FactSheet

Meningococcal vaccines

NATIONAL CENTRE FOR IMMUNISATION RESEARCH & SURVEILLANCE

MENINGOCOCCAL VACCINES FOR AUSTRALIANS: INFORMATION FOR IMMUNISATION PROVIDERS

This fact sheet provides information for immunisation providers on meningococcal disease and the use of meningococcal vaccines in Australia. It can be used in conjunction with the NCIRS fact sheet Meningococcal vaccines – frequently asked questions to facilitate discussions with parents or other individuals considering receiving meningococcal vaccines.

Disease and epidemiology

- Meningococcal disease is a rare but serious infection caused by the bacterium *Neisseria meningitidis* (*N. meningitidis*). There are 13 serogroups. Meningococcal disease is most commonly caused by serogroups A, B, C, W and Y.
- Septicaemia and/or meningitis are the most common clinical manifestations of invasive meningococcal disease (IMD). The highest incidence of meningococcal disease is in children aged <2 years and adolescents aged 15–19 years. Carriage rates of the bacteria are highest in older adolescents and young adults.
- The incidence of meningococcal disease fluctuates naturally over time. Meningococcal B (MenB) disease had been dominant until a rise in the incidence of meningococcal W (MenW) disease from 2013 resulted in serogroup W being slightly more common than serogroup B in 2016. In 2017, serogroups B and W caused similar numbers of meningococcal disease cases in Australia. Following the introduction of several state- and territory-funded MenACWY vaccination programs targeting W and Y serogroups, serogroup B disease became dominant again in 2018.
- MenB disease remains the most common cause of IMD in children, adolescents and young adults. Meningococcal W and Y disease occurs over a more diverse age range and may present with less typical clinical manifestations than disease due to other serogroups.

Vaccines

- Three types of meningococcal vaccines are available in Australia (see also Figure 1):
  - recombinant meningococcal B (MenB) vaccines: Bexsero®, Trumenba®
  - quadrivalent (A, C, W, Y) meningococcal (MenACWY) conjugate vaccines: Menactra®, Menveo®, Nimenrix®
  - meningococcal C (MenC) conjugate vaccine: Menitorix® (combination formulation with the *Haemophilus influenzae* type b vaccine), NeisVac-C® (monovalent meningococcal C vaccine)

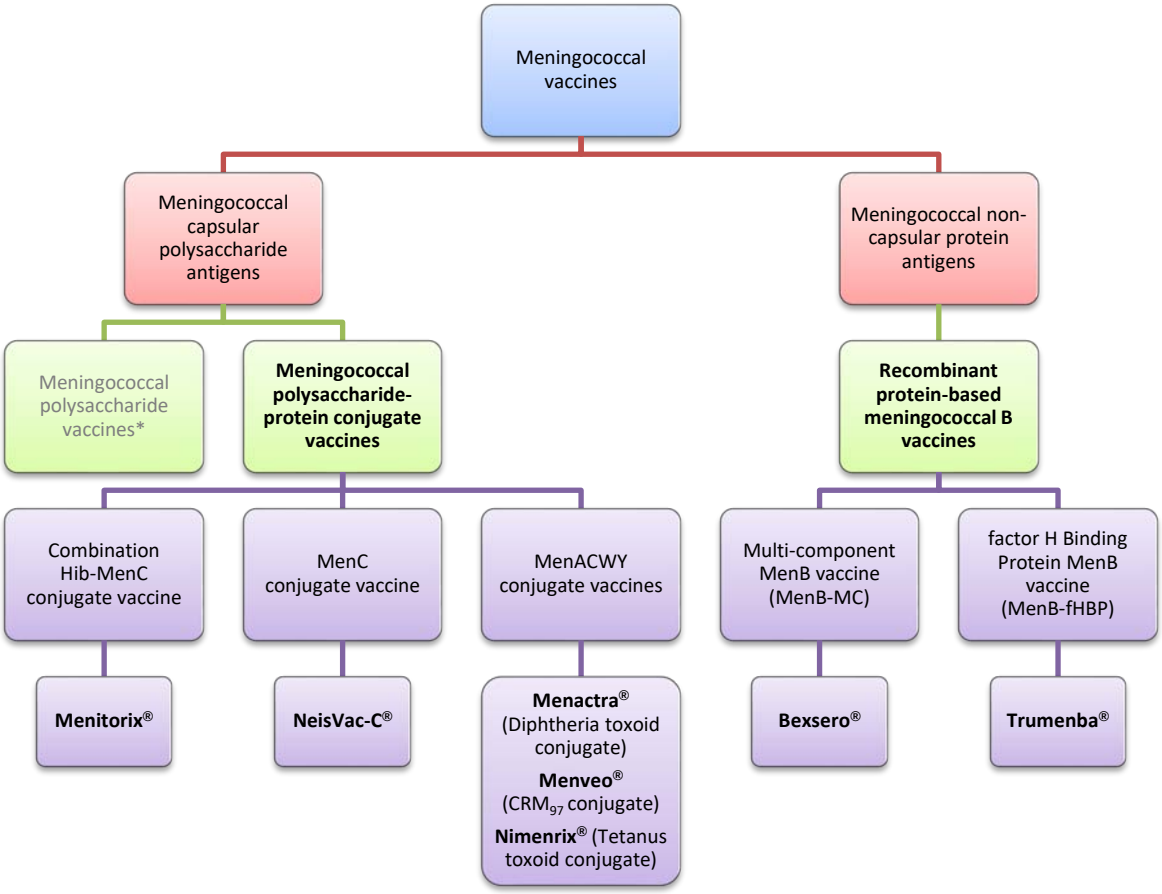
Who should be vaccinated (Table 1)

- **People in age groups with increased incidence of IMD or high carriage rates of *N. meningitidis*:**
  - ***Infants and young children aged <2 years****:* All infants and children aged <2 years are recommended to receive MenB and MenACWY vaccines. A routine single dose of Nimenrix (MenACWY vaccine) at 12 months of age is recommended and funded under the National Immunisation Program (NIP). MenB vaccine (Bexsero® only for this age group) is not funded under the NIP, but South Australia is providing free MenB vaccine for infants in response to higher local rates and predominance of MenB disease (refer to Table 2). Earlier vaccination maximises protection during this at-risk period, and both MenACWY vaccine and Bexsero are available from 6 weeks of age through private prescription..
  - ***Adolescents and some young adults*****:** MenB and MenACWY vaccine are recommended for all adolescents aged 15–19 years and additionally for young adults aged 20–24 years who live in close quarters (such as new military recruits and students living in residential accommodation) or who are current smokers. Nimenrix (MenACWY vaccine) is available on the NIP for adolescents aged 14–19 years. Those aged 14–16 years can receive the vaccine through a school-based program for Year 10 students; those aged 15–19 years who did not receive the vaccine in school can receive it from their

GP. MenB vaccine is not funded on the NIP, but is state-funded in South Australia in 2019 for 15–20-year-olds (refer to Table 2).

- **Aboriginal and/or Torres Strait Islander people:**
  - Aboriginal and Torres Strait Islander people aged 2 months to 19 years are recommended to receive MenB and MenACWY vaccines.
- **People with medical conditions associated with an increased risk of IMD:**
  - People with complement disorders, asplenia and other immunocompromising conditions are recommended to receive MenB and MenACWY vaccines.
- **Travellers:**
  - People travelling to certain destinations where there is an increased risk of exposure to serogroups A, C, W or Y (including, but not limited to, the 'meningitis belt' of sub-Saharan Africa and pilgrims to the Hajj in Mecca, Saudi Arabia) are recommended to receive MenACWY vaccine.
- **People who have occupational risk:**
  - Laboratory personnel who frequently handle *N. meningitidis* should be vaccinated with MenB and MenACWY vaccines.
- **Anyone wishing to reduce their risk of IMD:**
  - Vaccination with MenB and MenACWY vaccines may be offered to anyone aged ≥6 weeks.

Figure 1: Classification of meningococcal vaccines available in Australia



* Meningococcal polysaccharide vaccines are no longer supplied or recommended for use in Australia

Table 1: People and age groups strongly recommended to receive meningococcal vaccination

Population	6 weeks–23 months	2–4 years	5–14 years	15–19 years	20–24 years	≥25 years
Healthy Aboriginal or Torres Strait Islander people	MenB MenACWY	MenB MenACWY	MenB MenACWY	MenB MenACWY		
Healthy non-Indigenous Australians	MenB MenACWY			MenB MenACWY		
Increased medical risk*	MenB MenACWY	MenB MenACWY	MenB MenACWY	MenB MenACWY	MenB MenACWY	MenB MenACWY
People living in close quarters†				MenB MenACWY	MenB MenACWY	
Current smokers				MenB MenACWY	MenB MenACWY	
Occupational risk‡				MenB MenACWY	MenB MenACWY	MenB MenACWY
Travellers§	MenACWY	MenACWY	MenACWY	MenACWY	MenACWY	MenACWY

* Includes those with a specified medical condition associated with increased risk of meningococcal disease, including 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.

† Includes students living in residential accommodation and new military recruits.

‡ Includes laboratory personnel who are at occupational risk of exposure to *Neisseria meningitidis.*

§ People (age ≥6 weeks) who are travelling to areas where meningococcal disease is more common and there is an increased risk of exposure to meningococcal serogroups A, C, W or Y disease.

Table 2: Meningococcal vaccines available for use in Australia and current access/availability

Trade name	Formulation	Current access/availability as of March 2019
Recombinant meningococcal B (MenB) vaccines* against B serogroup		
Bexsero®	Recombinant multicomponent MenB (MenB-MC)	MenB vaccine available nationally through private prescription (Trumenba can only be used for people aged ≥10 years). In South Australia, Bexsero is available for free for infants aged 6 weeks to 12 months (with catch-up for those aged 12 months to <4 years until December 2019), and free for adolescents aged 15–16 years (catch-up for those aged 16 to <21 years until December 2019).†
Trumenba®	Recombinant bivalent fHBP MenB (MenB-fHbp)	
Quadrivalent meningococcal (MenACWY) conjugate vaccines‡ against A, C, W, and Y serogroups		
Menactra®	Quadrivalent diphtheria toxoid conjugate	Nimenrix is NIP-funded for a single dose at age 12 months. NIP funding for those aged 14–19 years from April 2019; Year 10 students will receive the vaccine through a school-based program while eligible non-students can receive a dose from their GP. Some states provide free vaccine to additional age groups. WA funds vaccination for children aged 1–4 years (until December 2019) and Aboriginal and Torres Strait Islander children aged 6 weeks to 4 years.† NT and TAS also fund MenACWY vaccine for some infants and children. Please check state health department websites for details.† All brands are available through private prescription for other age groups. [Note: Menactra is not licensed for infants aged <9 months.]
Menveo®	Quadrivalent CRM_{197} conjugate	
Nimenrix®	Quadrivalent tetanus toxoid conjugate	
Meningococcal C (MenC) conjugate vaccines against C serogroup		
Menitorix®	Haemophilus influenzae type b and MenC conjugate combination	Combination Hib–MenC conjugate vaccine or monovalent MenC vaccine available on the NIP for those requiring catch-up of the previous 12-month childhood MenC dose (if they are not eligible to receive MenACWY vaccine, i.e. aged >12 months on 1 July 2018).
NeisVac-C®	Monovalent MenC conjugate	

* There are many strains of serogroup B meningococcus. Laboratory tests indicate that both MenB vaccines are likely to protect against a large proportion (>75%) of MenB strains in Australia, but there is as yet inadequate information about the exact proportion or any difference between the two vaccines. Refer to Table 4 for dosing guidelines.

† Refer to state and territory health department websites.

‡ Vaccine brands are registered for use in different age groups (refer to Table 3).

The disease

Meningococcal disease is a relatively rare but serious infection caused by the bacterium *Neisseria meningitidis*, commonly known as the meningococcus. There are 13 serogroups, distinguished by differences in the surface polysaccharides of the organism's outer membrane capsule. Globally, most cases of meningococcal disease are caused by serogroups A, B, C, W and Y.

Currently, even with antibiotic treatment, the mortality rate for meningococcal disease is around 5–10%. About 10–30% of children and adolescents who survive the disease develop permanent complications such as limb deformity, skin scarring, deafness and neurological deficits.[1-3]

Clinical features

Invasive meningococcal disease (IMD; defined by isolation of meningococci from body sites that are normally sterile) most commonly manifests as septicaemia and meningitis. Typical symptoms are often non-specific and can include sudden onset of fever, a rash that can be petechial or purpuric (like red-purple spots or bruises) or maculopapular (a flat or raised non-specific rash), headache, neck stiffness, photophobia, altered consciousness, muscle aches, joint pain, nausea and vomiting.[1,4-6] Other less common manifestations of meningococcal disease include pneumonia, arthritis, epiglottitis, pericarditis and conjunctivitis.[4,5,7]

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. Meningococcal W disease, in particular, has been associated with higher rates of atypical presentations in up to 20% of cases.[8]

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.[9] Smokers have increased carriage rates[10-12] which may increase transmission and invasive disease.

Meningococcal bacteria are transmitted via 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

People 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, smoking or exposure to smokers, crowded living conditions, intimate kissing with multiple partners, and recent or current viral infection of the upper respiratory tract.[4,6]

Management of meningococcal disease

IMD 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 intravenous antibiotics and hospitalised for further management. The relevant state or 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 of contacts (refer to Use of vaccines for close contacts…).

Epidemiology

Meningococcal disease is both sporadic and epidemic throughout the world. Its incidence fluctuates naturally over time. In Australia, meningococcal disease follows a seasonal trend, with most cases occurring in winter or early spring.[14,15] Notification rates decreased from a peak of 3.5 cases per 100,000 in 2002 to 0.6 per 100,000 in 2013. Notification rates have since increased, reaching 1.5 per 100,000 in 2017[16] (Figure 2). Most meningococcal disease occurs in young children aged <2 years and in older adolescents and young adults aged 15–24 years.[14]

Nationally, for over a decade, from 2006 to 2015, MenB was the most common serogroup causing IMD, accounting for 63% to 88% of annual notified cases where a serogroup was identified.[17] MenB rates have slowly declined but it still remains the major cause of IMD in children aged <2 years, particularly infants aged <1 year, adolescents and young adults (refer to Figure 3).

Since 2013MenW has emerged as an important cause of meningococcal disease (17 cases, 10.4% of cases with an identified serogroup in 2013),[8] surpassing MenB disease in 2016 (110 MenW cases and 93 MenB cases),[18] and being comparable with MenB disease in 2017 (139 MenW cases, 38.1% and 137 MenB cases, 37.5%).[8,19,20] Many MenW cases have been due to a single clone of meningococcus, the ST11 strain type, suggesting sustained person-to-person transmission.[19] As of June 2018, MenB had become the dominant serogroup again, causing 25 of 56 IMD cases compared with 16 cases due to MenW.[21]

The incidence of MenW and MenB disease peaks in the <2 years and 15–19 years age groups. However, a larger proportion of MenW cases occurs in adults aged ≥45 years (median age of MenW cases is 44 years) compared to MenB cases.[8]

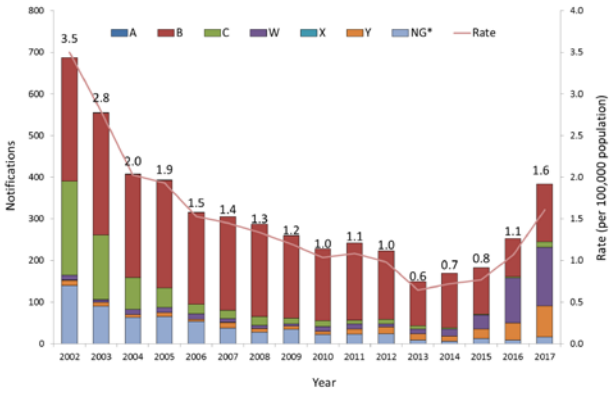
The burden of IMD due to MenW and MenB is disproportionately higher in the Aboriginal and Torres Strait Islander people, particularly in those aged <15 years.[22] Large outbreaks have occurred in central Australia where many children aged <10 years have been affected. Incidence rates >100 times higher for MenW and 7 times higher for MenB than the non-Indigenous population were documented in this age group during 2016–2017.[23]

MenW disease appears to have a higher case fatality rate than disease caused by other serogroups (about 9.3% for MenW versus about 5% for MenB).[20] This may indicate a tendency towards more severe infection.[8]

A smaller but notable increase in serogroup Y disease has occurred in the recent few years, from 12 cases (7.4% of those with an identified serogroup) in 2014 to 75 cases (20.5% of cases with an identified serogroup) in 2017.[8,19,20] Serogroup Y disease is more common in older adults, with 61% of cases (46/75) in 2017 occurring in people aged ≥45 years.[24]

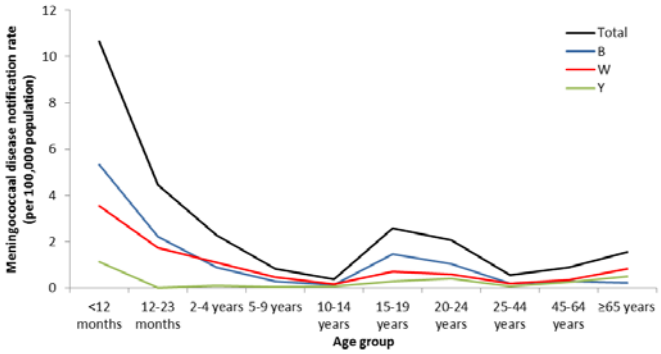
Serogroup C (MenC) disease has decreased markedly after the implementation of the national MenC conjugate vaccination program in 2003, with the number of cases falling from 225 in 2002 to 14 (3.8% of cases with an identified serogroup) in 2017.[19,20] Serogroup A disease remains rare in Australia. Updated epidemiological data on meningococcal disease are available at the Australian Government Department of Health website.

Figure 2: National notification rates for invasive meningococcal disease by serogroup, Australia, 2002–2017



Source: National Notifiable Diseases Surveillance System (NNDSS) data, analysis completed by Office of Health Protection, Australian Government Department of Health.Invasive meningococcal disease national report, December 2017. Full report available at: http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-meningococcal-W.htm

Figure 3: Notifications of invasive meningococcal disease by age group and serogroup, Australia, 2016–2017



Source: Australian Technical Advisory Group on Immunisation. Public consultation on changes to the recommended use of meningococcal and *Haemophilus influenzae* type B vaccines. April 2018. Available at: https://consultations.health.gov.au/ohp-immunisation-branch/proposed-changes-to-meningococcal-and-hib/

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 (Figure 1):

- recombinant meningococcal B (MenB) vaccines
- quadrivalent (A, C, W, Y) meningococcal (MenACWY) conjugate vaccines.
- meningococcal C (MenC) conjugate vaccines

Quadrivalent meningococcal (MenACWY) conjugate vaccines

There are three brands of MenACWY vaccines, each of which uses a different carrier protein to conjugate the polysaccharide antigens of four serogroups (A, C, W and Y). Clinical trials have demonstrated the immunogenicity of MenACWY vaccine in children, adolescents and adults. All studies indicate that MenACWY vaccines are safe and immunogenic.[25-27] It is preferable to use the same brand of MenACWY vaccine to complete a primary vaccination course. Any brand of vaccine may be used as a booster dose.

MenACWY vaccines available for use in Australia are:

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

Nimenrix is NIP-funded at 12 months of age.[28] The Hib booster (4th) dose previously administered at 12 months, is now given at 18 months as a monovalent vaccine (Act-HIB). From April 2019, Nimenrix is also NIP-funded for adolescents aged 14–19 years. The other two vaccines are not available through the NIP.

Dosage for MenACWY vaccines depends on the age group and indication (refer to Table 3). There is some evidence that antibody response after Nimenrix or

Menveo is modestly higher than that after Menactra, especially for serogroups W and Y.[29-31] There is also some evidence showing that immunity decreases more quickly with Menactra than with Nimenrix or Menveo.[30,32,33] Therefore, **when available, for people aged ≥2 years, Nimenrix or Menveo is preferred to Menactra**. If Nimenrix or Menveo are not available, Menactra should be given as it is still significantly better than no vaccination. For infants and toddlers aged <2 years, any of the three brands may be given in the age-appropriate dosing schedule (refer to Table 3).

MenACWY vaccines can be given concomitantly (at the same time) with most routine childhood and adolescent vaccines. However, be aware of the following issues:

Menactra and 13 valent pneumococcal conjugate vaccine (13vPCV)

Coadministration of Menactra and 13vPCV should be avoided at any age because of possible interference in the immune response to some pneumococcal serotypes. Ideally Nimenrix or Menveo should be co-administered with 13vPCV instead, noting Nimenrix is the vaccine currently on the NIP. If only Menactra is available, 13vPCV should be given first followed by Menactra at least 4 weeks later.

If Menactra has been inadvertently co-administered with 13vPCV, repeating the dose of 13vPCV is not required. In a *healthy* person with no risk factors for invasive pneumococcal disease (IPD), no extra doses of any pneumococcal vaccines are required. For those at *increased risk of IPD*, it is usual for a dose of 23-valent pneumococcal conjugate vaccine (23vPPV) to follow at least 2 months after 13vPCV or at 4–5 years of age. Administering 23vPPV will appropriately boost the initial 13vPCV dose. If this dose has not been given, administer the 23vPPV at the appropriate time as above.

Nimenrix after a tetanus toxoid (TT)-containing vaccine

Co-administration of Nimenrix and a TT-containing vaccine such as Infanrix Hexa or Boostrix does not affect meningococcal immune response. However, in studies where Nimenrix *followed* a TT-containing vaccine by approximately 1 month, lower meningococcal antibody responses for some serogroups were shown in children aged 12–23 months[34] and adults aged 18–64 years.[35] The clinical significance of these findings is not yet clear, and there are no data on the optimal interval between vaccines. The data do not suggest any negative effect on the immune response if TT-containing vaccine is given after Nimenrix.

These findings should not be generalised to infants. For infants aged 6 weeks to <11 months, data do not warrant delaying Nimenrix. Nimenrix can be given at any time in relation to previous or upcoming doses of Infanrix Hexa. Ensure an 8-week interval from the previous dose for the NIP-funded Nimerix 12-month dose.

For anyone aged ≥11 months, co-administration of Nimenrix and a TT-containing vaccine is preferable. If the TT-containing vaccine has already been given, it is still best to administer Nimenrix as planned without any delay, as vaccination in this sequential order is still preferred to delaying or missing the dose.

Menactra after a diphtheria toxoid (DT)-containing vaccine

A similar interaction involving reduced meningococcal vaccine response is possible when Menactra is given 1 month after a DT-containing vaccine, for example, DTPa vaccine (shown in those aged 4–6 years and 11–17 years).[36,37] If planning administration of these vaccines, ideally use Nimenrix or Menveo instead of Menactra. If not possible, it is preferable to co-administer them or give Menactra before the DT-containing vaccine.

In all patients, particularly those at risk of IMD, ensure the appropriate total number of vaccine doses according to the age group and brand are subsequently administered (refer to Table 3).

Recombinant meningococcal B (MenB) vaccines

There are two brands of MenB vaccines available in Australia. Note that the two vaccines are registered for different age groups and in different dosing schedules (refer to Table 4).

Bexsero® (GlaxoSmithKline Australia) is a recombinant multicomponent vaccine (MenB-MC) designed to provide protection against multiple strains of MenB. It contains four major antigens that are highly conserved across multiple MenB strains.

The primary vaccination course of Bexsero consists of 2 to 4 doses, depending on the age at which the course commences and presence of medical conditions associated with increased IMD risk (refer to Table 4). Antibody response in healthy children has been shown to be the same with 3 doses compared with 4 in infants commencing vaccination between the ages of 6 weeks to 5 months.[38,39] Data from the UK, where an infant MenB vaccination program using 3 doses was introduced in 2015, shows the effectiveness of the first 2 doses given in infants to be 82.9%.[39]

Trumenba® (Pfizer) is a recombinant bivalent human factor H binding protein (MenB-fHBP) vaccine consisting of two surface proteins that are highly conserved across MenB strains. It is registered for use in people aged ≥10 years.

Clinical trials have shown that this vaccine is safe and immunogenic and it can be used in a 2- or 3-dose schedule depending on the person's medical risk of IMD (refer to Table 4).[40,41] Trumenba may be administered concomitantly with other vaccines.

There is no preference between Trumenba and Bexsero in people aged ≥10 years. However, they are not interchangeable and the same vaccine should be used to complete the vaccination course. Both vaccines can be safely co-administered with MenACWY and other routine vaccines.

Meningococcal C (MenC) conjugate vaccine

MenC conjugate vaccines are now infrequently used as they have been replaced by Nimenrix (MenACWY) which covers additional A, W and Y serogroups. They are still used as the catch-up MenC vaccines for the cohort of children who were older than 12 months before the introduction of Nimenrix on the NIP (1 July 2018).

Who should be vaccinated

Table 1 summarises vaccination recommendations. Table 2 provides a summary of meningococcal vaccines registered for use in Australia. Recommended brands and doses by age group for MenACWY vaccines can be found in Table 3 and for MenB vaccines in Table 4. Refer also to the NCIRS fact sheet Meningococcal vaccines – frequently asked questions.

Healthy infants and younger children (<2 years)

- A single dose of Nimenrix (MenACWY vaccine) is recommended and funded under the NIP for all children at 12 months of age. This vaccination is required for parents to be able to claim child care subsidies and family assistance benefits.
- Vaccination using other brands or at an earlier age (from 6 weeks old) is available through private prescription, but there are differences in the number of MenACWY vaccine doses required between vaccine brands for children aged <2 years. Only the 12-month dose of Nimenrix is funded under the NIP. Menveo and Menactra are not funded under the NIP.
- MenB vaccine (Bexsero only) is also recommended for infants and young children aged <2 years, but is not funded under the NIP.
- Some states/territories are providing free MenACWY or MenB vaccine for infants and children. The programs vary by age and other eligibility criteria. Check state or territory health department websites for further information.

Healthy adolescents (15–19 years)

- MenACWY vaccine is recommended for all adolescents. A single dose of Nimenrix is provided free on the NIP through a school-based program (14–16-year-olds); those aged 15–19 years who did not receive the vaccine at school can receive it from their GP(refer to Table 1).
- Healthy adolescents should also receive a 2-dose schedule of MenB vaccine (funded only in South Australia). Either MenB vaccine can be given, but the same vaccine should be used to complete the series.

Healthy people in other age groups

- MenACWY and MenB vaccines are available through private prescription to anyone aged ≥6 weeks who wants to reduce their likelihood of becoming ill with meningococcal disease.

Aboriginal and Torres Strait Islander people

- Aboriginal and Torres Strait Islander people are at increased risk of IMD, particularly from serogroups B and W. Both MenACWY and MenB vaccines are recommended for anyone aged 2 months to 19 years.

Current smokers (adolescents and young adults aged 15–24 years)

- Smokers have increased carriage rates and are at increased risk of IMD. A single dose of MenACWY vaccine and 2 doses of MenB vaccine are recommended.

Adolescents and young adults (aged 15–24 years) living in close contact

- Healthy adolescents and young adults living in close contact conditions, such as military recruits or those in residential accommodation, should receive a 2-dose schedule of MenB vaccine and a single dose of MenACWY vaccine.

People with specified medical conditions associated with an increased risk of meningococcal disease

- MenACWY and MenB vaccines are recommended for individuals with specified 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. Ongoing boosters of MenACWY vaccine are recommended (refer to Table 3).

Laboratory personnel who frequently handle *Neisseria meningitidis*

- For people with occupational exposure risks, a single primary dose of MenACWY vaccine and a primary course of 2 doses of MenB vaccine are recommended. MenACWY vaccine boosters every 5 years are also recommended.

Travellers

- For travellers, MenACWY vaccine is recommended for people (aged ≥6 weeks) 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).

Table 3: Dose schedule recommendations for immunisation using MenACWY vaccines, by age and vaccine brand, the number of doses required and minimum intervals

Age at commencement of vaccine course	MenACWY vaccine brand	Healthy individuals, including Aboriginal and Torres Strait Islander people, travellers and laboratory personnel	With any specified medical conditions associated with increased risk of meningococcal disease (see footnote Table 1)
6 weeks–5 months	Menveo*	3 doses (8 weeks between 1st and 2nd doses; 3rd dose at 12 months of age)	4 doses (8 weeks between doses; 4th dose at 12 months of age or 8 weeks after 3rd dose, whichever is later)
	Nimenrix		
6–8 months	Menveo*	2 doses (2nd dose at 12 months of age)	3 doses (8 weeks between 1st and 2nd doses; 3rd dose at 12 months or 8 weeks after 2nd dose, whichever is later)
	Nimenrix		
9–11 months	Menveo	2 doses (2nd dose at 12 months of age or 8 weeks after 1st dose, whichever is later)	3 doses (8 weeks between each dose)
	Nimenrix		
	Menactra#		
12–23 months	Menveo	2 doses (8 weeks between doses)	2 doses (8 weeks between doses)
	Menactra#	2 doses (8 weeks between doses)	
	Nimenrix	1 dose	
≥2 years‡	Menveo	1 dose	2 doses (8 weeks between doses)
	Menactra#§		
	Nimenrix		
Booster doses for all ages	Any brand	Required only for travellers and laboratory personnel facing ongoing risks, who completed the primary series at: a) ≤6 years of age: give at 3 years after completion of primary immunisation schedule, then every 5 years thereafter b) ≥7 years of age: give every 5 years after completion of the primary immunisation schedule	For those with ongoing increased risk for IMD who completed the primary series at: a) ≤6 years of age: give at 3 years after completion of primary immunisation schedule, then every 5 years thereafter b) ≥7 years of age: give every 5 years after completion of the primary immunisation schedule

* These recommendations are endorsed by the Australian Technical Advisory Group on Immunisation (ATAGI) and differ from the Menveo product information in regards to the number of recommended doses. See variations from product information in the Australian Immunisation Handbook.

\# Do not co-administer Menactra with 13vPCV (Prevenar 13). Ideally Menveo or Nimenrix should be used instead. If only Menactra is available, 13vPCV should be given first followed by Menactra, with a minimum interval of 4 weeks between the dose of 13vPCV and Menactra. If Menactra and 13vPCV have already been co-administered, no repeat dose of 13vPCV is required in healthy individuals. In those at increased risk of IPD, a dose of 23vPPV is indicated. A repeat dose of 13vPCV for the co-administered dose will then not be required.

‡ Menveo and Nimenrix are preferred, if available, in individuals aged ≥2 years. If unavailable, use Menactra.

§ There is no registered upper age limit for use of Menveo or Nimenrix. Although Menactra is registered for use up to 55 years of age only, it can be given to people older than 55 years, as per *The Australian Immunisation Handbook.*

Table 4: Recommended brands and doses of MenB vaccine by age group in healthy individuals or those with any specified medical conditions associated with increased risk of meningococcal disease

Age at commencement of vaccine course	Brands registered for use in Australia	Number of doses required	Recommended interval between doses	Notes
6 weeks–5 months	Bexsero®	3 (healthy) 4 (increased risk)	8 weeks	8 weeks between doses; last dose at 12 months or 8 weeks after previous dose, whichever is later.* † Refer to footnote in Table 1 for conditions with increased IMD risk
6–11 months	Bexsero®	3	8 weeks	8 weeks between 1st and 2nd doses; 3rd dose at 12 months or 8 weeks after 2nd dose, whichever is later†
12–23 months	Bexsero®	2	8 weeks	
2–9 years	Bexsero®	2	8 weeks	The recommended interval is 8 weeks. The minimum interval is 4 weeks.
≥10 years†	Bexsero®	2	8 weeks	The recommended interval is 8 weeks. The minimum interval is 4 weeks.
	Trumenba®	2 (healthy) 3 (increased risk, see note)	6 months (2 doses); see note for 3 dose schedule	For those with specified medical conditions (refer to footnote in Table 1), 3 doses are required (at least 4 weeks between 1st and 2nd doses; 3rd dose at least 4 months after 2nd dose and at least 6 months after 1st dose)

* These recommendations differ from the Bexsero product information which recommends an interval of 6 months between the second and third doses. See variations from product information in the Australian Immunisation Handbook.
† Bexsero® and Trumenba® are not interchangeable. The same vaccine should be used to complete the vaccination course.

Note: The requirement for booster doses with MenB vaccine has not yet been determined, and at present booster doses are not recommended.

Vaccine safety

Meningococcal conjugate vaccines

Meningococcal conjugate vaccines are generally considered safe and well tolerated.

MenACWY vaccines

The most frequently reported adverse events following MenACWY vaccine include fever, headache, dizziness[42] and erythema at the injection site. Injection site reactions generally resolve within 48–72 hours.[4]

MenACWY vaccines can be safely administered at the same time as other routine vaccines provided to young children through the NIP. In most studies, the frequency of reactions after vaccination was similar regardless of whether the vaccines were given together or separately. Some studies showed slight increases in mild reactions when vaccines were given together.

An initial suspicion of an association between a certain brand of MenACWY vaccine (Menactra) and Guillain–Barré syndrome (GBS), a rare neurological disorder associated with muscle weakness and paralysis, has been thoroughly investigated and disproven.[43,44]

Recombinant meningococcal B vaccines

A moderately high rate of fever was the most notable systemic reaction in infants and young children aged <2 years in clinical trials for Bexsero. Because of this concern, the prophylactic use of paracetamol is recommended with every dose of Bexsero for children <2 years of age. Concurrent administration of Bexsero with other childhood vaccines may increase further the frequency of fever,[45,46] as shown in Table 5.

While it is safe to concurrently administer Bexsero with other routine vaccines, at separate injection sites, an alternative is that children <2 years of age can receive Bexsero separately from other routine infant vaccines with a minimum interval of 3 days. However, do not delay routine vaccines.

Table 5: Proportion (%) of infants reporting fever within 7 days after at least 1 of the 3 infant doses of Bexsero[46]

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

Fever in infants and young children given Bexsero 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 the immunogenicity of Bexsero or the other vaccines given

concurrently.[47] Other common adverse events following immunisation with Bexsero include tenderness, swelling, erythema or rarely a persistent nodule at the injection site, irritability, sleepiness, change in eating habits, unusual crying, rash, vomiting and diarrhoea. Most of these events were considered mild or moderate and were transient in nature. A recent review of 3 million Bexsero doses given in the UK infant and toddler immunisation program found no significant safety concerns, and specifically, no increase in febrile seizures following vaccination.[48]

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

Prophylactic use of paracetamol is recommended with every dose of Bexsero® 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.

Clinical trials of Trumenba administered alone or with other vaccines in adolescents aged ≥10 years showed that the most common adverse events in adolescents aged ≥10 years were injection site pain, redness and swelling at the injection site, headache, fatigue, chills, muscle pain and joint pain. Most of these events were considered mild or moderate and were transient in nature.[40,41] The safety profiles were similar for the 2- or 3-dose schedules.

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

The meningococcal vaccine that covers 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 disease risk because of a local outbreak (such as an outbreak in a residential facility). The relevant state or territory public health authority should be contacted as soon as possible for guidance on determining the risk of disease, and the need for vaccination and clearance antibiotics. (Refer also to Management of meningococcal disease.)

Contraindications/precautions

For all meningococcal vaccines, 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.[49]

The product information for Menveo states that the tip cap of the syringe contains natural rubber. The risk of allergy is lower from natural rubber than from latex. However, consider using an alternative product in people with an allergy or sensitivity to latex.

Additional resources for primary medical care/vaccination providers

- The Australian Immunisation Handbook: Meningococcal disease chapter
- NCIRS fact sheet Meningococcal vaccines – frequently asked questions
- Australian Government Department of Health: Meningococcal W disease www.health.gov.au/internet/main/publishing.nsf/Content/ohp-meningococcal-W.htm
- Immunise Australia website https://beta.health.gov.au/health-topics/immunisation
- National Immunisation Program schedule https://beta.health.gov.au/health-topics/immunisation/immunisation-throughout-life/national-immunisation-program-schedule
- National Immunisation Program childhood schedule changes https://beta.health.gov.au/resources/publications/national-immunisation-program-childhood-schedule-changes-advice-for
- ACT Health www.health.act.gov.au
- Health Victoria. www.health.vic.gov.au
- Northern Territory Department of Health https://health.nt.gov.au
- NSW Health www.health.nsw.gov.au/immunisation
- Queensland Health www.health.qld.gov.au
- SA Health www.sahealth.sa.gov.au
- Tasmanian Department of Health and Human Services www.dhhs.tas.gov.au
- WA Health ww2.health.wa.gov.au
- Centers for Disease Control and Prevention (USA): Meningococcal disease www.cdc.gov/meningococcal

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