World Health Organization

Meningitis

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Key facts

- **Meningitis is a devastating disease with a high case fatality rate and leading to serious long-term complications (sequelae).**
- **Meningitis remains a major global public-health challenge.**
- **Epidemics of meningitis are seen across the world, particularly in sub-Saharan Africa.**
- **Many organisms can cause meningitis including bacteria, viruses, fungi, and parasites.**
- **Bacterial meningitis is of particular concern. Around 1 in 10 people who get this type of meningitis die and 1 in 5 have severe complications.**
- **Safe affordable vaccines are the most effective way to deliver long-lasting protection.**

The focus of this fact sheet is on the four main causes of acute bacterial meningitis:

- *Neisseria meningitidis* (meningococcus)
- *Streptococcus pneumoniae* (pneumococcus)
- *Haemophilus influenzae*
- *Streptococcus agalactiae* (group B streptococcus)

These bacteria are responsible for more than half of the deaths from meningitis globally and they cause other severe diseases like sepsis and pneumonia.

Other bacteria e.g., *Mycobacterium tuberculosis*, Salmonella, Listeria, Streptococcus and Staphylococcus, viruses such as enteroviruses and mumps, fungi especially Cryptococcus, and parasites like Amoeba are also important causes of meningitis.

Who is at risk?

Although meningitis affects all ages, young children are most at risk. Newborn babies are at most risk from Group B streptococcus, young children are at higher risk from meningococcus, pneumococcus and Haemophilus influenzae. Adolescents and young adults are at particular risk of meningococcal disease while the elderly are at particular risk of pneumococcal disease.

People all over the world are at risk of meningitis. The highest burden of disease is seen in a region of sub-Saharan Africa, known as the African Meningitis Belt, especially recognised to be at high risk of epidemics of meningococcal but also pneumococcal meningitis.

Higher risk is seen when people are living in close proximity, for example at mass gatherings, in refugee camps, in overcrowded households or in student, military and other occupational settings. Immune deficiencies such as HIV infection or complement deficiency, immunosuppression, and active or passive smoking can also raise the risk of different types of meningitis.

Transmission

The route of transmission varies by organism. Most bacteria that cause meningitis such as meningococcus, pneumococcus and *Haemophilus influenzae* are carried in the human nose and throat. They spread from person to person by respiratory droplets or throat secretions. Group B streptococcus is often carried in the human gut or vagina and can spread from mother to child around the time of birth.

Carriage of these organisms is usually harmless and helps build up immunity against infection, but the bacteria occasionally invade the body causing meningitis and sepsis.

Signs and symptoms

The incubation period is different for each organism and can range between two and 10 days for bacterial meningitis. Since bacterial meningitis is often accompanied by sepsis, the signs and symptoms cover both conditions.

Signs and symptoms can include:

- severe headache
- stiff or painful neck
- high fever
- avoiding bright light
- drowsy, confused, comatose
- convulsions
- rash
- joint pains

- cold hands and feet
- vomiting

In babies, signs can include:

- poor feeding
- sleepy, difficult to wake, comatose
- irritable, crying when handled
- difficulty breathing, grunting
- fever
- neck rigidity
- bulging soft spot on top of head (fontanelle)
- high pitched cry
- convulsions
- vomiting
- rash
- pale or blotchy skin

Prevention

Preventing meningitis through vaccination is the most effective way to reduce the burden and impact of the disease by delivering long-lasting protection.

Antibiotics are also used to help prevent infection in those at high risk of meningococcal and group B streptococcal disease. Controlling epidemics of meningococcal meningitis relies on both vaccination and antibiotics.

1. Vaccination

Licensed vaccines against meningococcal, pneumococcal and *Haemophilus influenzae* disease have been available for many years. These bacteria have several different strains (known as serotypes or serogroups) and vaccines are designed to protect against the most harmful strains. Over time, there have been major improvements in strain coverage and vaccine availability, but no universal vaccine against these infections exists.

Meningococcus

The meningococcus has 12 serogroups, with A,B,C,W,X,and Y causing most meningitis.

There are three types of vaccine available:

- Polysaccharide-protein conjugate vaccines (conjugate vaccines) are used in prevention and

outbreak response:
  - They confer longer-lasting immunity, and also prevent carriage, thereby reducing transmission and leading to herd protection.
  - They are effective in protecting children under two years of age.
  - Vaccines are available in different formulations:
    - monovalent vaccines (serogroup A or C)
    - tetravalent vaccines (serogroups A, C, W, Y).
    - in combination (serogroup C and *Haemophilus influenzae* type b)
- Protein based vaccines against serogroup B. These vaccines protect against meningitis in all ages but are not thought to prevent carriage and transmission so do not lead to herd protection.
- Polysaccharide vaccines are safe and effective in children and adults, but weakly protective in infants. Protection is short-lived and they do not lead to herd protection as they do not prevent carriage. They are still used for outbreak control but are being replaced by conjugate vaccines.

Global public health response – elimination of meningococcal A meningitis epidemics in the African meningitis belt

In the African meningitis belt, meningococcus serogroup A accounted for 80–85% of meningitis epidemics before the introduction of a meningococcal A conjugate vaccine through mass preventive campaigns (since 2010) and into routine immunization programmes (since 2016). As of April 2021, 24 of the 26 countries in the meningitis belt have conducted mass preventive campaigns targeting 1-29 year olds (nationwide or in high-risk areas), and half of them have introduced this vaccine into their national routine immunization schedules. Among vaccinated populations, incidence of serogroup A meningitis has declined by more than 99% - no serogroup A case has been confirmed since 2017. Continuing introduction into routine immunization programmes and maintaining high coverage is critical to avoid the resurgence of epidemics.

Cases of meningitis and outbreaks due to other meningococcal serogroups, apart from serogroup B, continue to strike. The roll out of multivalent meningococcal conjugate vaccines is a public health priority to eliminate bacterial meningitis epidemics in the African Meningitis Belt.

Pneumococcus

The pneumococcus has over 97 serotypes, 23 causing most disease.

- Conjugate vaccines are effective from 6 weeks of age at preventing meningitis and other severe pneumococcal infections and are recommended for infants and children up to the age of 5 years, and in some countries for adults aged over 65 years, as well as individuals from certain risk groups. Two different conjugate vaccines are in use that protect against 10 and 13 serotypes. New conjugate vaccines designed to protect against more pneumococcal serotypes are either in development or have been approved for use in adults. Research continues into protein based

vaccines.

- A polysaccharide vaccine against 23 serotypes is available but, as for other polysaccharide vaccines, this type of vaccine is considered less effective than conjugate vaccines. It is used mostly in those aged over 65 years to protect against pneumonia, as well as in individuals from certain risk groups. It is not used in children under 2 years of age and is less useful in protecting against meningitis.

Haemophilus influenzae

Haemophilus influenzae has 6 serotypes, serotype b causing most meningitis.

- Conjugate vaccines protect specifically against *Haemophilus influenzae* serotype b (Hib). They are highly effective in preventing Hib disease and are recommended for routine use in infant vaccine schedules.

Group B streptococcus

Group B streptococcus has 10 serotypes, 1a, 1b, II, III, IV and V causing most disease.

- Conjugate and protein vaccines designed to protect against group B streptococcal disease in mothers and babies are in clinical development.

2. Antibiotics for prevention (chemoprophylaxis)

Meningococcus

Antibiotics for close contacts of those with meningococcal disease, when given promptly, decreases the risk of transmission. Outside the African meningitis belt, chemoprophylaxis is recommended for close contacts within the household. Within the meningitis belt, chemoprophylaxis for close contacts is recommended in non-epidemic situations. Ciprofloxacin is the antibiotic of choice, and ceftriaxone an alternative.

Group B streptococcus

Identifying mothers whose babies are at risk of getting Group B streptococcal disease is recommended in many countries. One way to do this is by universal screening for carriage of Group B streptococcus in pregnancy. Mothers at risk are offered intravenous penicillin during labour to prevent their babies developing Group B streptococcal infection.

Diagnosis

Initial diagnosis of meningitis can be made by clinical examination followed by a lumbar puncture. The bacteria can sometimes be seen in microscopic examinations of the spinal fluid. The diagnosis is supported or confirmed by growing the bacteria from specimens of cerebrospinal

fluid or blood, by rapid diagnostic tests or by polymerase chain reaction (PCR). The identification of the serogroups and susceptibility to antibiotics are important to define control measures. Molecular typing and whole genome sequencing identify more differences between strains and inform public health responses.

Treatment

Meningitis is fatal in up to half of patients, when left untreated, and should always be viewed as a medical emergency. Admission to a hospital or health centre is necessary. Isolation of the patient is not usually advised after 24 hours of treatment.

Appropriate antibiotic treatment must be started as soon as possible in bacterial meningitis. Ideally, lumbar puncture should be done first as antibiotics can make it more difficult to grow bacteria from the spinal fluid. However, blood sampling can also help to identify the cause and the priority is to start treatment without delay. A range of antibiotics is used to treat meningitis, including penicillin, ampicillin, and ceftriaxone. During epidemics of meningococcal and pneumococcal meningitis, ceftriaxone is the drug of choice.

Complications and sequelae

One in five people surviving an episode of bacterial meningitis may have long lasting after-effects. These after-effects include hearing loss, seizures, limb weakness, difficulties with vision, speech, language, memory, and communication, as well as scarring and limb amputations after sepsis.

Support and after-care

Meningitis sequelae can have an enormous impact on individuals, families and communities, both financially and emotionally. Sometimes, complications such as deafness, learning impairment or behavioural problems are not recognized by carers and healthcare workers and therefore go untreated.

Those who have lived through meningitis often have health-care needs requiring long-term medical treatments. The ongoing psychosocial impacts of disability from meningitis can have medical, educational, social and human rights-based implications. Despite the high burden of meningitis sequelae on people with meningitis, their families and the community, access to both services and support for these conditions is often insufficient, especially in low and middle income countries. Individuals and families with members disabled by meningitis should be encouraged to seek servies and guidance from local and national Organizations of Disabled People (ODPs) and other disability focused organizations, which can provide vital advice about

legal rights, economic opportunities and social engagement to ensure people disabled by meningitis are able to live full and rewarding lives.

Surveillance

Surveillance, from case detection to investigation and laboratory confirmation is essential to the control of meningitis. Main objectives include:

- **Detect and confirm outbreaks.**
- **Monitor the incidence trends, including the distribution and evolution of serogroups and serotypes.**
- **Estimate the disease burden.**
- **Monitor the antibiotic resistance profile.**
- **Monitor the circulation, distribution, and evolution of specific strains (clones).**
- **Estimate the impact of meningitis control strategies, particularly preventive vaccination programmes.**

WHO response

The global roadmap “Defeating Meningitis by 2030” was developed by WHO with the support of many partners. The strategy was approved in the first ever resolution on meningitis by the World Health Assembly in 2020 and endorsed unanimously by WHO member states.

The roadmap sets a comprehensive vision “Towards a world free of meningitis” and has three visionary goals:

- **Elimination of bacterial meningitis epidemics.**
- **Reduction of cases of vaccine-preventable bacterial meningitis by 50% and deaths by 70%.**
- **Reduction of disability and improvement of quality of life after meningitis due to any cause.**

It sets a path to achieve goals, through concerted actions across five interconnected pillars:

- **Prevention and epidemic control focused on the development of new affordable vaccines, achievement of high immunization coverage, improvement of prevention strategies and response to epidemics.**
- **Diagnosis and treatment, focused on speedy confirmation of meningitis and optimal patient care.**
- **Disease surveillance to guide meningitis prevention and control.**
- **Care and support of those affected by meningitis, focusing on early recognition and improved access to care and support for complications from meningitis, and**
- **Advocacy and engagement, to ensure high awareness of meningitis, to promote country engagement and to affirm the right to prevention, care, and after-care services.**

In a complementary initiative, the WHO is working on the I*ntersectoral global action plan on*

epilepsy and other neurological disorders in consultation with Member States to address many challenges and gaps in providing care and services for people with epilepsy and other neurological disorders that exist worldwide. Human rights for people affected by disability are also recognised and addressed in the WHO Global Disability Action Plan in alignment with the Convention on the Rights of the Child and the Convention on the Rights of Persons with Disability (CRPD) and in a landmark resolution on attaining the highest standard of health for persons with disabilities adopted at the 74th World Health Assembly.

While the road map on defeating meningitis addresses all meningitis regardless of the cause, it primarily focuses on the main causes of acute bacterial meningitis (meningococcus, pneumococcus, *Haemophilus influenzae* and group B streptococcus). These bacteria were responsible for over 50% of the 250,000 deaths from all-cause meningitis in 2019. They also cause other severe diseases like sepsis and pneumonia. For each of these infections, vaccines are either available, or in the case of group B streptococcus, likely to become available in the next few years.

Source:

Defeating meningitis 2030: baseline situation analysis

Defeating meningitis 2030: global roadmap

Confederation of Meningitis Organizations - Facts | CoMO (comomeningitis.org)

Web-based consultation on the first draft of the Intersectoral global action plan on epilepsy and other neurological disorders

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