FactSheet

Meningococcal disease

MENINGOCOCCAL VACCINES FOR AUSTRALIANS: INFORMATION FOR IMMUNISATION PROVIDERS

Disease and epidemiology

- Meningococcal disease is a rare but serious infection caused by the bacterium *Neisseria meningitidis*. There are 13 serogroups; those that most commonly cause disease are A, B, C, W and Y.
- The incidence of invasive meningococcal disease (IMD) fluctuates naturally over time. The national notification rate declined from 2002 to 2013, but has increased since 2014. Serogroup B disease has been dominant until recently, but has been naturally declining even in the absence of widespread vaccination against this serogroup. There has been a recent increase in serogroup W disease since 2013; this is now the main serogroup causing meningococcal disease (44.5% of cases with identified serogroup) in Australia in 2016.
- Septicaemia and/or meningitis are the most common clinical manifestations of IMD. The highest incidence of meningococcal disease is in children aged <5 years and adolescents aged 15–19 years. Carriage rates of the bacteria are highest in older adolescents and young adults. Serogroup B disease remains the most common cause of IMD in children, adolescents and young adults. Serogroup W disease occurs over a more diverse age range and may present with less typical clinical manifestations than disease due to other serogroups.
- Serogroup C has become rare (1.2% of cases with identified serogroup in 2016) since the introduction of the conjugate meningococcal C vaccine to the National Immunisation Program (NIP) in 2003.

Vaccines

- Three types of meningococcal vaccines are available in Australia:
  - meningococcal C conjugate vaccine (MenCCV), available as a single vaccine, NeisVac-C®, or in a combination formulation with the *Haemophilus influenzae* type b (Hib) vaccine (Hib–MenCCV): Menitorix®
  - multicomponent meningococcal B vaccine (MenBV): Bexsero®
  - quadrivalent (A, C, W, Y) meningococcal conjugate vaccines (4vMenCV): Menactra®, Menveo®, Nimenrix®. (These have replaced quadrivalent polysaccharide vaccines which are now discontinued.)

Who should be vaccinated

- **People at increased risk of IMD:** Those with complement disorders, asplenia and other immunocompromising conditions, or occupational exposure should be vaccinated with MenBV and 4vMenCV.
- **People within age groups with increased incidence of IMD or high carriage rates of *N. meningitidis*:**
  - *Infants and young children particularly those aged ≤2 years of age:* Routine MenCCV at 12 months of age is recommended and funded under the NIP. MenBV is also recommended and 4vMenCV may be offered to protect against A, C, W and Y serogroups. MenBV and 4vMenCV are available through private prescription for this age group, but are not funded.
  - *Adolescents and young adults (15–19 years):* MenBV is recommended and 4vMenCV may be offered, particularly for those living in close quarters such as new military recruits and students living in residential accommodation. In some Australian states, these vaccines are funded for this age group in response to locally predominant meningococcal B or W disease. Refer to Table 1.

Who should be vaccinated (cont'd)

- **Travellers:** 4vMenCV is recommended for travellers to certain destinations where there is an increased risk of exposure (including, but not limited to, the 'meningitis belt' of sub-Saharan Africa). 4vMenCV is required for pilgrims attending the annual Hajj in Mecca.
- **Anyone wishing to reduce their risk of IMD:** Vaccination with MenBV (from 6 weeks of age) and 4vMenCV (from 2 months of age) may be offered and is available through private prescription.

Table 1: Current access to meningococcal vaccines in Australia

Vaccine	Serogroup(s) covered	Availability as of March 2017
Combination *Haemophilus influenzae* type b (Hib) / Meningococcal C conjugate vaccine (Hib–MenCCV)	C	Recommended and funded under the NIP for 1 dose at 12 months of age in all children nationally
Multicomponent meningococcal B vaccine (MenBV)	B	Available through private prescription, from age 6 weeks. Doses required vary by age.* Funded in South Australia from April 2017 for a 2 year study for students enrolled in years 10, 11 and 12 in 2017.†‡
Quadrivalent meningococcal conjugate vaccines (4vMenCV)	A, C, W, Y	Available through private prescription. Three vaccine brands for use in different age groups (Table 2). Funded in New South Wales in 2017 from school term 2 for year 11 and 12 students.‡ Funded in Victoria and Queensland in 2017 for adolescents/young adults aged 15–19 years. Funded in Western Australia (2017–2019) commencing with year 10–12 students and those aged 18–19 years in 2017, and only year 10 students in 2018–2019.‡

* Refer to *The Australian Immunisation Handbook,* 10th edition, 2015 update, for dosing guidelines.[1]

† Funded doses of MenBV for this age group in South Australia are provided through a population-level study assessing the impact of the vaccine on nasopharyngeal carriage of *N. meningitidis* and herd immunity.[2]

‡ Consult the respective state or territory health department website for further details.

The disease

Meningococcal disease is caused by the bacterium *Neisseria meningitidis*, commonly known as the meningococcus. There are 13 serogroups, distinguished by differences in the surface polysaccharides of the outer membrane capsule. Globally, most meningococcal disease is caused by serogroups A, B, C, W and Y.

Meningococcal disease is relatively rare but is very often serious. Septicaemia, meningitis or a combination of both are the most common manifestations of invasive meningococcal disease (IMD, defined by isolation of meningococci from sites that are normally sterile). Today, even with antibiotic treatment, the mortality rate is approximately 5–10%. Furthermore, about 10–30% of children and adolescents who survive the disease develop permanent sequelae such as limb deformity, skin scarring, deafness and neurological deficits.[3-5] Other less common manifestations of meningococcal disease include pneumonia, arthritis, epiglottitis, pericarditis and conjunctivitis.[6-8] Primary meningococcal conjunctivitis may precede invasive disease.[9]

Clinical features

Meningococcal septicaemia and meningitis are the commonest forms of disease but symptoms may not necessarily be typical and are often non-specific. They can include sudden onset of fever, a rash that can be petechial or purpuric (i.e. like red-purple spots or bruises) or maculopapular (a flat or raised non-specific rash), headache, neck stiffness, photophobia, altered consciousness, muscle aches, cold hands, joint pain,

nausea and vomiting.[3,6,7,10] Serogroup W disease has been associated with atypical presentations, such as septic arthritis or epiglottitis, in up to 20% of cases.[11]

Not all symptoms or signs may be present at disease onset. The characteristic rash of meningococcal disease (a rash which does not disappear with gentle pressure on the skin) is not always present.

Transmission

Meningococci are carried and transmitted only by humans. Individuals within a population can carry meningococci in their throat and/or nose. The prevalence and duration of carriage varies over time and in different populations and age groups, with peak carriage rates (>20%) occurring in adolescents.[12]

Meningococcal bacteria are transmitted in respiratory droplets. The risk of acquiring infection is increased by regular, prolonged close contact such as living in the same household or intimate kissing.

The disease has an incubation period of 1–10 days, most commonly 3–4 days.

Risk factors for acquiring the disease

Individuals who are immunocompromised due to certain disorders of the immune system (particularly complement deficiencies), certain medical treatments, or functional or anatomical asplenia have an increased risk of acquiring the disease.

Other risk factors for meningococcal infection include occupational exposure to meningococci in microbiological laboratories, exposure to smokers (who are more likely to be carriers), crowded living conditions, intimate kissing with multiple partners, and recent or current viral infection of the upper respiratory tract.[6,10]

Management of meningococcal disease

Invasive meningococcal disease is notifiable in all states and territories, and prompt diagnosis and medical treatment is important. If meningococcal disease is suspected, the patient should be treated promptly with appropriate parenteral antibiotics and referred to hospital for further emergency clinical management. The relevant state/territory public health authority should be notified as soon as possible so that contacts can be identified and the appropriate public health response determined in accordance with national guidelines.[13] This may include vaccination (refer to Use of vaccines for close contacts…).

Epidemiology

Meningococci cause both sporadic and epidemic disease throughout the world. The incidence of meningococcal disease fluctuates naturally over time. In Australia, notification rates of meningococcal disease decreased from a peak of 3.5 cases per 100,000 in 2002 to 0.6 per 100,000 in 2013. Notification rates have increased since 2014, reaching 1.1 per 100,000 in 2016[14] (Figure 1).

Nationally, for over a decade prior to 2016, serogroup B ('MenB') was the most common serogroup causing invasive meningococcal disease (accounting for 63% to 88% of annual notified cases where a serogroup was identified from 2006 to 2015).[15] However, the incidence of serogroup B disease has declined in the absence of any significant vaccine use. The incidence fell from 1.5 per 100,000 in 2002 to 0.4 per 100,000 in 2016 (data from NNDSS provided by Office of Health Protection, Australian Government Department of Health).[11,16] However, future trends cannot be predicted. MenB remains the most common cause of IMD in children, adolescents and young adults (Figure 2).

Since 2013, serogroup W has emerged as an increasing cause of meningococcal disease.[11] There were 17 cases (10.4% of cases with an identified serogroup) in 2014, rising to 34 cases (20.0%) in 2015, and 110 cases (44.5%) in 2016, surpassing serogroup B (92 cases, 37.7%).[11,14] Many serogroup W cases were due to a single clone of meningococcus, the ST11 strain type, suggesting sustained person-to-person transmission.[14]

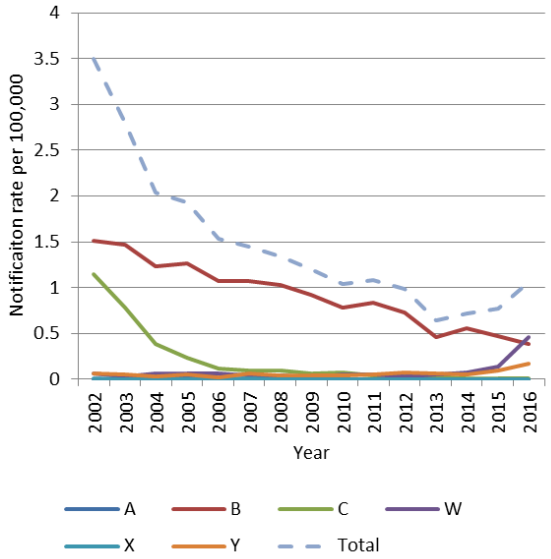
Serogroup C ('MenC') disease has almost disappeared following implementation of the national MenC conjugate vaccination program in 2003, with the number of cases falling from 225 in 2002 to 3 in 2016.[14]

A smaller increase in serogroup Y disease, from 12 cases (7.4% of those with an identified serogroup) in 2014 to 41 cases (16.4%) in 2016, occurred during the same time period as the emergence of serogroup W disease.[11,14] Serogroup A disease remains rare in Australia.

In Australia meningococcal disease follows a seasonal trend, with most cases occurring in winter or early spring.[16,17] Most meningococcal disease occurs in young children <5 years of age and in older adolescents/young adults (15–24 years of age).[16] The highest incidence of MenB disease is in children aged <5 years, particularly infants aged <1 year, with a lower, secondary peak in late adolescence and early adulthood (15–19 years). While the incidence of MenW disease also has peaks in these age groups, a large proportion of all MenW cases occurs in older adults ≥45 years (median age of MenW cases is 44 years),[11] and MenW accounted for 59% of IMD in adults aged ≥65 years in 2016 (Figure 2).[14]

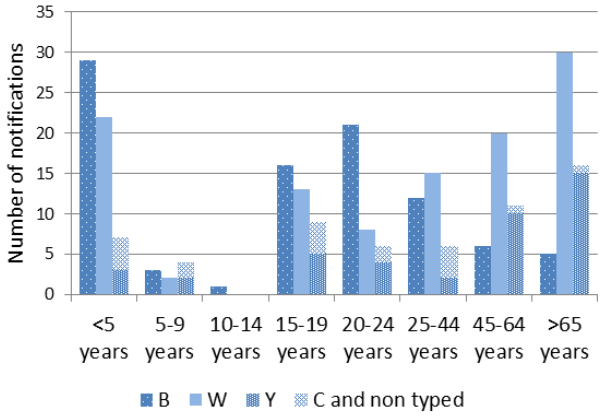
MenW disease appears to have a higher case fatality rate than disease caused by other serogroups. This may indicate a tendency towards more severe infection or reflect the higher proportion of cases of MenW occurring in the elderly.[11]

Figure 1: National notification rates for invasive meningococcal disease by serogroup, Australia, 2002–2016



Source: National Notifiable Diseases Surveillance System (NNDSS) data provided by Office of Health Protection, Australian Government Department of Health.

Figure 2: Notifications of invasive meningococcal disease by age group and serogroup,* Australia, 2016



* No cases of serogroup A or X disease were recorded in 2016.

Adapted from Invasive Meningococcal Disease National Surveillance Report.[14]

Vaccines

There is no single vaccine that offers protection against all serogroups that cause meningococcal disease. There are three types of meningococcal vaccines registered in Australia, which cover different serogroups:

- meningococcal C conjugate vaccines (MenCCV)
- multicomponent meningococcal B vaccine (MenBV)
- quadrivalent (A, C, W, Y) meningococcal conjugate vaccines (4vMenCV). (These have replaced quadrivalent meningococcal polysaccharide vaccines which were withdrawn from the Australian market in early 2017.)

Meningococcal C conjugate vaccine (MenCCV)

In MenCCVs, the serogroup C antigen is conjugated to a carrier protein. The use of MenCCVs from 2003 in Australia resulted in a 96% (95% CI 94–98%) reduction in MenC invasive disease in all age groups by 2012, with evidence of indirect protective benefits ('herd immunity') in non-vaccinated age groups.[18]

It is available as a combination formulation of meningococcal C conjugate and *Haemophilus influenzae* type b vaccines (Hib–MenCCV), **Menitorix**® (GlaxoSmithKline) on the NIP schedule at 12 months of age or as a single vaccine **NeisVac-C**® (Pfizer).

Quadrivalent meningococcal conjugate vaccine (4vMenCV)

In 4vMenCVs, the antigens of four serogroups (A, C, W and Y) are conjugated to a carrier protein. Clinical trials have demonstrated the immunogenicity of 4vMenCV in children, adolescents and adults. All studies indicate that 4vMenCVs are safe and immunogenic.[19]

4vMenCVs have largely replaced quadrivalent polysaccharide vaccines (i.e. without protein conjugation). Conjugate vaccines have superior immunogenicity in infants and younger children, and induce a T cell-dependent immune response, important for immunological memory, both of which were problematic with polysaccharide vaccines.

The 4vMenCVs available for use in Australia are:

- **Menactra**® (Sanofi Pasteur)
- **Menveo**® (GlaxoSmithKline)
- **Nimenrix**® (Pfizer).

To address the recent emergence of serogroup W disease, targeted state-based immunisation programs using 4vMenCV have been introduced in 2017 for adolescents and some young adults (Table 1). These programs are aimed at students in years 11 and 12 in New South Wales and those aged 15–19 years in Victoria, Queensland and Western Australia. In other states and for other age groups, 4vMenCV is available through private prescription.

Dosing for 4vMenCV depends on age group and indication. Check with state or territory guidelines for updated dosing recommendations used in state-based programs. Refer to Table 2 below for dosing in healthy individuals and Table 4.10.2 in the *The Australian Immunisation Handbook*, 10th edition, 2015 update,[1] for those at increased risk of IMD.

Multicomponent meningococcal B vaccine (MenBV)

MenBV (**Bexsero**®, Novartis) is a recombinant multicomponent vaccine designed to provide protection against multiple strains of MenB. It contains four major antigens that are highly conserved across multiple MenB strains. Based on laboratory tests, it is estimated that the vaccine induces protective antibodies against about 76% of MenB strains in Australia.[20] This vaccine differs from other MenB vaccines previously used in other countries, for example New Zealand, for control of epidemics dominated by a single MenB strain.[21]

The clinical efficacy of MenBV cannot feasibly be assessed in clinical trials as invasive MenB disease is rare. Instead, the immunogenicity of this vaccine has been demonstrated through laboratory methods that correlate with protection against clinical meningococcal disease. There is currently a lack of data on the duration of protection of MenBV and the immunogenicity of MenBV in people who are immunocompromised.

The primary vaccination course of MenBV consists of 2–4 doses, depending on the age at which the course commences. Refer to *The Australian Immunisation Handbook*, 10th edition, 2015 update, for more details.[1]

MenBV may be administered concurrently, at separate injection sites, with other infant vaccines in the NIP schedule. However, concurrent administration of MenBV with other vaccines will increase the frequency of vaccine-related adverse reactions, most notably fever, compared to when MenBV or other vaccines are administered on their own. Due to this concern, the prophylactic use of paracetamol is recommended with every dose of MenBV for children <2 years of age (refer to Vaccine safety).

Individuals who have previously received other meningococcal vaccines (including the strain-specific meningococcal B vaccine previously used in New Zealand) can receive MenBV.

Table 2: Recommended brands and doses of 4vMenCV by age group for healthy individuals and travellers*

Age at commencement of vaccine course	Recommended brand	Primary immunisation	Recommended interval between primary doses*
2–6 months	Menveo	3 doses	8 weeks
7–11 months	Menveo	2 doses	12 weeks
12–23 months	***Either*** Menveo	2 doses	12 weeks
	Or Nimenrix	1 dose	Not applicable
≥2 years	Menactra, Menveo or Nimenrix	1 dose	Not applicable

* For travellers who have ongoing exposure to areas with increased risk of group A, C, W or Y meningococcal disease, booster doses are also recommended. Refer to Table 4.10.3 of *The Australian Immunisation Handbook*, 10th edition, 2015 update.[1] For those with medical conditions associated with increased risk of meningococcal disease, refer to Table 4.10.2 of the *Handbook*.

Adapted from Chapter 4.10 'Meningococcal disease', *The Australian Immunisation Handbook*, 10th edition, 2015 update.[1]

Who should be vaccinated

For detailed information about the use of meningococcal vaccines, please refer to Chapter 4.10 'Meningococcal disease' in *The Australian Immunisation Handbook*, 10th edition, 2015 update.[1]

A summary of the meningococcal vaccines registered for use in Australia and who should be vaccinated can be found in Table 3 below.

Healthy infants and younger children

- A single dose of MenCCV is recommended for all children at the age of 12 months, provided through the NIP. Since July 2013, it is given in a combination formulation with the Hib vaccine (Hib–MenCCV).
- Healthy children who missed receiving a dose of MenCCV at 12 months of age, or who received their last dose aged <12 months, should receive a catch-up dose.
- MenBV is recommended for infants and young children, particularly those aged <2 years.
- 4vMenCV is available through private prescription to any child from 2 months of age whose parents wish to reduce the likelihood of them becoming ill with serogroup A, C, W and Y disease. Dosing is dependent on age. Refer to Table 2 above.

Healthy adolescents

- Healthy adolescents who missed receiving a dose of MenCCV in childhood should receive a catch-up dose.
- A 2-dose schedule of MenBV is recommended for all adolescents aged 15–19 years. It is particularly recommended for those living in close conditions such as military recruits or those in residential accommodation.

- A single funded dose of 4vMenCV is available for all adolescents and young adults aged 15–19 years in some states as a response to an emergence of MenW disease. Refer to Table 1 or check state or territory health department websites for information. Vaccination can be offered to those in other states and territories through private prescription.

Healthy individuals in other age groups

- 4vMenCV and MenBV are available through private prescription to any person aged ≥2 months (for 4vMenCV) or ≥6 weeks (for MenBV) who wishes to reduce their likelihood of becoming ill with meningococcal disease. Refer to Table 3 below and 4.10 'Meningococcal disease' in *The Australian Immunisation Handbook*, 10th edition, 2015 update[1] for dosing guidelines.

Those with medical conditions associated with increased risk of meningococcal disease

- 4vMenCV and MenBV are recommended for individuals with medical conditions associated with an increased risk of meningococcal disease. These conditions include inherited defects or deficiency of properdin or complement components, current or future treatment with eculizumab, functional or anatomical asplenia, HIV infection, and haematopoetic stem cell transplant.
- The appropriate vaccine formulations and the required doses, including the need for a booster dose, differ by age. Refer to Table 4.10.2 in *The Australian Immunisation Handbook*, 10th edition, 2015 update, for more details.[1]

Laboratory personnel who frequently handle *Neisseria meningitidis*, and travellers

- A single primary dose of 4vMenCV and a primary course of 2 doses of MenBV (1–2 months apart) are recommended for people with occupational exposure risks. 4vMenCV boosters every 5 years are also recommended until further information regarding duration of immunity afforded by 4vMenCV becomes available.
- For travellers, a single primary dose of 4vMenCV is recommended for individuals (aged ≥2 months) who intend to travel to parts of the world where epidemics of group A, C, W or Y disease are frequent. Vaccination is a requirement for pilgrims attending the annual Hajj in Mecca (certificate of vaccination is a condition of entry to Saudi Arabia for this purpose). Refer to Table 2 above for dosing guidelines according to age.

Table 3: Meningococcal vaccines available for use in Australia and groups recommended for vaccination

Trade name	Formulation	Provides protection against serogroup:					Population group recommended for vaccination (refer also to Who should be vaccinated)
		A	B	C	W	Y	
Meningococcal C conjugate vaccines (MenCCV)							
NeisVac-C®	MenC conjugate vaccine			✓			All children at age 12 months (All adolescents should have been vaccinated) Monovalent vaccine replaced by Hib–MenCCV combination vaccine for use under NIP since July 2013.
Menitorix®	Hib–MenC conjugate combination vaccine			✓			
		Menitorix® also serves as a booster dose of Hib vaccine					
Multicomponent meningococcal B vaccine (MenBV)							
Bexsero®	Recombinant multicomponent MenB		✓*				Infants and young children, particularly those aged <2 years, adolescents† and those with increased medical or occupational exposure risks of MenB disease. Vaccination can be offered to anyone aged ≥6 weeks wishing to reduce the risk of MenB disease.
Quadrivalent meningococcal conjugate vaccines (4vMenCV)							
Menactra®	Quadrivalent diphtheria toxoid conjugate	✓		✓	✓	✓	Those with increased medical, occupational or other exposure (including travel) risks of meningococcal disease caused by serogroups contained in these vaccines Adolescents/young adults 15–19 years of age† Vaccination may be offered to anyone aged ≥2 months wishing to reduce the risk of Men A, C, W or Y disease.
Menveo®	Quadrivalent CRM_{197} conjugate	✓		✓	✓	✓	
Nimenrix®	Quadrivalent tetanus toxoid conjugate	✓		✓	✓	✓	

* Bexsero® protects against MenB disease. There are many strains of serogroup B meningococcus. Bexsero® is estimated to protect against 76% of MenB strains in Australia.[20]

† Funded vaccination may be available in some states or territories for adolescents/young adults. Refer to Table 1 or state and territory health department websites.

Vaccine safety

Meningococcal conjugate vaccines

Meningococcal conjugate vaccines are generally considered safe and well tolerated. Common adverse events following MenCCV include pain, tenderness and occasional erythema at the injection site, which tend to be of mild to moderate severity and typically resolve within 1 day. Transient headache may also occur. However, serious adverse reactions are rare.[6]

The most frequently reported adverse events following 4vMenCV include fever, headache, dizziness[22] and erythema at the injection site. Injection site reactions generally resolve within 48–72 hours.[6]

An initial suspicion of an association between a certain brand of 4vMenCV and Guillain-Barré Sydnrome (GBS), a rare neurological disorder associated with muscle weakness and paralysis, has been thoroughly investigated and disproven.[23,24]

Multicomponent meningococcal B vaccine

Fever was the most notable systemic reaction in infants and young children in clinical trials for MenBV. Concurrent administration of MenBV with other childhood immunisations has been shown to increase the frequency of fever,[25,26] as shown in Table 4.

Table 4: Proportion (%) of infants reporting fever within 7 days after at least 1 of the 3 infant doses[26]

Axillary temperature	Routine vaccines alone	MenBV alone	Routine vaccines + MenBV
≥38°C	23–36%	26–41%	51–62%
≥39°C	3–4%	4–8%	10–15%

This increased likelihood of fever in infants can be reduced by prophylactic use of paracetamol (refer to box below). A clinical trial demonstrated that prophylactic use of paracetamol reduced the likelihood of high-grade fever by approximately half with no overall impact on immunogenicity of MenBV or the other vaccines given concurrently.[27]

Other common adverse events following immunisation with MenBV include tenderness, swelling and erythema at the injection site, irritability, sleepiness, change in eating habits, unusual crying, rash, vomiting and diarrhoea. While these reactions were reported more frequently when MenBV was co-administered with other vaccines, most of these events were considered mild or moderate and were transient in nature. (Refer to *The Australian Immunisation Handbook*, 10th edition, 2015 update, for further details on adverse events.[1])

Prophylactic use of paracetamol with MenBV vaccination in children aged <2 years

Prophylactic use of paracetamol is recommended with every dose of MenBV administered to children <2 years of age. This is an exception to the general recommendation not to routinely give paracetamol with vaccinations unless it is for relief of fever or pain following immunisation – refer to *The Australian Immunisation Handbook*, 10th edition, 2015 update (Chapter 2.3).[1]

Use of vaccines for close contacts of patients or in public health management of meningococcal disease outbreaks

The meningococcal vaccine with coverage of the relevant serogroup may be considered for individuals who have had close household or household-like contact with someone who has meningococcal disease, or for individuals at increased risk of disease because of a local disease outbreak (such as an outbreak in a residential facility). The relevant state/territory public health authority should be contacted as soon as possible for advice on determining the risk of disease and whether to offer vaccination (in addition to clearance antibiotics) and for guidance on management. (Refer also to Management of meningococcal disease.)

Contraindications/precautions

For all meningococcal vaccines (MenCCV/Hib–MenCCV, MenBV, 4vMenCV), the absolute contraindications are anaphylaxis following a previous dose of the respective vaccine, or anaphylaxis following any component of the vaccine. Previous meningococcal disease, regardless of the serogroup, is not a contraindication for vaccination.[1]

Additional resources for primary medical care/vaccination providers

- *The Australian Immunisation Handbook*, 10th edition – the most up-to-date clinical recommendations are contained in the online version of the *Handbook* www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook10-home
- Immunise Australia website www.immunise.health.gov.au
- National Immunisation Program schedule www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/national-immunisation-program-schedule
- ACT Health http://www.health.act.gov.au/
- Northern Territory Department of Health https://health.nt.gov.au/

- NSW Health http://www.health.nsw.gov.au/immunisation/
- Queensland Health https://www.health.qld.gov.au
- SA Health https://www.sahealth.sa.gov.au/
- Tasmanian Department of Health and Human Services http://www.dhhs.tas.gov.au/
- Victoria – Health.vic http://www.health.vic.gov.au
- WA Health http://ww2.health.wa.gov.au
- Centers for Disease Control and Prevention Meningococcal disease www.cdc.gov/meningococcal/

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