# Editorial: Meningococcal disease

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Meningococcal disease causes at least 500,000 cases and 50,000 deaths worldwide each year. Epidemics of meningococcal meningitis occur in many parts of the world. Serogroup A is associated with explosive epidemics with attack rates up to 500 per 100,000. An epidemic of serogroup A in the African 'meningitis belt', which began in 1996, has resulted in at least 300,000 cases to date and many thousands of deaths.[1] Serogroup B is the major cause of sporadic meningococcal disease in industrialised countries. Serogroup C, which also occurs in industrialised countries, causes both sporadic and epidemic disease. Serogroup C outbreaks typically result in attack rates between those of serogroups A and B.[2] Serogroups Y and W135 are uncommon in Australia.

In New Zealand, an epidemic of serogroup B meningococcal disease is in its eleventh year (Martin, Communicable Disease Control Conference, April 2001, abstract 2). In 2000 there were 480 cases of meningococcal disease in New Zealand giving a notification rate of 13.3 per 100,000 compared with 3.1 per 100,000 in Australia in the same year. The epidemic in New Zealand is particularly concentrated in the North Island among Maori and Pacific Islander communities. Overcrowded housing has been identified as a strong risk factor for meningococcal disease in this epidemic.[3] Phenotype B:4:P1.4(7) associated with hyper-epidemic disease in New Zealand was also present in New South Wales in 2000 (see the Australian Meningococcal Surveillance Programme Annual Report 2000, this issue pp 113-121)

Meningococcal disease in Australia has been in decline since a pandemic of serogroup A disease during World War II, when notification of 'meningitis' was 33.1 per 100,000.[4] Notifications fell to <0.5 per 100,000 in 1987 but increased due to an outbreak of serogroup A disease among indigenous populations in Central Australia[5] and a rise in notifications of group B and C disease. The notification rate for meningococcal disease to the National Notifiable Diseases Surveillance System (NNDSS) has been slowly increasing over the past 10 years from 1.6 per 100,000 in 1991 to 3.1 per 100,000 in 2000 (Figure 1). In common with other industrialised countries, the increase of meningococcal disease in Australia has been primarily due to the expansion of virulent phenotypes of serogroups B and C[2] causing small outbreaks.[6,7]

The rates of meningococcal disease in 2000 varied from 5.1 per 100,000 in the Northern Territory to 1.6 per 100,000 in the Australian Capital Territory. The disease shows a typical late winter peak each year between July and September (Figure 2). The disease typically affects children aged 0 to 4 years but also occurs in young adults aged 15 to 19 years (Figure 3). In 2000, the number of cases among adolescents and young adults aged 15 to 24 was almost equivalent to the number of cases among infants and children aged less than 4 years. There were 41 deaths attributable specifically to invasive meningococcal disease in 1999, giving an overall case-fatality rate of 7.2 per cent. This may be an underestimate however, as some of the deaths due to unspecified meningitis and septicaemia may have been caused by the meningococcus (ABS, 2001).

**Figure 1. Notification rate for meningococcal disease, Australia, 1991 to 2000**

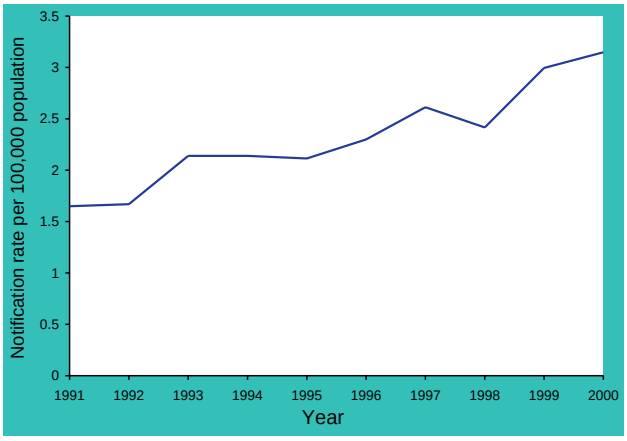



**Figure 2. Notifications of meningococcal disease, Australia, 1991 to 2000, by month of onset**

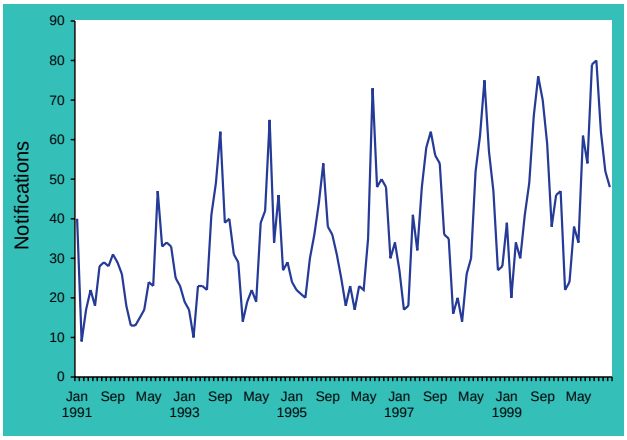
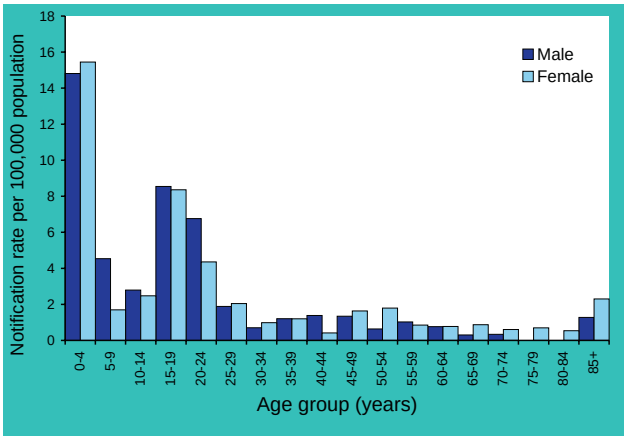



**Figure 3. Notification rate of meningococcal disease, Australia, 2000, by age and sex**



There is some variation among the case definitions of meningococcal disease in use across Australia (Table 1). The Meningococcal Working Group of the Communicable Diseases Network Australia (CDNA) is developing a standard case definition for invasive meningococcal disease that will be used in all jurisdictions. This will help provide a more accurate measure of the incidence of meningococcal disease in Australia.

Since 1994, the National Neisseria Network (NNN) has provided important information on the serogroups of *Neisseria meningitidis* circulating in Australia and on their antibiotic susceptibility. A variable proportion of culture confirmed and of all notified meningococcal cases in Australia each year are all referred to the NNN (Tables 2 and 3). In 2000, 89 per cent of notified cases were included in the NNN reports (388 culture positive and 147 culture negative samples). The culture positive sample tested by the NNN represents isolates from all jurisdictions with between 56 per

**Table 1. Definitions of meningococcal disease in use in Australia**

| Jurisdiction/ Organisation | Definition of meningococcal disease |
|---|---|
| NHMRC<br>(National Health & Medical Research Council)<br>(in use in the ACT, SA, Tasmania, Victoria) | Isolation of *Neisseria meningitidis* from a normally sterile site;<br>OR Detection of meningococcal antigen in joints blood or CSF<br>OR Detection of gram negative diplococci in blood or CSF. |
| New South Wales | **Suspected case:**<br>Any person with signs or symptoms of meningococcal disease.<br>**Presumptive case:**<br>A suspected case with: contact with an infectious confirmed case 2 to 10 days before onset;<br>OR A clinical diagnosis of meningococcal disease;<br>OR A positive antigen test on CSF.<br>**Confirmed case:**<br>Culture of *N. meningitidis* from normally sterile site;<br>OR Culture of *N. meningitidis* from the conjunctiva;<br>OR Detection of gram-negative diplococci in a normally sterile site;<br>OR A positive PCR test on CSF or blood in a case with clinically compatible illness;<br>OR Positive serology indicating *N. meningitidis* infection, either as a single positive IgM antibody titre, or as a 4-fold rise in antibody titre between acute and convalescent specimens where the convalescent serum is taken more than 2 weeks after onset of illness. |
| Northern Territory | **Confirmed case:**<br>Clinically compatible illness AND Isolation of *N. meningitidis* from a normally sterile site;<br>OR Detection of a gram-negative intracellular diplococci in blood CSF or skin;<br>OR isolation of *N. meningitidis* from skin in the absence of a positive blood culture.<br>**Probable case:**<br>Clinical pupura fulminans in the absence of positive blood cultures;<br>OR Detection of meningococcal antigen in CSF. |
| Queensland | As per NHMRC with the addition of detection of *N. meningitidis* nucleic acid in joints, blood, CSF, tissue or urine. |
| Western Australia<br><br>PHLN<br>(Public Health Laboratory Network) | Isolation of *N. meningitidis* from blood CSF or other normally sterile site;<br>OR Detection of gram-negative diplococci in blood CSF or other normally sterile site or in smears from skin lesions in a patient with meningitis, septicaemia or other clinically compatible illness.<br>**Definitive criteria:**<br>Isolation of *N. meningitidis* from a normally sterile sit;<br>OR Detection of *N. meningitidis* by NAT;<br>OR Single high titre IgM and/or IgG titres to outer membrane antigens of *N. meningitidis*.<br>**Suggestive criteria:**<br>Detection of gram-negative diplococci in gram-stained material from a normally sterile site;<br>OR Positive polysaccharide antigen test in CSF with other laboratory parameters consistent with meningitis. |

**Table 2. Number of cases of invasive meningococcal disease (IMD) notified to NNDSS and number of culture confirmed cases tested by the NNN, 2000, by State and Territory**

| | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Total |
|---|---|---|---|---|---|---|---|---|---|
| IMD reported to NNDSS (n) | 5 | 253 | 9 | 51 | 32 | 15 | 162 | 72 | 599 |
| Culture confirmed IMD tested by the NNN | 5 | 141 | 7 | 43 | 20 | 14 | 108 | 50 | 388 |
| Culture confirmed cases as a proportion of all cases on the NNDSS | 100 | 56 | 78 | 84 | 63 | 93 | 67 | 69 | 65 |

**Table 3. Proportion of cases of meningococcal disease notified to NNDSS tested by the NNN, 2000, by age group**

| | < 1 year | 1-4 years | 5 to 9 years | 10-14 years | 15 to 19 years | 20 to 24 years | 25 to 44 years | 45 to 64 years | 65+ | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| No. reported to NNDSS | 70 | 121 | 41 | 36 | 114 | 76 | 72 | 50 | 15 | 599 |
| No. referred to NNN* | 58 | 99 | 39 | 33 | 108 | 69 | 64 | 43 | 14 | 535[†] |
| % of all cases reported by NNDSS and NNN | 82.9 | 81.8 | 95.1 | 91.7 | 94.7 | 90.8 | 88.9 | 86.0 | 93.3 | 89.0 |

* Cases diagnosed by culture, serology or PCR

cent and 100 per cent of notified cases in the States and Territories being culture positive (Table 2). There was also a representative sample of laboratory-confirmed cases from each age group in the NNN report (Table 3). Increasing use of non-culture methods for diagnosis of meningococcal disease was noted. In this report 147 cases were diagnosed by PCR, serology or both. Some of these diagnostic methods, such as serology were more likely to be used in older patients. Sixty-four cases on the NNDSS were either notified on clinical or epidemiological grounds or laboratory specimens had not been referred to the NNN.

The NNN report for 2000 highlights two important features of meningococcal disease in Australia.[8] There was a significant difference in the distribution of different *N. meningitidis* phenotypes geographically and among different age groups. Serogroup C isolates, especially phenotype C:2a:P1.4,[7] are common in Victoria, particularly among adolescents and young adults. This phenotype is infrequently found in other centres; the reasons for this geographical difference are unclear. *N. meningitidis* serogroup B phenotypes associated with hyperendemic disease in New Zealand predominate in New South Wales and are found widely distributed elsewhere in Australia.

Meningococcal disease in Australia, while moderately resistant to penicillins, is susceptible to third generation cephalosporins and to rifampicin and ciprofloxacin used in prophylaxis. Drug resistance in *N. meningitidis* does not yet compromise the treatment and control of meningococcal disease in Australia. Continued surveillance of meningococcal antibiotic susceptibility however, is essential to disease control.

The impending release of the CDNA '*Guidelines for the early clinical and public health management of meningococcal disease in Australia* is principally aimed at assisting primary care providers with the emergency management of cases of suspected invasive meningococcal disease and to assist public health practitioners to prevent further transmission after an index case has been reported. Combined with information sheets sent to all general practices in Australia, it is hoped that the diagnosis and treatment of the individual patient and management of outbreaks of meningococcal disease will improve. The report will shortly be available on the Communicable Diseases Australia Website at: http://www.health.gov.au/pubhlth/cdi/cdihtml.htm.

Ultimately the most effective public health strategy for controlling meningococcal disease may be routine vaccination of at-risk populations.[9] A study recently published[10] examined the cost effectiveness of meningococcal vaccination using the polysaccharide vaccine in Australia. Skull and colleagues concluded that in a population with incidence rates in excess of 14 per 100,000, vaccination of persons in the 15-19 year age group would be cost effective assuming that there would be a 5 year duration of protection.

A recent report on the new meningococcal serogroup C conjugate vaccine in England[11] showed an efficacy of 97 per cent in adolescents and a 92 per cent efficacy in infants 9 months after a single dose. The efficacy of the vaccine in infants was far superior to that obtained with the meningococcal polysaccharide vaccine. A more recent study has shown a 25 per cent increase in serogroup B disease across all age groups in the United Kingdom since the vaccination campaign (Kaczmarski, 2001 abstract). This observation supports a hypothesis that serogroup replacement may be an important factor in the epidemiology of meningococcal disease after the introduction of new vaccines. It therefore remains to be seen what the value of meningococcal vaccines will be in the future control of meningococcal disease.

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