Annual report

Australian Meningococcal Surveillance Programme annual report, 2013

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Abstract

In 2013, there were 143 laboratory-confirmed cases of invasive meningococcal disease (IMD) analysed by the Australian National Neisseria Network (NNN). This was the lowest number of laboratory confirmed IMD cases referred to the NNN since the inception of the Australian Meningococcal Surveillance Programme in 1994. Probable and laboratory confirmed IMD is notifiable in Australia. There were 149 IMD cases notified to the National Notifiable Diseases Surveillance System in 2013. Meningococcal serogrouping was determined for 139/143 laboratory confirmed IMD cases; 74.8% (104 cases) were serogroup B infections; 5.8% (8 cases) were serogroup C infections; 8.6% (12 cases) were serogroup W135; and 10.8% (15 cases) were serogroup Y. Primary and secondary disease peaks were observed, respectively, in those aged 4 years or less, and in adolescents (15–19 years). Serogroup B cases predominated in all jurisdictions and age groups, except for those aged 65 years or over where serogroup Y predominated. The overall proportion and number of IMD caused by serogroup B decreased from previous years. The number of cases of IMD caused by serogroup C was low, and has been proportionally stable over recent years. The number of IMD cases caused by W135 and Y serogroups was similar to previous years but the proportion has increased with the overall reduction in numbers of IMD cases. Molecular typing was performed on 92 of the 93 IMD isolates, and 23 of the 50 cases confirmed by nucleic acid amplification testing. In 2013, the most common *porA* genotype circulating in Australia was P1.7-2,4. All IMD isolates tested were susceptible to ceftriaxone; ciprofloxacin and rifampicin. Decreased susceptibility to penicillin was observed in 78.5% of isolates. *Commun Dis Intell* 2014;38(4):E301–E308.

Keywords: antibiotic resistance; disease surveillance; meningococcal disease; *Neisseria meningitidis*

Introduction

The Australian National Neisseria Network (NNN) is a long-standing collaborative network of reference laboratories in each state and territory that undertake laboratory surveillance of the pathogenic *Neisseria* species *(N. meningitidis* and *N. gonorrhoeae)*. Since 1994 the NNN has provided a national program for the examination of *N. meningitidis* from laboratory confirmed cases of invasive meningococcal disease (IMD). This program is funded by the Australian Government Department of Health, and is known as the Australian Meningococcal Surveillance Programme (AMSP).[1] The NNN laboratories supply data on the phenotype and the genotype of invasive meningococci and these data supplement the clinical notification data from the National Notifiable Diseases Surveillance System (NNDSS), which includes cases of probable IMD as well as laboratory confirmed IMD. The characteristics of the meningococci responsible for IMD are important for individual patient management; contact management; and to tailor the public health response for outbreaks or case clusters, locally and nationally. The introduction of the publicly funded conjugate serogroup C meningococcal vaccine onto the National Immunisation Program in 2003 has seen a significant and sustained reduction in the number of cases of serogroup C IMD after 2003.[2] However, IMD remains an issue of public health concern in Australia.

Methods

Case confirmation of invasive meningococcal disease

Case confirmation is based on isolation of *N. meningitidis*, or a positive nucleic acid amplification testing (NAAT) from a normally sterile site, defined as laboratory definitive evidence of IMD by the Communicable Diseases Network Australia criteria.[3] Information regarding the site of infection, age and sex of the patients is collated by the NNN for the AMSP.

IMD cases are categorised on the basis of the site from which *N. meningitidis* was isolated or from which meningococcal DNA was detected by the NNN for the AMSP. When *N. meningitidis* is grown from both blood and cerebrospinal fluid (CSF) cultures from the same patient, the case is classified as one of meningitis. Where the diagnosis is made by serology, it is not possible to definitively classify a case as meningitis or septicaemia.

Phenotyping and genotyping of *Neisseria meningitidis*

Phenotyping is limited to the determination of the serogroup by detection of soluble polysaccharide antigens. Genotyping of both isolates and DNA extracts is performed by sequencing of products derived from amplification of the porin genes *porA, porB* and *FetA*.

Antibiotic susceptibility testing

Isolates were tested to determine their minimum inhibitory concentration (MIC) values to antibiotics used for therapeutic and prophylactic purposes: ceftriaxone, ciprofloxacin; rifampicin. This program uses the following parameters to define the various levels of penicillin susceptibility or resistance when determined by a standardised agar plate dilution technique:[4]

Sensitive: MIC ≤ 0.03 mg/L

Less sensitive: MIC 0.06–0.5 mg/L

Resistant: MIC ≥ 1 mg/L

Meningococcal serology

Serological diagnosis of IMD can be made on the demonstration of IgM antibody by enzyme immunoassay to *N. meningitidis* outer membrane protein using the methods and test criteria of the Health Protection Agency UK, and as assessed for Australian conditions.[5–7]

Results

In 2013, there were 143 laboratory-confirmed cases of IMD analysed by the NNN, and 149 cases notified to the NNDSS. Thus laboratory data were available for 96% of notified cases of IMD in Australia in 2013 (Table 1). This is the lowest annual number of IMD cases recorded by the NNDSS and the AMSP since surveillance data collaboration began in Australia. There was a reduction of 31% in the number of IMD cases from 2012 (Figure 1). As in previous years, the peak incidence for IMD continues to be late winter and early spring (1 July to 30 September) (Table 1).

The highest number of laboratory confirmed cases was from New South Wales (43 cases), which was notably lower than the 62 cases in 2012. Other states that recorded a significant reduction in IMD cases were Queensland (32 cases in 2013, compared with 59 in 2012), and Victoria (23 cases in 2013, compared with 33 in 2012). Numbers for the other states were similar to 2012 (Table 2).

Age distribution

Nationally, the peak incidence of IMD was in children less than 5 years of age, which was similar

Figure 1: Number of invasive meningococcal disease cases reported to the National Notifiable Diseases Surveillance System compared with laboratory confirmed data from the Australian Meningococcal Surveillance Programme, Australia, 1991 to 2013

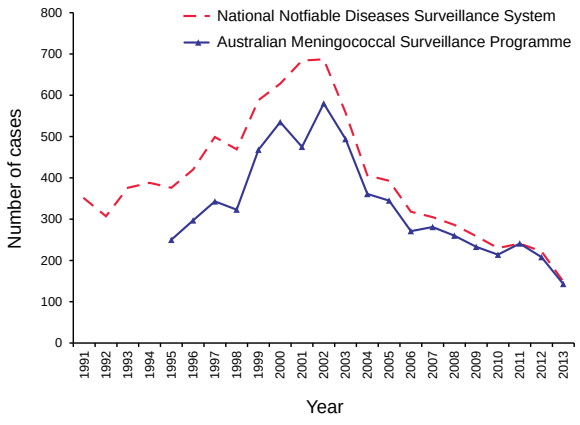


Table 1: Laboratory confirmed cases of invasive meningococcal disease, Australia, 2013, by quarter

Serogroup	1 January to 31 March	1 April to 30 June	1 July to 30 September	1 October to 31 December	Total 2013
B	30	20	32	22	104
C	3	2	2	1	8
Y	1	3	3	8	15
W135	1	2	7	2	12
NG/ND	0	2	2	0	4
Total	35	29	46	33	143

NG Non-groupable.

ND Non-determined (samples were examined by nucleic acid amplification test).

to previous years. Between 2007 and 2012, 28% to 36% of cases were in this age group. In 2013, 47/143 (33%) IMD cases occurred in this age group (Table 3). A secondary disease peak has also been observed in previous years among adolescents aged 15–19 years. Of the total cases of IMD, 26/143 (18%) were in those aged 15–19 years in 2013, which was higher than the proportion reported for 2012 (13.5%); but similar to the proportion reported in the period 2007 to 2011 (17%–20%). The proportion of IMD cases (7.7%, 11 confirmed cases) in those aged 25–44 was lower than in 2012 (13%, 27 confirmed cases). The other age categories represented similar proportions in confirmed IMD cases to previous years.

Anatomical site of samples for laboratory confirmed cases

In 2013, diagnosis was made by a positive culture in 93/143 (65%) cases and 50/143 (35%) cases were confirmed by NAAT testing. There were no IMD cases diagnosed serologically in 2013 (Table 4).

There were 53 diagnoses of meningitis based on cultures or NAAT examination of CSF either alone or with a positive blood sample. There were 86 diagnoses of septicaemia based on cultures or NAAT examination from blood samples alone (Table 4). There were 4 IMD diagnoses by positive joint fluid culture (n = 3) and NAAT (n = 1).

Table 2: Number of laboratory confirmed cases of invasive meningococcal disease, Australia, 2013, by state or territory and serogroup

State or territory	Serogroup						Total
	B	C	Y	W135	NG	ND	
ACT	2	0	1	0	0	0	3
NSW	23	3	9	6	2	0	43
NT	2	0	0	0	0	0	2
Qld	25	2	2	3	0	0	32
SA	19	0	1	1	0	0	21
Tas	2	0	0	0	0	1	3
Vic	19	1	1	1	1	0	23
WA	12	2	1	1	0	0	16
Australia	104	8	15	12	3	1	143
(%)	(72.7)	(5.6)	(10.5)	(8.4)	(2.1)	(0.70)	

NG Non-groupable.
ND Non-determined (samples were examined by nucleic acid amplification test).

Table 3: Laboratory confirmed cases of invasive meningococcal disease, Australia, 2013, by age and serogroup

Serogroup	Age group										Total
	<1	1–4	5–9	10–14	15–19	20–24	25–44	45–64	65+	NS	
B	21	23	5	4	22	10	9	8	2	0	104
C	0	0	0	0	1	2	0	4	1	0	8
Y	0	0	0	0	0	3	1	5	6	0	15
W135	2	0	0	1	3	0	1	1	4	0	12
NG/ND	0	1	1	1	0	0	0	1	0	0	4
Total	23	24	6	6	26	15	11	19	13	0	143
% of B within age group	91.3	95.8	83.3	66.7	84.6	66.7	81.8	42.1	15.3	0	

NS Age not stated.
NG Non-groupable.
ND Non-determined (samples were examined by nucleic acid amplification test).

Table 4: Number of laboratory confirmed cases of invasive meningococcal disease, Australia, 2013, by anatomical source and method of confirmation

Specimen type	Isolate of MC	NAAT positive*	Serology alone	Total
Blood	67	19	0	86
CSF +/– blood	23	30	0	53
Joint fluid	3	1	0	4
Total	93	50	0	143

* Nucleic acid amplification test (NAAT) positive in the absence of a positive culture.
CSF Cerorospinal fluid

Serogroup data

Number of cases of invasive meningococcal disease by serogroup B, C Y W135

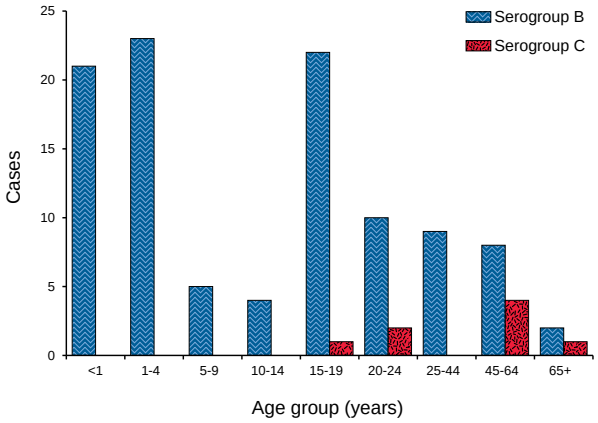
The serogroup was determined for 139 of 143 laboratory confirmed cases of IMD in 2013 (Tables 2 and 3). There has been an overall decrease in the number of cases of IMD in Australia in recent years, which was initially predominantly due to a reduction in the number of cases of IMD caused by serogroup C from 2003 to 2007, followed by a decline in the numbers IMD cases caused by serogroup B from 194 cases in 2009, to 104 cases in 2013. The number of cases of IMD caused by serogroup Y and W135 has remained relatively stable over recent years.

Proportion of serogroup B, C, Y, W135 invasive meningococcal disease

Of the 139 IMD strains for which the serogroup was determined, 74.8% were serogroup B, which is lower than that reported in 2006–2012 (84%–88%). The proportion of cases of IMD caused by serogroup B in those aged less than 20 years, was higher than the previous year (Table 3, Figure 2). However in those aged 20–24 years the proportion of IMD due to serogroup B was lower than in 2007–2010 (66.7%), and 2012 (between 80% and 88%); but higher than in 2011 (61%). In those aged 25 years and over, IMD due to serogroup B accounted for 13.3% of the total number of IMD cases, a marked decrease in proportion of from 25% in 2012. The decrease was most notable in people aged 65 years or over. Serogroup B IMD predominated in all age groups except in those more than 65 years of age.

The proportion of IMD caused by serogroup C was unchanged from 2012 (5.7%). The peak number of serogroup C cases in 2013 occurred in those aged 45–64, which differed from the reported peak of serogroup C in 2011–2012, in those aged 25–44 years age. There was 1 case of IMD caused by serogroup C in those aged less than 20 years in 2013 (2 cases in 2012, no cases in 2011).

Figure 2: Number of serogroup B and C cases of confirmed invasive meningococcal disease, Australia, 2013, by age



Of note, the proportion of IMD caused by serogroup Y (10.8%) was higher than in 2012 (7.7%). Over time the proportion of cases of IMD caused by serogroup Y has been increasing (3.5% in 2009), but the number of cases has remained reasonably stable over recent years. The number and proportion of IMD cases caused by serogroup Y was highest in people aged 45 years or over in 2013; while in people aged 65 years or over, serogroup Y was the most prevalent serogroup causing IMD. Serogroup W135 accounted for 8.6% of IMD cases, which was higher than the 3.4% in 2012.

Genotyping

In 2013, genotyping was performed on 114/143 (80%) IMD cases (Tables 5 and 6). The predominant *porA* genotypes for serogroup B isolates were again P1.7-2,4 (24 cases, compared with 35 in 2012) and P1.22,14 (13 cases, compared with 15 in 2012). P1.7,16-26, previously one of the more common genotypes, showed a decline in case numbers

over recent years (4 cases in 2013, compared with 12 cases in 2012 and 19 in 2011) (Table 5 and Figure 3). The predominant *porA* genotype for serogroup C isolates was again P1.5-1,10-8 (6 cases, compared with 6 in 2012). The AMSP was not aware of any epidemiological link between any of the cases reported where genotyping was available.

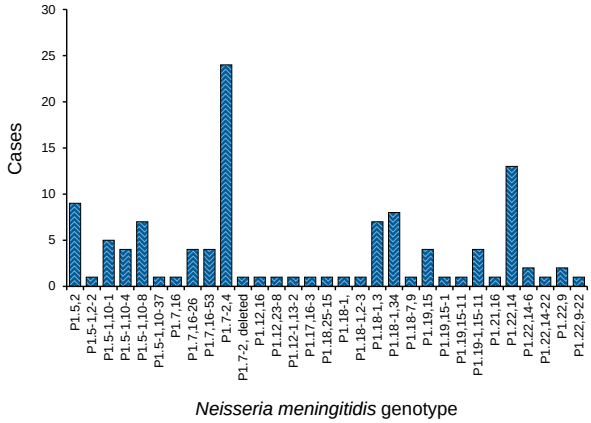
Table 5: Laboratory confirmed cases of invasive meningococcal disease, Australia, 2013, by *porA* gentoype

PorA genotype	B	C	W135	Y	Total
P1.5,2	0	1	6	2	9
P1.5-1,2-2	0	0	0	1	1
P1.5-1,10-1	1	0	0	4	5
P1.5-1,10-4	1	0	0	3	4
P1.5-1,10-8	1	6	0	0	7
P1.5-1,10-37	0	0	0	1	1
P1.7,16	1	0	0	0	1
P1.7,16-26	4	0	0	0	4
P1.7,16-53	4	0	0	0	4
P1.7-2,4	24	0	0	0	24
P1.7-2, deleted	1	0	0	0	1
P1.12,16	1	0	0	0	1
P1.12,23-8	1	0	0	0	1
P1.12-1,13-2	1	0	0	0	1
P1.17,16-3	1	0	0	0	1
P1.18,25-15	0	1	0	0	1
P1.18-1,	1	0	0	0	1
P1.18-1,2-3	0	0	1	0	1
P1.18-1,3	1	0	4	2	7
P1.18-1,34	8	0	0	0	8
P1.18-7,9	1	0	0	0	1
P1.19,15	4	0	0	0	4
P1.19,15-1	1	0	0	0	1
P1.19,15-11	1	0	0	0	1
P1.19-1,15-11	4	0	0	0	4
P1.21,16	0	0	0	1	1
P1.22,14	13	0	0	0	13
P1.22,14-6	2	0	0	0	2
P1.22,14-22	1	0	0	0	1
P1.22,9	2	0	0	0	2
P1.22,9-22	1	0	0	0	1
Total	81	8	11	14	114

Antibiotic susceptibility testing

Testing for antimicrobial susceptibility was able to be performed for 93/143 of the IMD cases (65%) in 2013. All isolates tested were susceptible to ceftriaxone, ciprofloxacin and rifampicin.

Figure 3: Number of *porA* genotypes for serogroup B in cases of invasive meningococcal disease,* Australia, 2013



* Where genotype data were available.

Using defined criteria, 20/93 (21.5%) isolates were fully sensitive to penicillin (MIC 0.03 mg/L or less). There were 73 (78.5%) isolates less sensitive to penicillin (MIC = 0.06–0.5 mg/L). There were no isolates that had an MIC value ≥ 1.0 mg/L (resistant). The proportion of penicillin less sensitive strains was lower than in 2012 (82%) but within the range for those reported in the period 2007 to 2012 (range 72%–85%; mean = 77.4%).

Discussion

In 2013, there were 143 IMD cases laboratory confirmed by the NNN, representing 96% of the number of notifications to the NNDSS.[2] This is both the lowest number of cases reported since laboratory based surveillance for confirmed IMD cases (AMSP) began in 1994, and since notification data collection commenced in 1991. The total number of laboratory confirmed cases of IMD in Australia in 2013 (143) represents less than one-quarter of the laboratory confirmed cases (580) of IMD reported in Australia in 2002, when IMD rates peaked. This is likely to be largely due to the introduction of the serogroup C vaccine to the national immunisation schedule in 2003, which was followed by a steady decline in the total number of cases of IMD in Australia. The primary peak in IMD infection continues to be evident in children aged less than 5 years, as reported in previous years, with a secondary peak in adolescents.

The proportion of IMD cases caused by serogroup B are in the majority, however this was lower in 2013 than that reported from 2006 to 2012. The proportion of IMD caused by serogroup C continues to be small across all age groups. As in previous years, there were only a small number of serogroup C cases in those aged 25 years or over. This

Table 6: Distribution of *porA* genotype laboratory confirmed cases of invasive meningococcal disease, Australia, 2013, by state or territory

Genotype *porA*	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA
P1.5,2		1C, 4W135, 1Y		1W135	1Y			1W135
P1.5-1,2-2		1Y						
P1.5-1,10-1		3Y		1Y			1B	
P1.5-1,10-4		1B,2Y						1Y
P1.5-1,10-8		2C		1C			1B, 1C	2C
P1.5-1,10-37							1Y	
P1.7,16		1B						
P1.7,16-26	1B			1B	1B		1B	
P1.7,16-53		1B		3B				
P1.7-2,4		4B	1B	7B	10B		2B	
P1.7-2, deleted								1B
P1.12,16								1B
P1.12,23-8				1B				
P1.12-1,13-2							1B	
P1.17,16-3		1B						
P1.18,25-15				1C				
P1.18-1,							1B	
P1.18-1,2-3							1W135	
P1.18-1,3		1Y, 2W135		1Y, 2W135		1B		
P1.18-1,34			1B	5B			2B	
P1.18-7,9							1B	
P1.19,15		1B		1B			1B	1B
P1.19,15-1		1B						
P1.19,15-11				1B				
P1.19-1,15-11		2B		2B				
P1.21,16	1Y							
P1.22,14		4B		4B		1B		4B
P1.22,14-6				2B				
P1.22,14-22		1B						
P1.22,9		1B					1B	
P1.22,9-22							1B	

may reflect the secondary benefit of herd immunity accruing to the wider community following vaccination of those age groups where disease was formerly highly concentrated.[8] Low numbers of infections with serogroups Y and W135 is usual for Australia, and this has remained relatively unchanged over time. However, in the context of decreased overall numbers of IMD cases, there has been a proportional increase in serogroups Y and W135 disease in 2013.

As in previous years, genotypic data found no evidence of a substantial number of cases of IMD caused by *N. meningitidis* that have undergone genetic recombination. There have been concerns that the emergence of new and invasive subtypes following extensive vaccine use would occur given the capacity for genetic recombination within meningococci.[8] Monitoring of meningococcal genotypes will continue as part of the NNN program.

All isolates were susceptible to ceftriaxone, ciprofloxacin and rifampicin. The proportion of IMD isolates with penicillin MIC values in the less sensitive category in 2013 was 78.5%, within the 78%–85% range established from 2007. In the years 2000–2006 the range of penicillin MIC values was 62%–68%. This indicates a shift in penicillin MIC values of IMD isolates from sensitive to less sensitive category over this time frame.

In early 2014, a recombinant multi-component meningococcal B vaccine became available in Australia.[9] This vaccine is not on the immunisa-

tion register but is available for purchase privately. Therefore uptake will be elective and the impact of its introduction is yet to be determined in this country. The AMSP continues to monitor the serogroups and antibiograms of *N. meningitidis* to inform treatment and prevention strategies.

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