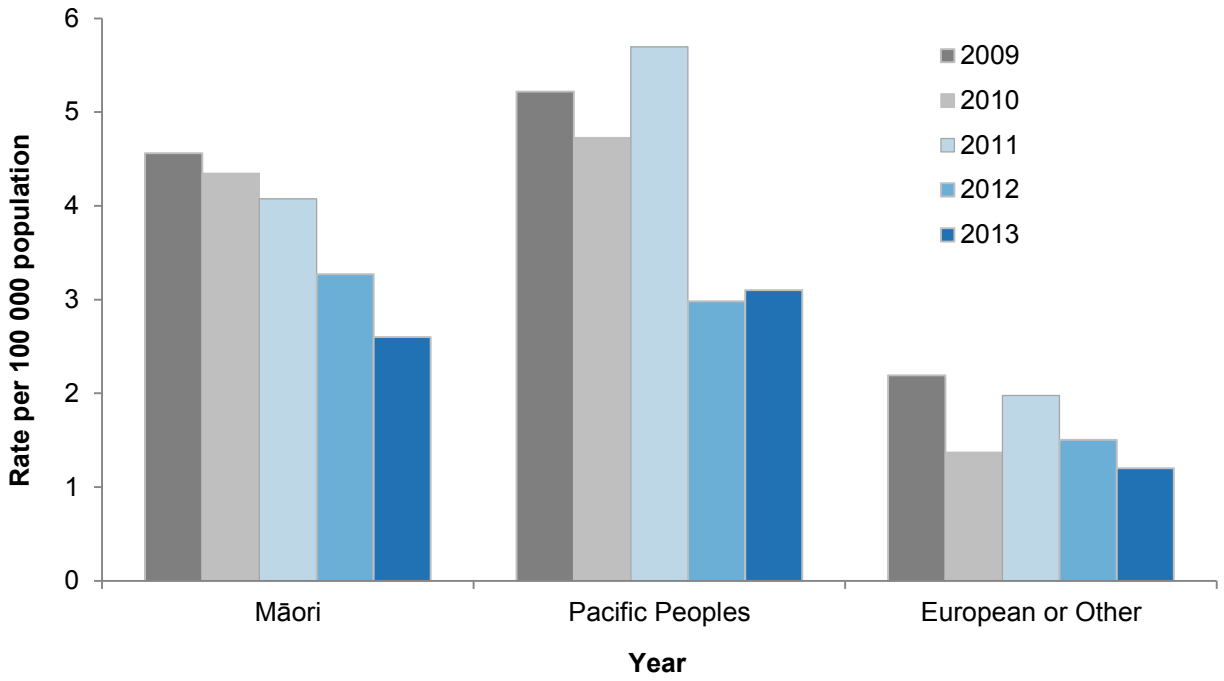
The median age of meningococcal disease cases differed markedly across different ethnic groups in 2013. Median ages were 2.0 years for Māori, 12.0 years for Pacific Peoples and 18.0 years for cases in the European or Other ethnic groups.

Table 3. Age-standardised meningococcal disease rates by ethnic group, 2013

Ethnic group	No.	Rate[1]
Māori	23	2.6
Pacific Peoples	9	3.1
Asian	2	-
MELAA[2]	0	-
European or Other	34	1.2

[1] Rate per 100 000 population
[2] Middle Eastern/Latin American/African

Figure 4. Age-standardised meningococcal disease rates by ethnic group, 2009–2013

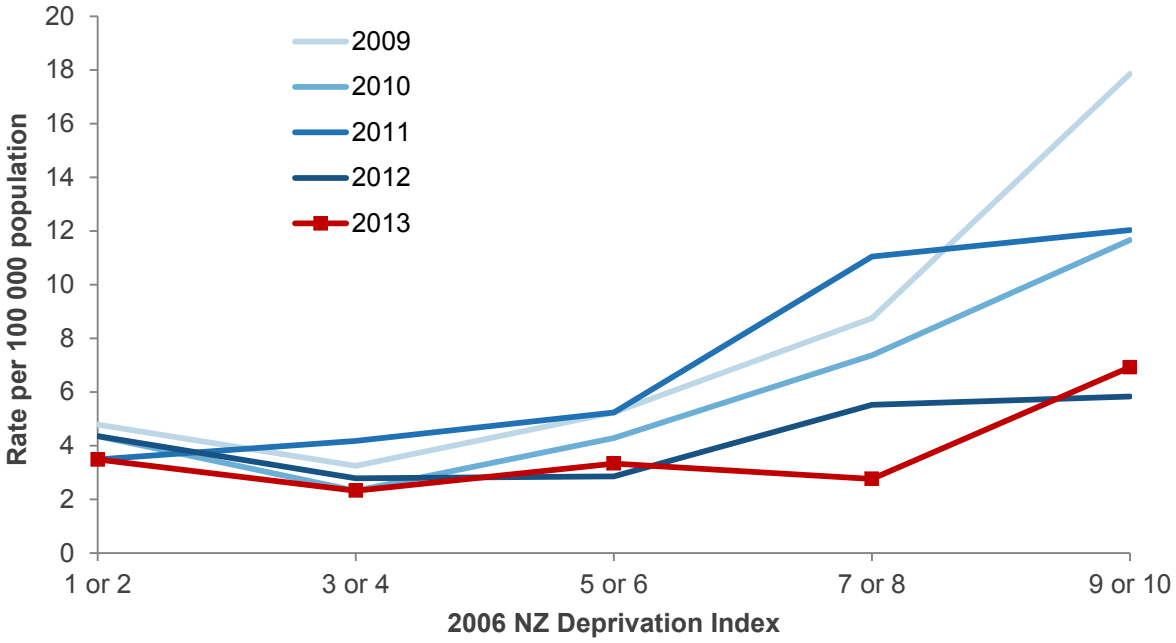


Note: Rates have not been calculated where fewer than five cases were notified in any category. Asian and MELAA ethnic groups are not presented in this graph due to the small number of cases.

Incidence by deprivation index for cases aged less than 20 years

A gradient in meningococcal disease rates by socio-economic status was a consistent feature of the disease data between 2009 and 2013 (Figure 5). The rate of meningococcal disease for cases living in the most deprived areas (quintiles 9 and 10) had decreased from 17.9 per 100 000 population in 2009 to 6.9 per 100 000 population in 2013. The rate for cases living in the least deprived areas (quintiles 1 and 2) has remained stable range 3.5–4.8.

Figure 5. Meningococcal disease rates by quintiles of NZDep06 for cases aged less than 20 years, 2009–2013



Laboratory confirmation and typing

In 2013, 61 (89.7%) cases of meningococcal disease were confirmed by laboratory analysis. Forty-four cases were confirmed by the isolation of *N. meningitidis* and a further 17 by the detection of meningococcal DNA by PCR.

Strain types among confirmed cases

Table 4 shows the distribution of strain types in meningococcal disease cases in 2013. The strain type was determined for 57 (93.4%) of the 61 confirmed cases. More than 50% of cases were group B strains and 30% were group C strains. The most common strain type in 2013 was group C:P1.5-1,10-8 (15 cases) followed by group B:P1.7-2,4 (11 cases).

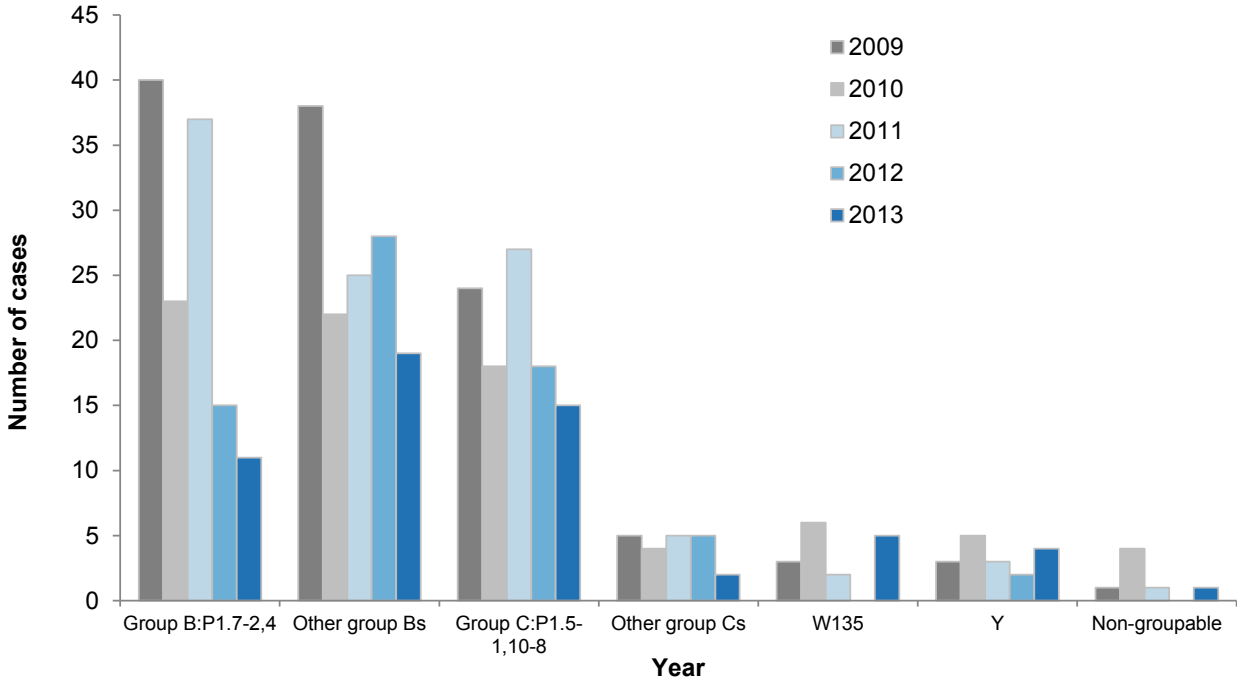
Table 4. Distribution of strain types among meningococcal disease cases, 2013

Strain group	Number of cases	Percentage[1]
Group B	**30**	**52.6**
P1.7-2,4	11	19.3
Other group Bs	19	33.3
Group C	**17**	**29.8**
P1.5-1,10-8	15	26.3
Other group Cs	2	3.5
Other	**10**	**17.5**
Group W135	5	8.8
Group Y	4	7.0
Non-groupable (P1.7-2,4)	1	1.8
Total	**57**	**100**

[1] Percentage was calculated using the total number of laboratory-confirmed cases where a strain group was determined.

The groups and dominant subtypes among strain-typed meningococcal disease cases between 2009 and 2013 are shown in Figure 6 and Table 12. Trends in the numbers of cases due to the two most common strains (groups B:P1.7-2,4 and C:P1.5-1,10-8), are described in the following sections. The number of cases due to other group B strains has varied from year to year, but was generally lower in 2010, 2011 and 2013 than in 2009 and 2012. Cases due to other group C strains, and to strain groups W135 and Y have been consistently uncommon, although there were two fatalities in cases due to these strains in 2013 (see Clinical outcomes section page 29).

Figure 6. Groups and dominant subtypes among strain-typed meningococcal disease cases, 2009–2013



Dominant circulating strain – Group C:P1.5-1,10-8

The number of cases due to the group C:P1.5-1,10-8 strain decreased from 24 cases in 2009 (0.6 per 100 000 population) to 18 cases (0.4 per 100 000 population) in 2012 and 15 cases (0.3 per 100 000 population) in 2013. In 2013, the cases were spread across eight DHBs, with 1–4 cases reported in each DHB (Table 5). MidCentral (1.8 per 100 000, 15 cases) and Northland (1.4 per 100 000, 11 cases) DHBs had the highest five-year average annual rates.

Figure 7. Rate of group C:P1.5-1,10-8 strain disease by year, 2009–2013

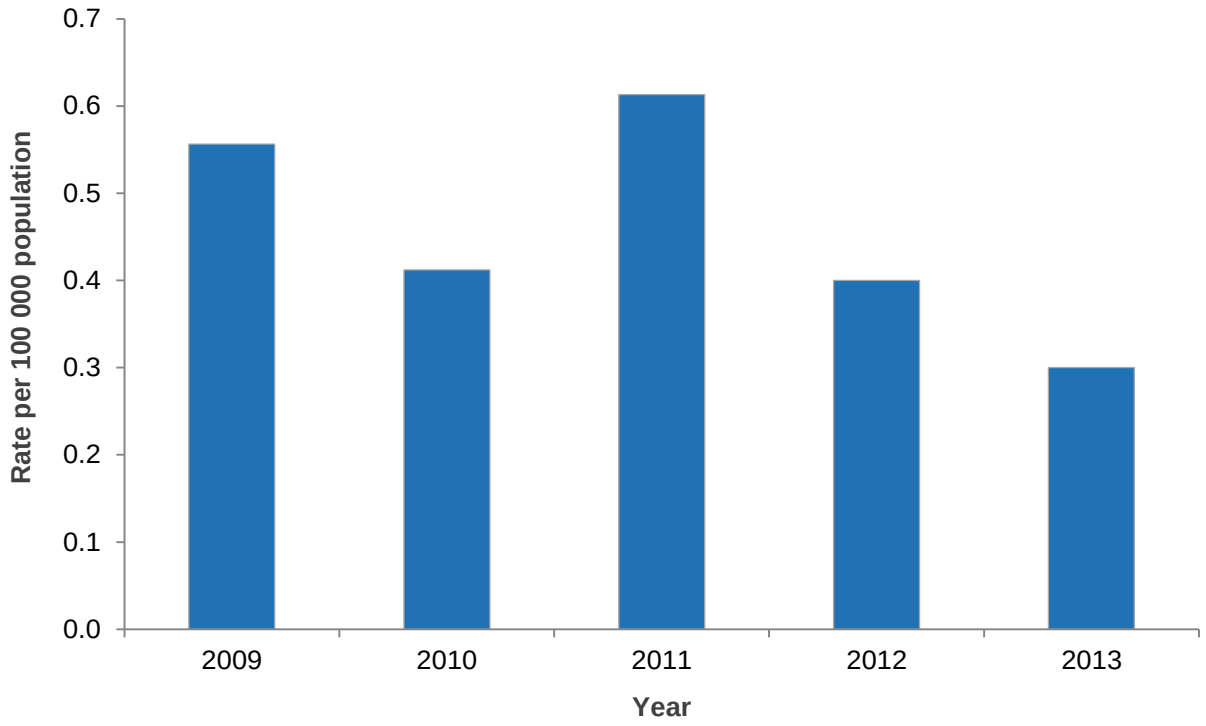


Table 5. Number of cases of group C:P1.5-1,10-8 strain by District Health Board, 2009–2013

District Health Board	Year					Total	Average annual rate[1]
	2009	2010	2011	2012	2013		
Northland	1	0	9	1	0	11	1.4
Waitemata	1	0	0	1	2	4	0.1
Auckland	1	2	0	1	0	4	0.2
Counties Manukau	3	2	2	1	4	12	0.5
Waikato	2	1	5	0	1	9	0.5
Lakes	0	0	0	0	0	0	-
Bay of Plenty	3	1	0	0	1	5	0.5
Tairawhiti	0	0	0	0	0	0	-
Taranaki	1	0	0	2	0	3	0.5
Hawke's Bay	0	2	0	0	0	2	0.3
Whanganui	1	0	0	1	1	3	1.0
MidCentral	5	5	2	3	0	15	1.8
Hutt Valley	0	1	1	0	0	2	0.3
Capital & Coast	1	0	2	5	1	9	0.6
Wairarapa	1	0	0	0	0	1	0.5
Nelson Marlborough	0	0	0	0	0	0	-
West Coast	0	0	0	0	0	0	-
Canterbury	0	0	3	2	3	8	0.3
South Canterbury	0	0	0	0	0	0	-
Southern	4	4	3	1	2	14	0.9
Total	**24**	**18**	**27**	**18**	**15**	**102**	**0.5**

[1] Rate per 100 000 population

Sex and age were recorded for all group C:P1.5-1,10-8 cases. Since 2009, the rate of meningococcal disease due to this strain has been the same or higher for females than for males, apart from 2013 when the rate for males was slightly higher than females (Table 6).

Between 2009 and 2013, the highest annual rate of disease from group C:P1.5-1,10-8 strain has occurred in the 1–4 years or the 15–19 years age groups (these are the only two main age groups with enough cases to calculate a rate). In 2013, the highest rate was for the 15–19 years age group 1.6 per 100 000 population, 5 cases) (Table 6). The highest five-year rate was also for the 15–19 years age group (2.0 per 100 000, 31 cases), followed by the less than one year (1.9 per 100 000, 6 cases) and the 1–4 years (1.2 per 100 000, 15 cases) age groups.

Table 6. Number of cases of group C:P1.5-1,10-8 strain by age group, sex and ethnic group, 2009–2013

Category	2009		2010		2011		2012		2013		Total	Average annual rate[1]
	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]		
Age group (years)												
<1	3	-	1	-	1	-	1	-	0	-	6	1.9
1–4	5	2.0	2	-	6	2.4	1	-	1	-	15	1.2
5–9	1	-	2	-	2	-	2	-	1	-	8	0.6
10–14	1	-	2	-	3	-	1	-	2	-	9	0.6
15–19	9	2.8	5	1.6	6	1.9	6	2.0	5	1.6	31	2.0
20–29	1	-	3	-	2	-	3	-	2	-	11	0.4
30–39	1	-	2	-	1	-		-	0	-	4	0.1
40+	3	-	1	-	6	0.3	4	-	4	-	18	0.2
Sex												
Male	9	0.4	8	0.4	11	0.5	7	0.3	15	0.7	50	0.5
Female	15	0.7	10	0.4	16	0.7	11	0.5	10	0.4	62	0.6
Ethnic group												
Māori	9	1.4	8	1.2	11	1.7	2	-	4	-	34	1.0
Pacific Peoples	1	-	2	-	1	-	1	-	2	-	7	0.5
Asian	0	-	0	-	0	-	0	-	1	-	1	0.0
MELAA[2]	1	-	0	-	0	-	1	-	0	-	2	0.8
European or Other	13	0.4	8	0.3	15	0.5	14	0.5	8	0.3	58	0.4
Total	**24**	**0.6**	**18**	**0.4**	**27**	**0.6**	**18**	**0.4**	**15**	**0.3**	**102**	**0.5**

[1] Rate per 100 000 population

[2] Middle Eastern/Latin American/African

From 2009 to 2013, the average annual rates of disease from the group C:P1.5-1,10-8 strain was highest in the Māori ethnic group (1.0 per 100 000, 34 cases) (Table 6). In 2013, the European or Other ethnic group was the only ethnic group with enough cases to calculate a rate (0.3 per 100 000 population, 8 cases).

Hospitalisation status was recorded for all 15 cases of group C:P1.5-1,10-8 strain disease reported in 2013, of which all cases were hospitalised. Of these, five cases (33.3%) had been seen by a doctor before hospital admission and none had been given antibiotics.

A total of 15 fatalities (case-fatality rate of 14.7%) were reported as being due to group C:P1.5-1,10-8 strain disease from 2009 to 2013, including nine in 2011 and three in 2012 (Table 16 and Table 17). No fatalities for this strain were reported in 2013.

Dominant circulating strain – Group B:P1.7-2,4

Between 2009 and 2012, the number of cases due to the group B:P1.7-2,4 strain decreased from 40 to 15 per annum. In 2013, the group B:P1.7-2,4 disease rate decreased to 0.2 per 100 000 population (11 cases); down from 0.9 per 100 000 population (40 cases) in 2009, and lower than the previous lowest rate of 0.3 per 100 000 population (15 cases) in 2012 (Figure 8). The cases were spread across eight DHBs, with 1–3

cases in each DHB (Table 7). Lakes DHB had the highest average annual five-year rate (1.8 per 100 000, 11 cases) followed by Northland (1.6 per 100 000, 12 cases), and Whanganui (1.6 per 100 000, 2 cases) DHBs (Table 7).

Figure 8. Rate of group B:P1.7-2,4 strain disease by year, 2009–2013

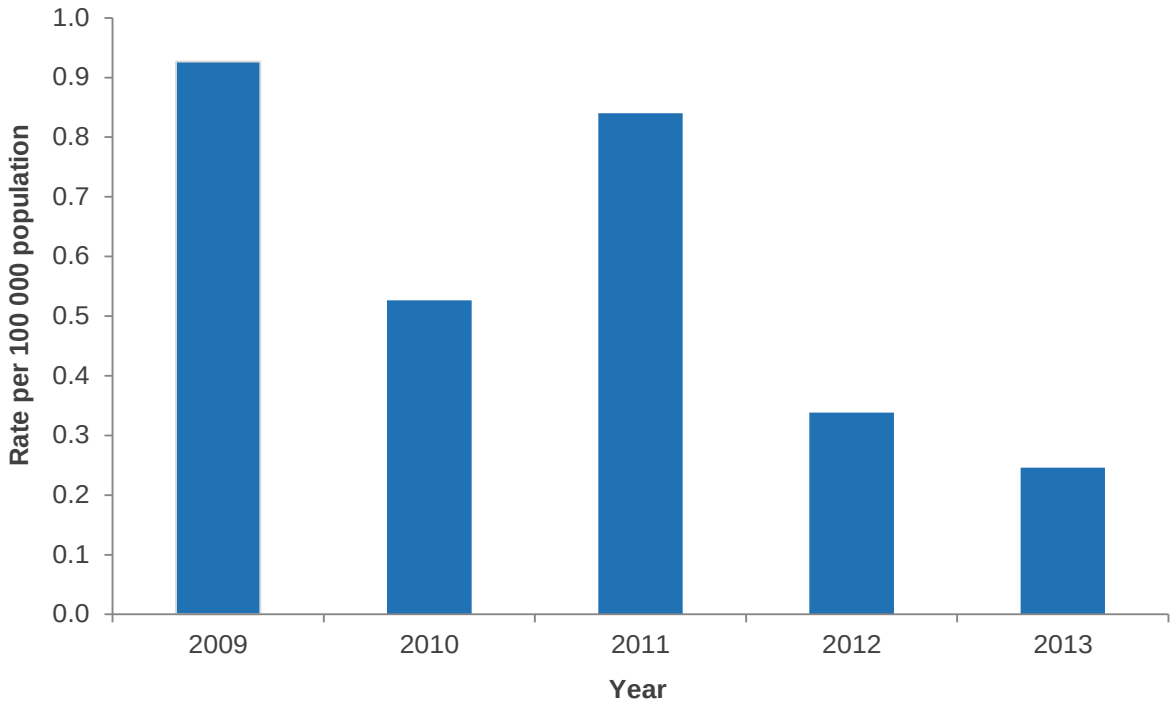


Table 7. Number of cases of group B:P1.7-2,4 strain by District Health Board, 2009–2013

District Health Board	Year					Total	Average annual rate[1]
	2009	2010	2011	2012	2013		
Northland	3	3	3	1	2	12	1.5
Waitemata	3	3	2	3	0	11	0.4
Auckland	4	1	2	1	1	9	0.4
Counties Manukau	3	7	9	1	3	23	0.9
Waikato	3	1	4	0	0	8	0.4
Lakes	4	1	3	2	1	11	2.1
Bay of Plenty	3	1	3	1	0	8	0.8
Tairawhiti	2	0	0	0	0	2	0.9
Taranaki	2	0	0	0	0	2	0.4
Hawke's Bay	3	1	1	1	1	7	0.9
Whanganui	0	0	2	0	0	2	0.6
MidCentral	1	0	1	0	1	3	0.4
Hutt Valley	0	3	2	1	0	6	0.8
Capital & Coast	6	1	2	2	1	12	0.8
Wairarapa	0	0	0	0	0	0	-
Nelson Marlborough	0	0	0	0	0	0	-
West Coast	0	0	0	0	0	0	-
Canterbury	1	1	2	1	0	5	0.2
South Canterbury	0	0	0	0	0	0	-
Southern	2	0	1	1	1	5	0.3
Total	**40**	**23**	**37**	**15**	**11**	**126**	**0.6**

[1] Rate per 100 000 population

Sex and age were recorded for all group B:P1.7-2,4 cases. Since 2009, the rate of meningococcal disease due to this strain has been higher for males than for females, apart from 2012 when the rate for females was slightly higher than males (Table 8).

The rate of group B:P1.7-2,4 strain disease has consistently been highest for individuals aged less than five years, and those aged less than one year in particular (Table 8). Three cases were reported for individuals aged less than one year in 2013, which is the lowest number of notifications for this age group in the last five years. Similarly, the 2012 and 2013 rates in the 1–4 years age group (2.0 per 100 000 population, 5 cases each) were also the lowest in the last five years.

Table 8. Number of cases of group B:P1.7-2,4 strain by age group, sex and ethnic group, 2009–2013

	2009		2010		2011		2012		2013		Total	Average annual rate[1]
	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]		
Age group (years)												
<1	10	15.9	15	23.5	7	11.2	5	8.3	3	-	40	12.9
1–4	13	5.4	6	2.4	12	4.8	5	2.0	5	2.0	41	3.3
5–9	3	-	1	-	3	-	1	-	0	-	8	0.6
10–14	2	-	0	-	1	-	1	-	0	-	4	0.3
15–19	3	-	0	-	1	-	1	-	0	-	5	0.3
20–29	2	-	0	-	1	-	1	-	0	-	4	0.1
30–39	2	-	0	-	5	0.9	0	-	1	-	8	0.3
40+	5	0.3	1	-	7	0.3	1	-	2	-	16	0.2
Sex												
Male	21	1.0	13	0.6	20	0.9	7	0.3	7	0.3	68	0.6
Female	19	0.9	10	0.4	17	0.8	8	0.4	4	-	58	0.5
Ethnic group												
Māori	19	3.0	12	1.8	14	2.1	8	1.2	7	1.0	60	1.8
Pacific Peoples	6	2.3	8	2.9	6	2.2	2	-	0	-	22	1.6
Asian	1	-	1	-	1	-	0	-	1	-	4	0.2
MELAA[2]	1	-	0	-	1	-	1	-	0	-	3	1.3
European or Other	13	0.4	2	-	15	0.5	4	-	3	-	37	0.3
Total	**40**	**0.9**	**23**	**0.5**	**37**	**0.8**	**15**	**0.3**	**11**	**0.2**	**126**	**0.6**

[1] Rate per 100 000 population

[2] Middle Eastern/Latin American/African

In 2013, the Māori ethnic group was the only ethnic group with sufficient cases for a rate to be calculated (1.0 per 100 000 population, 7 cases). In the five years from 2009 to 2012, rates of group B:P1.7-2,4 disease were highest for the Māori and Pacific Peoples ethnic groups (Table 8).

Hospitalisation status was recorded for all 11 cases of group B:P1.7-2,4 disease in 2013, and all were hospitalised. Of these, six cases (54.5%) were seen by a doctor prior to hospital admission and none were given antibiotics. From 2009 to 2013, a total of seven fatalities (case-fatality rate of 5.6%) were reported as being due to group B:P1.7-2,4 disease. No deaths due to group B:P1.7-2,4 were reported in 2013 (Table 16).

Vaccine-targeted strains

In 2013, 12 (21.1%) of the strain-typed cases were caused by a strain targeted by the MeNZB™ vaccine (Table 9). One of these cases reported being vaccinated with MeNZB™ (three doses) and received their last dose eight years prior to disease onset. The MeNZB™ vaccine was in use between 2004 and 2008, as part of a mass immunisation programme for under 20 year olds and the routine childhood immunisation schedule [3].

Seventeen (29.8%) of the strain-typed cases in 2013 were caused by strains targeted by the group C conjugate vaccine and the polysaccharide and conjugate quadrivalent vaccines, none of whom had been previously immunised with any of these vaccines. Group C conjugate vaccine is not part of the routine childhood immunisation schedule but may be funded to control community outbreaks [3].

The quadrivalent vaccine targets all group A, C, Y and W135 strains and polysaccharide quadrivalent vaccine is currently funded for adults and children pre- or post-splenectomy and may be funded to control community outbreaks [3]. Conjugate quadrivalent vaccine will be funded for specified high risk groups and may also be funded to control community outbreaks from July 2014 [11].

Most of the remaining 2013 cases were infected with group B strains other than P1.7-2,4 (19 cases) (Table 12). Currently, there is no vaccine licensed in New Zealand that targets group B strains. A new group B vaccine is licensed in United Kingdom, Canada and Australia, where it is recommended but not publicly funded for specific risk groups [12-15].

Table 10 shows the age distribution of cases caused by vaccine-targeted strains reported in 2013. Between 2009 and 2013, the number of cases due to strains targeted by MeNZB™ fell from 42 to 12. Similarly, the number of cases due to strains targeted by C conjugate vaccine decreased from 32 cases in 2011 to 17 in 2013 (Table 9). The trends in cases due to strains targeted by quadrivalent vaccine are being driven by group C disease cases. In 2013, only nine out of 26 cases of quadrivalent vaccine-targeted strains were due to non-group C strains (Table 12).

Table 9. Number of meningococcal disease cases caused by vaccine-targeted strains, 2009–2013

Vaccine	Year					Total
	2009	2010	2011	2012	2013	
MeNZB™ [1]	42	26	37	15	12	132
C conjugate[2]	29	22	32	23	17	123
Quadrivalent[3]	35	33	37	25	26	156

[1] Targets the P1.4 PorA variable region, and was part of the routine childhood immunisation schedule between 2004 and 2008.

[2] Targets all group C strains and may be funded to control a community outbreak, otherwise not funded.

[3] Targets all group A, C, Y and W135 strains. Polysaccharide quadrivalent vaccine is currently funded for adults and children pre- or post-splenectomy and may be funded to control a community outbreak. Conjugate quadrivalent vaccine is now licensed in New Zealand and will be funded for use in specified high risk groups from July 2014 [11] .

Table 10. Number of meningococcal disease cases caused by vaccine-targeted strains by age group, 2013

Vaccine	Age group (years)						Total
	<1	1–4	5–9	10–14	15–19	20+	
MeNZB™ [1]	3	5	0	0	0	4	12
C conjugate[2]	0	3	1	2	5	6	17
Quadrivalent[3]	2	3	2	2	7	10	26

[1] Targets the P1.4 PorA variable region, and was part of the routine childhood immunisation schedule between 2004 and 2008.

[2] Targets all group C strains and may be funded to control a community outbreak, otherwise not funded.

[3] Targets all group A, C, Y and W135 strains. Polysaccharide quadrivalent vaccine is currently funded for adults and children pre- or post-splenectomy and may be funded to control a community outbreak. Conjugate quadrivalent vaccine is now licensed in New Zealand and will be funded for use in specified high risk groups from July 2014 [11].

Antimicrobial susceptibility

The antimicrobial susceptibility of all 43 viable meningococcal isolates received by ESR from cases of invasive disease in 2013 was tested (Table 11).

All isolates were susceptible to ceftriaxone, rifampicin and ciprofloxacin. Reduced penicillin susceptibility (MIC ≥0.12 mg/L) was observed in 32.6% (14/43) of isolates: 66.7% (2/3) of group W135 isolates, 50.0% (2/4) of group Y isolates, 36.4% (8/22) of group B isolates (but none of the isolates belonging to the NZ B:P1.7-2,4 epidemic strain) and 14.3% (2/14) of group C isolates.

Reduced penicillin susceptibility in meningococci was first seen in the mid-1990s. Since then, a trend towards an increasing proportion of isolates with reduced susceptibility has been observed, with a prevalence of ≥20% in recent years (Figure 9). Infections due to isolates with reduced susceptibility are still treatable with penicillin.

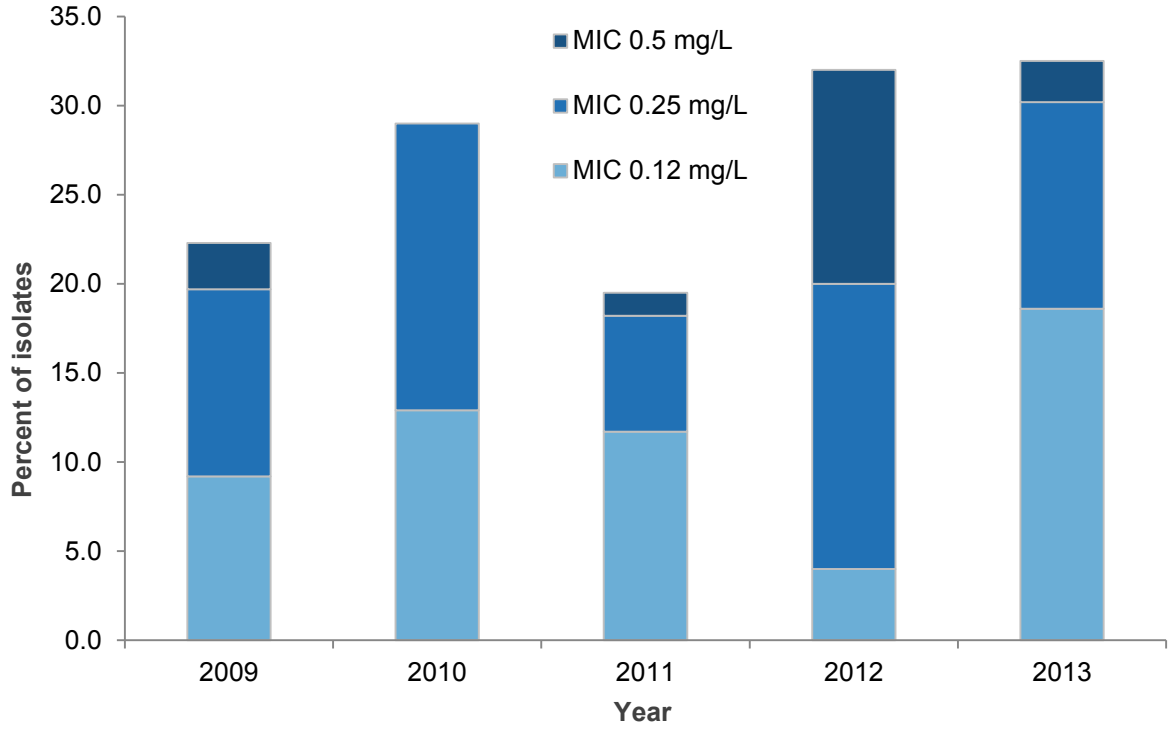
Rifampicin resistance is rare in meningococci from invasive disease in New Zealand, with a total of only seven isolates identified to date, the most recent in 2011. Ciprofloxacin resistance is also rare, with only one ciprofloxacin-resistant isolate identified in 2010. A full report on antimicrobial susceptibility of *N. meningitidis* is provided separately in the report entitled 'Antimicrobial susceptibility of invasive *Neisseria meningitidis*, 2013', available at www.surv.esr.cri.nz/PDF_surveillance/Antimicrobial/NME [16].

Table 11. MIC range and MIC90 of isolates, 2013

Antimicrobial	MIC[1] range (mg/L)	MIC_{90}[2] (mg/L)
Penicillin	0.03–0.5	0.25
Ceftriaxone	0.002–0.008	0.004
Rifampicin	0.004–0.06	0.03
Ciprofloxacin	0.004–0.008	0.008

[1] Minimum inhibitory concentration
[2] Concentration that inhibits at least 90% of the isolates

Figure 9. Reduced penicillin susceptibility among *N. meningitidis* from invasive disease, 2009–2013



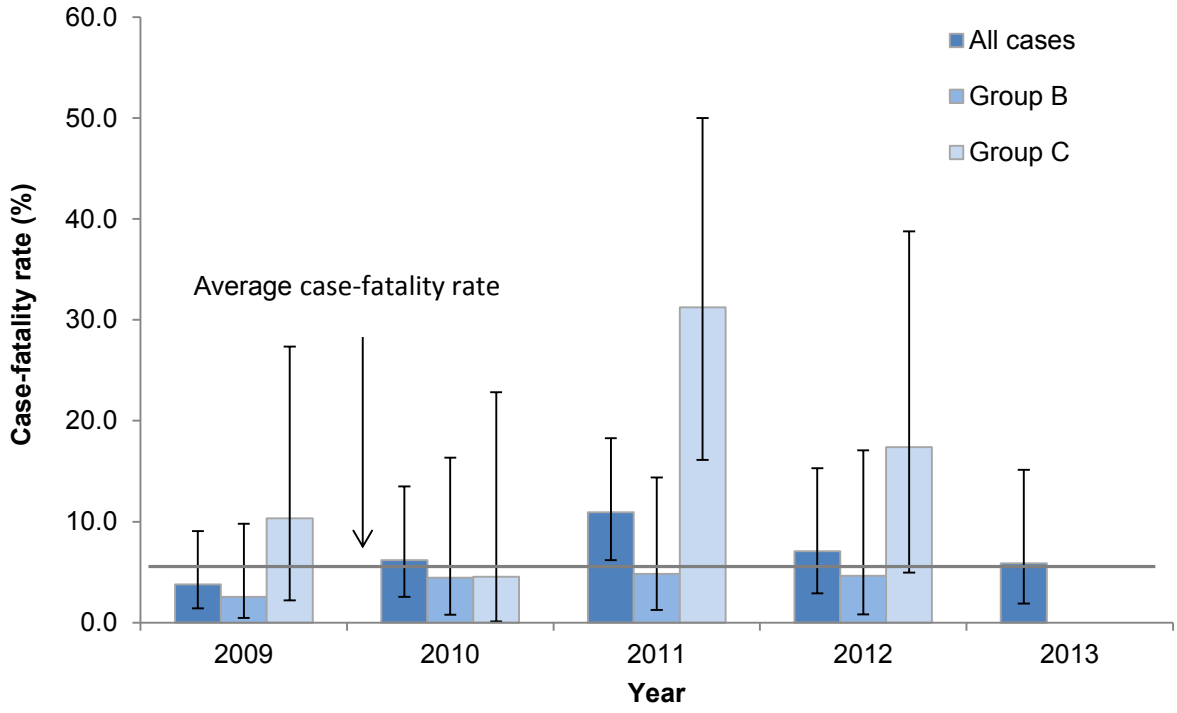
Clinical outcomes

Four fatalities due to meningococcal disease occurred in 2013. The case-fatality rate was 5.9% (Figure 10).

Three of the four 2013 fatalities were confirmed cases. The strain group was identified for two of these three fatalities: group W135 and group Y (1 fatality each). Between 2009 and 2013, the overall group C strain case-fatality rate was 14.6% (18 fatalities) and the case-fatality rate for group C:P1.5-1,10-8 strain was 14.7% (15 fatalities) (Table 16). By comparison, the case-fatality rate for the group B strain was 3.5% (9 fatalities) with a case-fatality rate for the group B:P1.7-2,4 strain of 5.6% (7 fatalities) (Table 16). Between 2009 and 2013, the only fatalities for groups W135 and group Y were in 2013 (Table 16). The case-fatality rates for 2009–2013 for all meningococcal disease cases and groups B and C are shown in Figure 10.

The case-fatality rate over the last five years was highest for those in the 40+ years age group (10.7%, 9 fatalities) and lowest in the 5–9 years age group (no fatalities). Between 2009 and 2013, the case-fatality rate was highest for European or Other (9.3%, 21 fatalities), followed by the Asian ethnic group (9.1%, 1 fatality), Māori (5.4%, 10 fatalities) and Pacific Peoples (2.8%, 2 fatalities) ethnic groups (Table 16).

Figure 10. Meningococcal disease case-fatality rates, 2009–2013



Case management

Information about hospitalisation was recorded for all 68 cases of meningococcal disease reported in 2013, of which 67 cases (98.5%) were hospitalised.

For the hospitalised cases, pre-hospital management information was recorded for 65 (97.0%) cases. Of these, 28 cases (43.0%) were seen by a doctor prior to hospital admission and four (6.2%) were given intravenous or intramuscular antibiotics before admission. Among the four fatalities reported in 2013, one was seen by a doctor and given antibiotics prior to admission, one was not seen by a doctor but given antibiotics at the time of admission, one was not seen by a doctor and not given antibiotics prior to hospital admission, and the remaining case was reported not to have sought medical attention prior to death.

DISCUSSION

DISCUSSION

The rate of meningococcal disease in New Zealand in 2013 was lower than in 2012, and was the lowest in more than 20 years. The incidence rate of 1.5 per 100 000 remains higher than the estimated rate for 2011 in the United States of 0.25 per 100 000; the 2012 incidence rate in Canada (0.43 per 100 000) or the 2011 incidence rate in Australia (1.1 per 100 000) but is similar to the reported 2011/2012 incidence rate in the United Kingdom (<2 per 100 000) [12, 15, 17, 18].

The less than one year age group continued to experience a disproportionately high burden of disease, however the rate of disease (18.4 per 100 000) in this age group was slightly lower than in 2012 and is now less than half of the rate reported in 2011. The rate for the less than one year age group in 2011/2012 in Australia was 14 per 100 000 and in the United Kingdom was ~25 per 100 000 [12, 15]. The rate of meningococcal disease in the 20–29 years age group decreased to a level similar to the years before the high rate seen in 2012 [19]. Case numbers were lower in 2013 compared with 2012 for all of the monitored ethnic groups apart from the Asian ethnic group. However age-standardised rates continue to be higher for the Māori and the Pacific Peoples ethnic groups, compared with other ethnic groups in 2013 and were at least double the European or Other ethnic group rate. Capital & Coast DHB had noticeably fewer cases in 2013 compared with the previous five years. Counties Manukau and Southern DHBs experienced the highest rates per DHB.

Group B strains continued to be the most prevalent, infecting over 50% of cases in 2013. However, a group C strain was the most common individual strain type and over a quarter of strain-typed cases in 2013 were infected with a C:P1.5-1,10-8 strain, as was also seen in 2012. The group B strain B:P1.7-2,4, responsible for the 1991–2007 meningococcal disease epidemic in New Zealand and the target for the now withdrawn MeNZB^{TM} vaccine, was the second most common individual strain reported but accounted for under 20% of strains reported. It is noteworthy that there were no cases of meningococcal disease due any group C strain in the Northland DHB in 2013. In 2011, a mass vaccination campaign using conjugate group C vaccine was initiated in this region, after nine cases of C:P1.5-1,10-8 strain disease were identified.

The number of deaths due to meningococcal disease fell from those recorded in 2012 and a further drop in the case-fatality rate was also seen. Over the last five years, the case-fatality rate was significantly higher ($p<0.001$) for group C disease compared with other groups, with a particularly high case-fatality rate for C:P1.5-1,10-8 strain disease ($p<0.001$). Multilocus sequence typing undertaken on C:P1.5-1,10-8 isolates from 2011 identified them as belonging to the ST-11 clonal complex, a complex that has been associated with more severe disease [20]. During this five year period, of the seven deaths recorded in the 15–19 years age group, six were laboratory confirmed cases with C:P1.5-1,10-8 strain disease. In the under five year age group there were 13 deaths, of which 10 were laboratory confirmed, six of these with group B strains (five with B:P1.7-2,4) and four with group C strains (three with C:P1.5-1,10-8).

Decreasing rates of meningococcal disease and a change in the predominant strains have also been seen in other countries such as the United Kingdom, Australia, the United States and Canada. However, unlike New Zealand, the most common strains in these countries during the 1990s were from meningococcal group C. Subsequently childhood immunisation programmes for group C were introduced in the United Kingdom (1999), Australia (2003) and Canada (2007), and an adolescent programme in the United States (2005) [15, 21-23]. Following these programmes, the incidence of meningococcal group C disease decreased in all four countries. Australia reported no cases of meningococcal disease due to group C strains in 2011 [24]. However the impact of the vaccination programme was less obvious in the United States [25].

In recent years group B strains have accounted for over 80% of cases reported in England/Wales and Australia, 60% in Canada and 40% in the United States [15, 21-23]. The new group B vaccine is now licensed in United Kingdom, Canada and Australia, and agencies in these countries have reviewed its use in high risk groups (infants and young children, people with medical conditions that place them at high risk of meningococcal disease and adolescents aged 15–19 years, and some laboratory personnel). Recommendations for use of the vaccine in these groups have been made in all three countries and the United Kingdom has agreed to fund an infant vaccination programme subject to negotiating a cost-effective price [12-15].

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APPENDIX

Table 12. Strain group distribution by year, 2009–2013

Strain group	Year					Total
	2009	2010	2011	2012	2013	
Group B	**78**	**45**	**62**	**43**	**30**	**258**
B:P1.7-2,4	40	23	37	15	11	126
Other group Bs	38	22	25	28	19	132
Group C	**29**	**22**	**32**	**23**	**17**	**123**
C:P1.5-1,10-8	24	18	27	18	15	102
Other group Cs	5	4	5	5	2	21
Other	**25**	**30**	**25**	**19**	**21**	**120**
Group W135	3	6	2	0	5	16
Group Y	3	5	3	2	4	17
Non-groupable	1	4	1	0	1	7
Other laboratory confirmed[1]	4	3	8	6	4	25
Probable	14	12	11	11	7	55
Total	**132**	**97**	**119**	**85**	**68**	**501**

[1] Includes DNA laboratory-confirmed by PCR where type was not determined, and laboratory-confirmed isolates not received by the Meningococcal Reference Laboratory

Table 13. Age distribution and age standardised incidence rates by ethnicity of meningococcal disease cases, 2009–2013

Age group (years)	2009		2010		2011		2012		2013	
	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
<5	63	20.6	50	16.0	56	17.8	26	8.3	24	7.8
<1	28	44.4	27	42.4	24	38.5	12	19.8	11	18.4
1–4	35	14.4	23	9.3	32	12.7	14	5.6	13	5.2
≥5	69	1.7	47	1.2	63	1.5	59	1.4	44	1.1
5–9	10	3.5	7	2.4	10	3.5	4	-	4	-
10–14	4	-	5	1.7	5	1.7	6	2.1	5	1.8
15–19	21	6.5	12	3.7	15	4.7	15	4.8	12	3.9
20–29	8	1.4	8	1.3	5	0.8	12	1.9	6	0.9
30–39	4	-	3	-	7	1.2	7	1.3	3	-
40+	22	1.1	12	0.6	21	1.0	15	0.7	14	0.7
Ethnic group										
Māori	49	4.6	42	4.3	41	4.1	29	3.3	23	2.6
Pacific Peoples	17	5.2	17	4.7	19	5.7	10	3.0	9	3.1
Asian	4	-	2	-	2	-	1	-	2	-
MELAA[2]	2	-	0	-	1	-	3	-	0	-
European or Other	58	2.2	36	1.4	55	2.0	42	1.5	3.4	1.2
Unknown	2	-	0	-	1	-	0	-	0	-
Total	**132**	**3.1**	**97**	**2.2**	**119**	**2.7**	**85**	**1.9**	**68**	**1.5**

[1] Rate per 100 000 population

[2] Middle Eastern/Latin American/African

Table 14. Numbers and incidence rates for cases of meningococcal disease by age group and ethnic group, 2013

Age group (years)	Māori		Pacific Peoples		Asian		MELAA[2]		European or Other		Total	
	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
<1	5	32.3	2	-	0	-	0	-	4	-	11	18.4
1–4	10	15.7	1	-	0	-	0	-	2	-	13	5.2
5–9	2	-	1	-	0	-	0	-	1	-	4	-
10–14	1	-	1	-	0	-	0	-	3	-	5	1.8
15–19	1	-	0	-	1	-	0	-	10	5.8	12	3.9
20–29	1	-	1	-	0	-	0	-	4	-	6	0.9
30–39	0	-	1	-	1	-	0	-	1	-	3	-
40+	3	-	2	-	0	-	0	-	9	0.6	14	0.7
Total	**23**	**3.4**	**9**	**3.3**	**2**	-	**0**	-	**34**	**1.1**	**68**	**1.5**

[1] Rate per 100 000 population

[2] Middle Eastern/Latin American/African

Table 15. Distribution of strain types among meningococcal disease cases and total cases by District Health Board, 2013

District Health Board	Group B				Group C				Other					Total	%
	P1.7-2,4	All other Bs	Total	%	P1.5-1,10-8	All other Cs	Total	%	W135	Y	NG[1]	Total	%		
Northland	2	2	4	100	0	0	0	-	0	0	0	0	-	4	5.9
Waitemata	0	5	5	71.4	2	0	2	28.6	0	0	0	0	-	7	10.3
Auckland	1	3	4	66.7	0	0	0	-	0	0	0	0	-	6	8.8
Counties Manukau	3	4	7	58.3	4	0	4	33.3	1	0	0	1	8.3	12	17.6
Waikato	0	0	0	-	1	1	2	50.0	1	0	0	1	25.0	4	5.9
Lakes	1	1	2	66.7	0	0	0	-	1	0	0	1	33.3	3	4.4
Bay of Plenty	0	1	1	50.0	1	0	1	50.0	0	0	0	0	-	2	2.9
Tairawhiti	0	0	0	-	0	1	1	100	0	0	0	0	-	1	1.5
Taranaki	0	0	0	-	0	0	0	-	1	0	0	1	33.3	3	4.4
Hawke's Bay	1	1	2	66.7	0	0	0	-	0	0	0	0	-	3	4.4
Whanganui	0	0	0	-	1	0	1	100	0	0	0	0	-	1	1.5
MidCentral	1	0	1	50.0	0	0	0	-	0	0	0	0	-	2	2.9
Hutt Valley	0	0	0	-	0	0	0	-	0	1	0	1	100	1	1.5
Capital & Coast	1	1	2	66.7	1	0	1	33.3	0	0	0	0	-	3	4.4
Wairarapa	0	0	0	-	0	0	0	-	0	0	0	0	-	0	-
Nelson Marlborough	0	0	0	-	0	0	0	-	0	0	0	0	-	0	-
West Coast	0	0	0	-	0	0	0	-	0	0	0	0	-	0	-
Canterbury	0	1	1	12.5	3	0	3	37.5	1	1	0	2	25.0	8	11.8
South Canterbury	0	0	0	-	0	0	0	-	0	1	0	1	100	1	1.5
Southern	1	0	1	14.3	2	0	2	28.6	0	1	1	2	28.6	7	10.3
Total	**11**	**19**	**30**	**44.1**	**15**	**2**	**17**	**25.0**	**5**	**4**	**1**	**10**	**14.7**	**68**	**100**

[1] Non-groupable

Table 16. Case-fatality rates for meningococcal disease cases by age, sex, ethnicity and strain group, 2009–2013

Features of case and infecting organism	Annual fatalities					Total fatalities	Total cases	CFR[1] (%)
	2009	2010	2011	2012	2013			
Age group (years)								
<1	2	1	3	0	0	6	102	5.9
1–4	0	3	3	1	0	7	117	6.0
5–9	0	0	0	0	0	0	35	0.0
10–14	1	0	0	1	0	2	25	8.0
15–19	1	1	3	1	1	7	75	9.3
20–29	1	0	0	1	0	2	39	5.1
30–39	0	0	1	0	0	1	24	4.2
40+	0	1	3	2	3	9	84	10.7
Sex								
Male	4	0	7	0	2	13	246	5.3
Female	1	6	6	6	2	21	255	8.2
Ethnic group								
Māori	2	2	5	1	0	10	184	5.4
Pacific Peoples	0	1	1	0	0	2	72	2.8
Asian	0	1	0	0	0	1	11	9.1
MELAA[2]	0	0	0	0	0	0	6	0.0
European or Other	3	2	7	5	4	21	225	9.3
Unknown	0	0	0	0	0	0	3	0.0
Strain group								
B:P1.7-2,4	2	2	2	1	0	7	126	5.6
Other group Bs	0	0	1	1	0	2	132	1.5
C:P1.5-1,10-8	2	1	9	3	0	15	102	14.7
Other group Cs	1	0	1	1	0	3	21	14.3
Group W135	0	0	0	0	1	1	16	6.3
Group Y	0	0	0	0	1	1	17	5.9
Non-groupable	0	0	0	0	0	0	7	0.0
Other laboratory confirmed[3]	0	0	0	0	1	1	25	4.0
Probable	0	3	0	0	1	4	55	7.3
Total	**5**	**6**	**13**	**6**	**4**	**34**	**501**	**6.8**

[1] Case-fatality rate

[2] Middle Eastern/Latin American/African

[3] Includes DNA laboratory-confirmed by PCR where type was not determined, and laboratory-confirmed isolates not received by the Meningococcal Reference Laboratory

Table 17. Case-fatality rates for group C strains by District Health Board, 2009–2013

District Health Board	Year										Total cases	Total fatalities	CFR[1] (%)
	2009		2010		2011		2012		2013				
	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths			
Northland	1	0	0	0	9	3	1	0	0	0	11	3	27.3
Waitemata	1	0	0	0	0	0	1	0	2	0	4	0	-
Auckland	2	1	2	0	0	0	1	1	0	0	5	2	40.0
Counties Manukau	4	1	2	0	2	1	1	0	4	0	13	2	15.4
Waikato	2	0	2	0	7	3	1	0	2	0	14	3	21.4
Lakes	0	0	0	0	0	0	0	0	0	0	0	0	-
Bay of Plenty	3	0	1	0	0	0	0	0	1	0	5	0	-
Tairawhiti	0	0	0	0	0	0	0	0	1	0	1	0	-
Taranaki	1	1	0	0	0	0	2	0	0	0	3	1	33.3
Hawke's Bay	0	0	2	0	1	0	0	0	0	0	3	0	-
Whanganui	1	0	0	0	0	0	1	0	1	0	3	0	-
MidCentral	6	0	5	0	2	0	3	1	0	0	16	1	6.3
Hutt Valley	0	0	2	0	1	1	0	0	0	0	3	1	33.3
Capital & Coast	1	0	0	0	3	1	5	1	1	0	10	2	20.0
Wairarapa	1	0	0	0	0	0	0	0	0	0	1	0	-
Nelson Marlborough	0	0	0	0	0	0	0	0	0	0	0	0	-
West Coast	0	0	0	0	0	0	0	0	0	0	0	0	-
Canterbury	2	0	2	0	4	1	3	0	3	0	14	1	7.1
South Canterbury	0	0	0	0	0	0	2	0	0	0	2	0	-
Southern	4	0	4	1	3	0	2	1	2	0	15	2	13.3
Total	**29**	**3**	**22**	**1**	**32**	**10**	**23**	**4**	**17**	**0**	**123**	**18**	**14.6**

[1] Case-fatality rate