Meningococcal disease

Meningococcal disease is a rare, but potentially devastating infection in travellers caused by the bacteria Neisseria meningitidis

Key messages

- **Meningococcal disease is a rare, but potentially devastating infection caused by the bacterium *Neisseria meningitidis*.**
- **The most common forms of meningococcal disease are meningitis (infection of the protective lining around the brain and spine) and septicaemia (blood poisoning).**
- **The highest incidence of meningococcal disease is in the extended 'meningitis belt' of sub-Saharan Africa, particularly during the dry season.**
- **Travellers whose planned activities or medical conditions put them at increased risk of meningococcal disease should consider vaccination with the quadrivalent conjugate vaccine that protects against four major meningococcal groups: A, C, W and Y.**
- **Pilgrims travelling to the Kingdom of Saudi Arabia for the Hajj or Umrah are required to show proof of vaccination with the quadrivalent MenACWY vaccine in order to obtain a visa.**
- **Travellers can reduce their risk of meningococcal disease by practising good hand hygiene and avoiding activities involving the exchange of respiratory secretions, such as sharing drinks and eating utensils.**

Overview

Invasive meningococcal disease is a serious illness caused by the Gram-negative bacterium *Neisseria meningitidis* (*N. meningitidis*). Currently, the World Health Organization (WHO) estimates that 5-15 percent of children and young adults carries *N. meningitidis* bacterium in their nose and throat at any given time. However, this carriage rate may be higher during epidemics [1]. Twelve

subtypes (serogroups) of *N. meningitidis* have been identified. Six of them: A, B, C, W, X and Y are recognised as the main causes of disease and epidemics [2].

Studies indicate that carriage peaks during early adolescence in Africa and in late adolescence in Europe. Therefore, individuals in these age groups are likely to be important disease transmitters in these regions [3]. Carriers are usually asymptomatic (symptom free) but very rarely, can develop invasive disease including, septicaemia (blood poisoning) and/or meningitis (infection of the lining of the brain and spine).

According to WHO, meningitis is fatal in one in ten cases (10 percent of cases), if left untreated. One in five (or 20 percent) of survivors may have long-term complications, such as brain damage or disability, including hearing loss [1]. Meningococcal septicaemia has a high fatality rate. It is characterised by fever and red/purple skin spots that do not fade under pressure (petechial or a purpuric rash). These symptoms are often accompanied by septic shock, disseminated intravascular coagulation and multiple organ failure. Neurological complications, hearing impairment or amputation occur in up to 20 percent of survivors [4].

Effective vaccines are available against groups A, B, C, W and Y [2, 5].

Risk areas

Meningococcal disease occurs worldwide [5] and is seen in a range of situations, from sporadic cases and small clusters to large epidemics throughout the world, with seasonal variations. The disease can affect anyone of any age, but mainly affects babies, preschool children and young people. Geographic distribution and epidemic potential differ according to the serogroup [1, 4].

Incidence varies globally, with the highest burden in the African meningitis belt [1, 3, 6]. In some epidemiologic settings, meningococcal disease occurs in cycles, with peaks and troughs every five to eight years.

Meningococcal disease in sub-Saharan Africa

Worldwide, the highest rates of disease occur in the extended 'meningitis belt' of sub-Saharan Africa [3, 6]. This area includes 26 countries and extends across the dry savannah regions from Senegal in the west, to Ethiopia in the east [2]. The meningitis belt was first defined as a "region south of the Sahara between latitudes 4 and 16°N" and was later expanded to include parts of Benin, Cameroon, Ethiopia, the Gambia, Ghana, Mali and Senegal [7]. In recent years, there has been an extension to the traditional meningitis belt, moving southwards and now including the countries of Burundi, the Central African Republic, Rwanda, Tanzania, Uganda and Zambia [8].

Meningitis belt epidemics typically occur in the dry season: usually between December and June in West Africa, while in East Africa the season is variable. A combination of factors helps facilitate this seasonal transmission; these include dust winds, cold nights, increased incidence of upper respiratory tract infections, overcrowding and seasonal population displacement [2, 9].

Seasonal hyperendemicity is observed every dry season, when weekly incidence rates rise up to 10/100,000 population throughout the African meningitis belt and can locally exceed 100/100,000 population [8]. Before 2010, historically serogroup A was the main cause of epidemics in the African meningitis belt [2]. The largest recorded serogroup A epidemic in this region occurred between 1996 and 1997 and resulted in over 25,000 deaths [10].

In 2010, a large-scale vaccination campaign against serogroup A was introduced progressively across the region [2]. Since then, most meningococcal infections have been due to serogroups other than A, and meningitidis serogroup A outbreaks have virtually disappeared in countries which implemented mass A conjugate vaccine vaccination campaigns [11]. Serogroups W, C and X are still responsible for localised epidemics and occasionally more widespread epidemic waves [8].

Please check our Country Information pages for individual country vaccine recommendations.

Meningococcal disease in the United Kingdom (UK) and mainland Europe

Invasive meningococcal disease (IMD) remains rare in European Union (EU) and European Economic Area (EEA) countries. Detailed information on surveillance and disease data for meningococcal disease in Europe can be found on the European Centre for Disease Control website.

In the UK, the COVID-19 pandemic and the implementation of social distancing measures and lockdown across the UK from 23 March 2020 has had a significant impact on the spread and detection of other infections including IMD [12].

Details on the epidemiology and distribution of IMD in England can also be found on UK Health Security Agency website.

Further information about global meningococcal disease distribution can be found on the World Health Organization website.

Meningococcal disease and mass gatherings

Mass gatherings have the potential for large outbreaks, particularly of respiratory and gastrointestinal pathogens. Although meningococcal outbreaks are rarely reported from mass gatherings, there are a few notable examples. The annual Hajj pilgrimage to Mecca in Saudi Arabia is one of the largest gatherings of its kind in the world and been associated with outbreaks of meningococcal disease in returning pilgrims and their contacts [13]. This is due to crowded conditions, high humidity and high carrier rates among pilgrims [14]. Several outbreaks of meningococcal disease have been associated with the annual Hajj pilgrimage [15, 16, 17]. In 1987, an outbreak caused by serogroup A resulted in Saudi Arabia requiring vaccination against serogroup A as a condition of entry for those travelling for the Hajj [17]. In 2000, more than 400 cases of serogroup W disease were reported. In this outbreak, cases were identified both in pilgrims and their close contacts across at least 16 countries around the world [16]. Since 2002, because of

this outbreak, pilgrims to the Hajj or Umrah require proof of vaccination with quadrivalent (ACWY) vaccine in order to obtain a visa for entry into Saudi Arabia. See General advice for pilgrims to the Hajj or Umrah.

Another example of a meningococcal outbreak associated with a mass gathering occurred in the summer of 2015 after the World Scout Jamboree in Japan. The 23rd World Scout Jamboree was held in Yamaguchi City, Yamaguchi Prefecture, Japan from 28 July to 8 August 2015 and was attended by over 33,000 scouts from 162 countries [18]. Following this event, five confirmed serogroup W meningococcal cases were reported in Scotland and Sweden, in individuals who had returned from the Jamboree [4, 18].

Risk for travellers

The risk of meningococcal disease in travellers is generally considered to be low [11]. Anecdotal reports of traveller cases suggest that disease may occur in any part of the world and in various types of travellers.

Destination and activity

Meningococcal disease risk may be increased for those travelling to areas in the extended meningitis belt of Africa or to a region with a current outbreak [13]. In these areas, environmental factors that increase exposure include crowding and prolonged close contact with a carrier. Exposure therefore varies, depending on activities, living conditions and mode of transport. Long-stay travellers who have close contact with the local population, health workers and those visiting friends and relatives are considered at greater risk.

Those who live or travel 'rough' such as backpackers may also be at increased risk. These travellers may be at more risk of severe illness when travelling to more remote areas with limited access to medical care [19].

Pilgrims and seasonal workers visiting Saudi Arabia for Hajj and Umrah are also at increased risk. This is due to a combination of overcrowding and close contact with people from countries with higher meningitis rates [19].

Host factors

Individuals with underlying conditions like asplenia (an absent or non-working spleen) or hyposplenia (reduced splenic function) and certain complement disorders (primary immunodeficiencies linked to defects in specific blood proteins) are highly susceptible to meningitis [20, 21].

Drugs that inhibit the complement component of the immune system are also risk factors for invasive meningococcal disease [21].

Meningococcal disease in travellers from the UK

In England, Wales and Northern Ireland, there is currently no routine surveillance for travel-related meningococcal disease. Establishing whether a case of meningococcal disease is travel-related can be difficult but is important to ensure that any subsequent public health action will target the appropriate contacts. Rather than acquiring infection overseas, a traveller can be colonised with meningococcal bacteria before travel and develop symptoms whilst abroad. A link with travel can be inferred through a short interval between returning from abroad and symptom onset or when a strain of *N. meningitidis* rarely seen in the UK is isolated (e.g. serogroup A). An example of this occurred in 2000 when a total of 27 confirmed cases of serogroup W meningococcal disease were reported in England and Wales. These cases were associated with pilgrims returning from the Hajj; 10 cases were in pilgrims themselves; the others were contacts of the pilgrims [22].

Transmission

Humans are the only natural hosts for *N. meningitidis*: there is no animal reservoir. The bacteria are transmitted from person-to-person through respiratory droplets or throat secretions from carriers. Close, prolonged contact, such as kissing, sneezing, coughing or living with a carrier, promotes spread. Transmission of *N. meningitidis* is facilitated during mass gatherings such as pilgrimages and jamborees [1]. Most infections do not cause clinical disease and many people carry the bacteria without any symptoms; they may serve as a reservoir of infection for others. Such carriage may provide some immunity to the host against invasive disease [3].

In the UK, between five and 11% of adults and up to 25% of adolescents are asymptomatic carriers. Rates of carriage are increased in closed populations such as military barracks and university halls of residence [23]. First year college students who live in halls of residence have a higher risk of disease than non-college students of a similar age [10].

Invasive meningococcal disease is rare, occurring only when bacteria invade the bloodstream from the nasopharynx. Damage to the lining of the nose resulting from smoking and upper respiratory tract infections may facilitate bacterial invasion from the nasopharynx [16].

Signs and symptoms

Typically, the incubation period for meningococcal disease is two to seven days. The most common clinical presentations of invasive meningococcal disease are meningitis and/or septicaemia. Meningococcal meningitis usually presents with sudden onset of fever, intense headache, neck stiffness, photophobia, nausea and vomiting. These symptoms can develop within hours or over several days. The person is often irritable and prefers to lie still. Septicaemia usually presents with fever and a non-blanching petechial or purpuric rash. Severe muscular or joint pains, vomiting and diarrhoea can occur. Confusion, shock and coma may ensue. Symptoms can appear in any order and not everyone develops the more common signs and symptoms associated with meningococcal disease. Infants and young children are more likely to present with non-specific symptoms and signs [1, 4 and 23].

These are serious diseases, with high morbidity and mortality, particularly if antibiotic treatment is delayed. Even with prompt antimicrobial treatment, the case fatality rate can be eight to 15%. If untreated, meningococcal meningitis is fatal in 50% of cases [1]. Up to 20% of survivors have long-term complications, including brain damage, seizures, hearing loss, severe visual impairment and limb amputation [1, 23].

A study looking at the outcomes of invasive meningococcal serogroup B disease in children and adolescents found that most children survive without major sequelae. However, about 10% had major disabling deficits and more than 33% had one or more deficits in physical, cognitive and psychological functioning, with the additional burden of memory deficits and executive function problems [24].

Less common manifestations of meningococcal disease include pericarditis (inflammation of the sac that surrounds the heart), arthritis, pharyngitis (sore throat) or conjunctivitis. In rare cases, the infection may present as a chronic form of invasive meningococcal disease (chronic meningococcemia) with prolonged, intermittent fevers, as well as a rash, joint pains and headaches [25].

Diagnosis and treatment

Early diagnosis and treatment is critical because meningococcal disease is potentially fatal.

Diagnosis can be confirmed by isolation of the organism from the blood or cerebrospinal fluid through culture. Antigen detection techniques or polymerase chain reaction (PCR) can also be used [1].

Suspected meningococcal infection is a medical emergency. Treatment with intravenous antibiotics should be commenced as soon as possible. Admission to intensive care for close monitoring and supportive treatment is usually necessary. Medical resources in countries where meningococcal disease is most common may be limited.

Meningococcal meningitis and septicaemia are notifiable diseases in England and Wales.

Preventing meningococcal disease

Travellers should be advised about disease transmission and activities that may put them at higher risk (see 'Risk for travellers' section above). Travellers should be advised to practise good hand hygiene and to avoid activities that promote exchange of respiratory secretions, such as sharing drinks and eating utensils. Overcrowded and confined spaces should also be avoided where possible [14].

Vaccination is a successful intervention for preventing meningococcal meningitis [6] and is the most effective measure for preventing invasive meningococcal disease.

Vaccine information

Different meningococcal vaccinations are administered as part of the routine NHS vaccination schedule. (Men C) vaccination was introduced into the UK schedule in 1999 and has been successful in reducing the incidence of invasive Men C disease in both vaccinated children and unvaccinated adults as result of reduced carriage rates [11]. Travellers visiting higher risk regions are recommended to have the conjugate quadrivalent ACWY vaccine (Menveo®, Nimenrix® or MenQuadfi®) if their planned activities put them at increased risk. These vaccines can be given even if individuals have previously received MenC conjugate vaccine as it protects against three more serogroups. A new quadrivalent conjugate ACWY vaccine (MenQuadfi®) was approved in 2021 for use in individuals 12 months of age and older [23].

There is currently no recommendation for meningococcal serogroup B vaccination for those travelling abroad [23]. Guidance on travel vaccines obtainable from the NHS is available on Travel vaccinations.

Indications for use of meningococcal ACWY vaccine

a) Routine immunisation

The travel consultation provides an opportunity to ensure all routine immunisations are up to date. Meningococcal vaccinations are provided in the childhood immunisation programme and young adults remain eligible for the ACWY vaccination up to the age of 25 years [11]. Vaccination is also recommended for individuals whose underlying medical condition puts them at increased risk of meningococcal disease:

- Individuals with no spleen or a poorly functioning spleen.
- Individuals with certain immune deficiencies e.g. certain types of complement deficiencies (including those on complement inhibitor therapies such as eculizumab).

b) Immunisation for travel

Vaccine may also be recommended for those travelling to areas prone to outbreaks (the meningitis belt of Africa) or to an area where a known outbreak is occurring. These travellers include:

- Long-stay travellers who have close contact with the local population.
- Healthcare workers.
- Those visiting friends and relatives.
- Those who live or travel 'rough' such as backpackers.
- Pilgrims and seasonal workers travelling to the Kingdom of Saudi Arabia (KSA) for the purpose of Hajj or Umrah (see part c below).

Outbreaks of meningococcal disease may also be reported from other parts of the world. If an outbreak is known to be caused by a vaccine-preventable strain, then the appropriate vaccine may

be recommended, depending on the risk to the individual. Country-specific information on the risk of meningococcal disease can be found on our Country Information pages and Outbreak Surveillance section.

c) Immunisation for pilgrims and seasonal workers for Hajj and Umrah

Meningococcal ACWY conjugate vaccine is recommended for all travellers to Hajj or Umrah.

To obtain a visa for entry into KSA, all those arriving to perform Hajj or Umrah, or undertake seasonal work, are required to submit proof of vaccination (as a vaccination certificate) for meningococcal disease.

Details of the vaccine name and type (i.e. conjugate vaccine) should be recorded in a patient held vaccine record showing the traveller's full name. It is advisable that the proof of vaccination record is issued by the traveller's doctor, nurse or pharmacist and should reflect accurately details of the vaccine administered and be authenticated with the healthcare provider's official stamp.

Meningococcal ACWY conjugate vaccine should be given at least 10 days before planned travel. For visa purposes, KSA consider the 'proof of vaccination' for the conjugate Men ACWY vaccine to be valid for 5 years.

Pilgrims and seasonal workers must carry vaccination certificates with them for inspection by the Saudi Authority at port of entry.

Patient vaccination record cards and/or blank ACWY certificates may be available to health professionals from the vaccine provider.

Alternatively, if an individual is in possession of an International Certificate of Vaccination or Prophylaxis (ICVP) booklet, meningococcal ACWY vaccine can be recorded in the 'Other Vaccinations' pages.

Available quadrivalent ACWY vaccines

There are currently three quadrivalent meningococcal conjugate vaccines licensed in the UK:

- Menveo® (marketing authorisation from two years of age, adolescents and adults) [26].
- Nimenrix® (marketing authorisation in individuals from six weeks of age) [27].
- MenQuadfi® (marketing authorisation in individuals from 12 months of age [28].

Polysaccharide ACWY vaccine (ACWY Vax) has not been available in the UK since 2014.

Table 1: Meningococcal ACWY vaccine schedule for travel: recommendations from the 'Green Book' [11] *

Age	ACWY schedule
Birth to less than one year*	First dose of 0.5ml Second dose of 0.5ml one month after the first dose
From one year of age (including adults)	Single dose of 0.5ml

***The Summary of Product characteristics (SPC) for each vaccine is available via the electronic medicines compendium (emc) and should be consulted for specific information relating to these products. Please note, manufacturers' information may differ from that in the 'Green Book', in these situations the Green Book should be followed. As of July 2022, Menveo® has a marketing authorisation for use in children from 2 years of age, Nimenrix® has a marketing authorisation for use in children from 6 weeks of age and MenQuadfi® from 12 months of age [24].**

Reinforcing immunisation

The Joint Committee on Vaccination and Immunisation (JCVI) Committee reviewed information on length of protection following ACWY conjugate vaccination [26]. Antibody against serogroup A disease was the first to wane, and this meant boosting was important for travel, but less important for the routine MenACWY programme in the UK. For travellers at continued risk, the Committee agreed that boosting every five years would be a sensible approach until data became available [29].

Intervals between Men ACWY conjugate vaccine and other meningococcal vaccines

Currently available evidence indicates that Bexsero® (MenB vaccine) can be safely co-administered with MenC and MenACWY conjugate vaccines and other conjugate vaccines (for example pneumococcal and Hib vaccines) without affecting the immune response to either vaccine [30]. Additional information on concomitant administration of MenQuadfi® and PCV-13 vaccines is available in the manufacturer's summary for MenQuadfi® [28].

For guidance on intervals between the different types of meningococcal vaccines, see Immunisation against infectious disease 'The Green Book': Chapter 22 Meningococcal.

Contraindications

Known hypersensitivity to any components of the vaccine, or to a previous dose. Vaccination should be delayed during an acute febrile illness [23].

Adverse Reactions

For Menveo®, injection site reactions (including pain, erythema, induration and pruritus), headache, nausea, rash and malaise have been commonly reported.

For Nimenrix®, injection site reactions (including pain, erythema and swelling), irritability, drowsiness, headache, nausea and loss of appetite have been commonly reported.

For MenQuadfi®, myalgia, injection site pain and headaches have been very commonly reported.

Details of all adverse reactions can be found in the SPC of individual vaccines.

Resources

- Hajj and Umrah factsheet
- NHS: Meningitis
- UK Health Security Agency: Immunisation against infectious disease 'The Green Book': Chapter 22 Meningococcal
- UK Health Security Agency: Meningococcal disease: guidance, data and analysis
- WHO: Meningococcal meningitis. Defeating meningitis by 2030: Development of the roadmap

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