Defeating Meningitis by 2030
a global roadmap

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Executive summary

Meningitis is deadly and debilitating, striking fast with serious health, economic and social consequences, and affecting people of all ages in all countries of the world. Bacterial meningitis can cause epidemics, lead to death within 24 hours, and leave one in five patients with lifelong disability after infection. Many cases and deaths from meningitis are vaccine-preventable, but progress in defeating meningitis lags behind other vaccine preventable diseases.

In 2017, representatives from governments, global health organizations, public health bodies, academia, private sector, and civil society called for a global vision to defeat meningitis. WHO took up the call to action and, with global partners and experts involved in meningitis prevention and control, developed a roadmap to defeat meningitis by 2030. Wide public and expert consultations took place through 2019.

This first global roadmap on meningitis sets a path to tackle the main causes of acute bacterial meningitis (meningococcus, pneumococcus, *Haemophilus influenzae* and group B streptococcus). The three visionary goals are to (i) eliminate bacterial meningitis epidemics, (ii) reduce cases and deaths from vaccine-preventable bacterial meningitis and (iii) reduce disability and improve quality of life after meningitis due to any cause. In order to achieve these visionary goals, strategic goals, key activities and milestones are set out in five pillars: Prevention and epidemic control, Diagnosis and treatment, Disease surveillance, Support and care for people affected by meningitis, Advocacy and engagement.

For prevention and epidemic control, the main drive for action is achieving higher coverage of existing vaccines, development of new vaccines, improved prevention strategies and more efficient response to epidemics. The diagnosis and treatment goals are focused on speedy confirmation of meningitis and optimal care. Improved global surveillance based on effective national surveillance systems is needed to guide meningitis prevention and control measures, to document the impact of vaccines and to improve estimation of disease burden including sequelae. For care and support of those affected by meningitis, the focus is on early recognition and improved management of after-effects from meningitis, on availability of support and access to care. For advocacy and engagement, the drive is to ensure that the roadmap is prioritized and integrated into country plans, that there is high population awareness of meningitis and the impact of this illness as well as the right to meningitis prevention and care, with increased acceptance and demand for vaccines and after-care services.

The meningitis roadmap has been designated as a flagship global strategy in WHO’s 13th Programme of Work and is an essential component of achieving Universal Health Coverage (UHC). The roadmap will reinforce, and integrate with, wider initiatives relating to strengthening primary health care and health systems, increasing immunization coverage, global health security, fighting antimicrobial resistance, ensuring disability rights and inclusion. It will complement other global control strategies such as those addressing sepsis, pneumonia, tuberculosis and HIV.

Implementation will be a challenge for all countries across the world, but especially in resource poor settings where the burden of meningitis is greatest. Targets for visionary and strategic goals will be adapted to regional and local context. Plans for monitoring and evaluation, communications, and risk management will be available to guide and support implementation.

Global action to implement this strategy and achieve the ambitious goals to defeat meningitis is needed now. Strong commitments from countries, partners, and donors will be essential to success.
Meningitis – a call for action

This roadmap is a call to action. It is a call towards the defeat of meningitis by 2030.

Meningitis is a life-threatening disease caused by inflammation of the membranes that surround the brain and spinal cord, is predominantly caused by infection with bacteria and viruses1. Acute bacterial meningitis (1) is one of the deadliest and most disabling forms of this illness (2-5), as it can cause epidemics, lead to death within 24 hours, and leave one in five with lifelong disability after infection.

Many cases and deaths from meningitis are vaccine-preventable, but progress in defeating meningitis lags behind other vaccine preventable diseases (6). Despite significant progress over the past 20 years, there were still an estimated 5 million new cases and 290,000 deaths globally from meningitis in 2017 (7). Although meningitis affects all ages, young children are most at risk with around half of cases and deaths in children under 5 years old. Meningitis and meningitis related sepsis can lead to severe after effects such as hearing loss, visual impairment, physical impairment, cognitive disability and limb loss that have a considerable emotional, social and financial impact on individuals, families and communities (8-10). In 2017, over 20 million years of healthy life were estimated as lost (years of life lost due to premature mortality added to years lost due to disability) from meningitis worldwide (5).

Although the burden of meningitis is greatest in the meningitis belt of sub-Saharan Africa, meningitis is a threat in all countries of the world (4,6,10) (Figure 1). Since 2014, epidemics of bacterial meningitis have been seen from Kyrgyzstan to Fiji, to Nigeria and Niger, to Chile and the USA (11-13), with the spread of some virulent strains across the world emphasizing the need for a global approach to surveillance and prevention. Recommended vaccination programmes against some of the bacteria causing meningitis have not yet been introduced in many countries, leaving their people at risk (5, 14). Wherever it is seen, meningitis presents a major challenge for health systems, the economy and society.

1 Meningitis can also be caused by infection with fungi and parasites, with cryptococcal meningitis having an increasing importance among adults living with HIV. Meningitis can also develop as a result of non-infectious factors, including certain medications, cancer and autoimmune diseases
In May 2017, over 50 representatives from governments, global health organizations, public health bodies, academia, private sector, and civil society called for a global vision action to “defeat meningitis by 2030” (15). In September of that year, 200 representatives from the 26 countries of the African meningitis belt amplified this call and highlighted the need for equitable and sustainable access to meningitis vaccines (16).

WHO is coordinating this call to action. A Technical Task Force of major partners historically invested in long-term meningitis control, with complementary focus and expertise, was convened to develop the roadmap presented here. A baseline situation analysis (5) was undertaken in 2018, and experts in meningitis, health and disability met early in 2019 to advance the draft roadmap (17) followed by wider expert and public consultations through 2019.

Patient groups around the world were extensively consulted about the global roadmap (18). In responses from over 600 groups in more than 90 countries, prevention was given the highest priority. The three most popular topics for inclusion in the roadmap were making vaccines more widely available, improved awareness, and improved diagnosis (immediate, rapid).

The meningitis roadmap has been designated as one of the four flagship global strategies in the WHO 13th Global Programme of Work to prevent high-threat infectious hazards. This strategy captures the essence of WHO’s mission set to drive progress towards the United Nations Sustainable Development Goals for 2030, especially SDG3 for health, structured around ensuring Universal Health Coverage (UHC) to protect the most vulnerable, and global health security to promote health, and keep the world safe (19, 20).

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2 The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city of area or of its authorities, or concerning the delimitation of its frontiers or boundaries.
Scope

This roadmap on meningitis sets a path to tackle the main causes of acute bacterial meningitis: Neisseria meningitidis (Nm, meningococcus), Streptococcus pneumoniae (Spn, pneumococcus), Haemophilus influenzae (Hi) and Streptococcus agalactiae (group B streptococcus, or GBS). This focus is based on (i) evidence of the worldwide burden of disease due to these four organisms, which also cause sepsis and pneumonia, that were responsible for over 50% of the 290,000 deaths from all cause meningitis in 2017 (7), and (ii) the impact that this global strategy could have to diminish the burden by 2030, since effective vaccines are available (now or in development) that protect against disease due to all four organisms. Although the focus of this roadmap is not on other important causes of meningitis such as tuberculosis, Cryptococcus, enteric bacteria and viruses such as Enterovirus, several goals directed at reducing the burden of disease are applicable to all causes of meningitis.

Vision

Roadmap vision

Towards a world free of meningitis

Our collective vision is “Towards a world free of meningitis”. Because meningitis has so many causes, it cannot be eliminated or eradicated. There will be no “world free” moment for meningitis. But we are committed to get as close to that as possible. This plan therefore aims to defeat meningitis as a public health threat, reducing the number of cases substantially and keeping them down.

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3 Other bacteria, such as non-typhoidal salmonella, Listeria monocytogenes, Streptococcus suis and, in healthcare settings, pathogens such as Staphylococcus aureus or S. epidermidis also cause meningitis, even if less frequently.
Visionary goals by 2030

All UN Member States have agreed to achieve UHC by 2030 (20). Visionary goals to eliminate epidemics, bring down cases and deaths, and give priority to care of disability are fully aligned with UHC and the drive for expanded Primary Health Care (PHC), with equity as a guiding principle.

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**Visionary goals by 2030**

- **✓ Eliminate bacterial meningitis epidemics***

- **✓ Reduce cases and deaths from vaccine-preventable bacterial meningitis**

- **✓ Reduce disability and improve quality of life after meningitis due to any cause**

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* An epidemic is defined for this goal as a cumulative attack rate of >100 suspected meningitis cases /100,000 population within one year in a given population based on a definition used for the African meningitis belt (21). Each Region will set their own definitions for epidemics/outbreaks and targets for reduction according to local epidemiology.

** Global and regional targets to be agreed and applied to acute bacterial meningitis.

The overall framework (theory of change) of the roadmap is summarized in Figure 2.

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* Although epidemic and outbreak can be used interchangeably, an outbreak is normally smaller and more localized. The word epidemic has been used throughout this roadmap.
Figure 2: Overall framework for global roadmap to defeat meningitis by 2030

**Issues**
- Meningitis causes 300,000 deaths a year globally and carries a risk of epidemics, many cases could be prevented by vaccination.
- Tools, supplies, and facilities for diagnosis and treatment are insufficient.
- Surveillance systems are not strong enough to document the numbers, causes and effects of meningitis.
- Meningitis and sepsis are a major cause of disability but availability and access to care and rehabilitation are weak.
- Awareness of meningitis as a global problem is low among policymakers.

**Inputs**
- Countries commit to develop, implement and prioritize plans to defeat meningitis.
- Partners commit to providing oversight, technical expertise, and innovative development.
- Donors commit to supporting the global plan.
- Civil society commits to endorsing the roadmap and raising awareness.

**Outputs**
- Achieve high vaccine coverage, develop new vaccines, develop strategies for prevention and epidemic control.
- Ensure availability of diagnostic tools, health workers trained, quality-assured treatment.
- Ensure surveillance of meningitis and monitoring of sequelae at all levels.
- Ensure management of sequelae and care for people affected by meningitis.
- Ensure meningitis has high global priority with awareness of meningitis and disability at all levels.

**Outcome**
- Enhanced access to improved vaccines and effective strategies for prevention and epidemic control.
- Improved tools and access to diagnosis and treatment.
- Improved monitoring of meningitis epidemiology through disease surveillance.
- Improved access to support and care for people and families affected by meningitis.
- Higher awareness through advocacy and engagement.

**Impact by 2030**
- Epidemics of bacterial meningitis are eliminated.
- Cases and deaths from vaccine-preventable bacterial meningitis are reduced.
- Disability is reduced and quality of life improved after meningitis due to any cause.
Pillars, strategic goals, key activities and milestones

The impact (the three visionary goals) depends on the outputs and outcomes that are organized into five pillars:

- Prevention and epidemic control
- Diagnosis and treatment
- Disease surveillance
- Support and care for people affected by meningitis
- Advocacy and engagement

Each pillar sets out strategic goals, key activities and specific milestones to be achieved in order to reach these goals. While serving to organize action, it is clear that the five pillars are interconnected: diagnosis is closely linked to surveillance, surveillance informs prevention and epidemic control, support and care for patients and families should commence during treatment at the time of diagnosis, and advocacy and engagement are necessary for the success of every pillar (Figure 3).

*Figure 3: The overlapping pillars to defeat meningitis*

Links between the five pillars and the 19 strategic goals are set out under each pillar. GBS is singled out for some goals as (i) GBS has a particularly high incidence in new born babies, (ii) GBS vaccines are in development, but not yet available, (iii) knowledge of disease burden and prevention strategies are less well established than for Nm, Spn and Hi, especially for Low and Middle Income Countries (LMICs).
Wider benefits and complementarity

The efforts of this roadmap will overlap with and provide benefits for much more than meningitis, by complementing global control strategies for diseases such as sepsis and pneumonia that can be caused by the same organisms which cause meningitis. In addition, the roadmap will reinforce and integrate with wider initiatives relating to UHC, PHC, health systems strengthening, immunization, global health security, antimicrobial resistance (AMR), and disability rights, support, rehabilitation and inclusion (see Connection to other global initiatives), that will also help achieve existing country priorities. Roadmap activities will form an integral part of PHC aligned with national strategies to achieve UHC and other initiatives at all levels.

Implementation

The successful implementation of the roadmap will depend foremost, on regional and country engagement and political willingness to defeat meningitis. Their efforts will require aligned and effective partner support to bring all globally available resources (technical, human and financial) as well as the support of the WHO secretariat. A business case will be used to mobilize sufficient resources for WHO & partners to support Member States to deliver on the strategic objectives, together with a Public Health Value Proposition for one or more priority milestones. Global research priorities, that are needed to achieve the goals, will be identified separately in the implementation plan.

A Strategy Support Group of global-level partners and sponsors, committed to the mission of defeating meningitis, is expected to promote the roadmap through high level advocacy, raising public awareness and supporting implementation activities.

The WHO secretariat, constituted of staff from the Department of Immunization, Vaccines and Biologicals, the Department of Mental Health and Substance Abuse, the Department for Management of Noncommunicable Diseases, Disability, Violence and Injury Prevention, and the WHO Health Emergencies Programme at country, regional and global levels, will provide integrated support, coordination and oversight, with accountability to its Member States for the development and implementation of the roadmap.

Country planning will take into consideration regional specificities and will be adapted to country settings under different activity streams including Research and Development, Strategy & Policy, Field implementation. Targets for visionary and strategic goals will be prioritized and adapted according to regional and local context, with priority countries identified within each Region taking into consideration of factors such as meningitis burden and equity of access to prevention and care. Plans for monitoring and evaluation, communications, and risk management will be available to guide and support implementation. To ensure it meets regional needs and specificities and promote regional commitment, Regions will develop specific implementation frameworks including key regional indicators, to be endorsed by the Regional Technical and Advisory Bodies.
Pillar 1: Prevention and epidemic control

Achieved through development and enhanced access to affordable vaccines, effective prophylactic strategies and targeted control interventions

Enhanced efforts are needed to advocate for all recommended immunization, especially in LMICs where the burden of meningitis is greatest, and to promote high levels of vaccine coverage at national and sub-national level. Conjugate vaccines are dramatically reducing the global burden of disease caused by Nm, Spn and Hi type b (Hib) but their global uptake and impact needs to be enhanced (5). However, not all serogroups/types are presently covered by these vaccines. Novel protein-based vaccines against Nm serogroup B (MenB) disease are now being used at public health scale in some High Income Countries (HICs) (5). No vaccine yet exists for the prevention of GBS disease, but GBS conjugate vaccine candidates are in development. Several Nm and Spn conjugate vaccine candidates are also in late stage development including multivalent products with broader serogroup/type coverage than existing vaccines. In addition, protein vaccine candidates against Nm, Spn and GBS are in various stages of development. Also, as high usage of antibiotics in the treatment of suspected meningitis can lead to the development of AMR, enhanced and sustained vaccination programmes being developed in Immunization Agenda 2030 will have an increasingly important role in strategies for mitigating the negative impact of AMR. National plans should include vaccines as a key strategic priority or as a first line of defense against AMR.

Chemoprophylaxis is generally used for close contacts of cases of meningococcal meningitis, but needs further evaluation, particularly in the context of epidemics in the African meningitis belt. Policies for prevention of GBS transmission from pregnant mothers to newborns using intravenous antibiotics are implemented using screening or risk-based strategies in many HICs. Evaluation of factors such as GBS disease burden, epidemiology and transmission, health service infrastructure, healthcare access, antibiotic supplies is needed before recommending prevention strategies for LMICs.

Although improvements in laboratory capacity have been seen through Invasive Bacterial Diseases surveillance networks, the most important challenges in the control of Nm or Spn meningitis epidemics include weak laboratory capacity to rapidly confirm the epidemic pathogen (see Pillar 2) and lack of timely access to sufficient quantities of affordable vaccines for epidemic response. For Spn meningitis epidemics, guidance on response is needed. Ultimately, evidence-based policy adjustment followed by high uptake of adequate preventive vaccination strategies using appropriate vaccines would ideally prevent the occurrence of cases and epidemics.

The aims of this pillar are to (i) achieve and maintain high coverage of licensed/WHO-prequalified vaccines against Nm, Spn and Hib with equitable access in all countries, and introduce these vaccines in countries that have not yet introduced them in line with WHO recommendations (ii) introduce effective and affordable new WHO prequalified vaccines targeting Nm, Spn, Hi and GBS (iii) develop evidence-based policy on vaccination strategies that result in optimal individual protection and, where possible, herd protection (iv) develop and implement context-specific strategies to prevent GBS infection in infants (v) develop and improve strategies for epidemic prevention and response including vaccination, chemoprophylaxis, infection control and risk communication, inclusive of mass gatherings and humanitarian emergencies.
<table>
<thead>
<tr>
<th>Strategic goals</th>
<th>Key activities</th>
<th>Landmark goals (milestones)</th>
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</table>
| **SG 1**: Achieve and maintain high coverage of licensed WHO-prequalified vaccines against Nm, Spn, and Hib with equitable access in all countries and introduce these vaccines in countries that have not yet introduced them in line with WHO recommendations  | Implement locally appropriate tailored immunization strategies to achieve and maintain high vaccination coverage against Nm, Spn, Hib in all countries, reinforcing and complementing existing immunization strategies, including those targeting special risk groups  
                                                                              | Ensure proper linkages and synergies with WHO, UNICEF, Gavi and other global or regional initiatives aiming to reduce price and increase sustainable access to vaccines for LMICs                                                                 |
|                                                                                 |                                                                                                                                                                                                             | *Nm (meningitis belt)*  
By 2021, vaccination against Nm serogroup A in routine immunization programmes in >= 18 meningitis belt countries; by 2023, in all meningitis belt countries as per national priorities  
*Spn, Hib*  
By 2022, Hib conjugate vaccines, and by 2025 Spn conjugate vaccines, included in routine infant immunization programmes in all countries  
By 2030, vaccine coverage of the full immunization schedule maintained or achieved in all countries (target coverage as defined by Immunization Agenda 2030 and regional prioritization) |
| *(link to SG18 Health care rights, SG19 Vaccine confidence)*                     |                                                                                                                                                                                                             |                                                                                                                                                              |
| **SG2**: Introduce effective and affordable new WHO pre-qualified vaccines targeting Nm, Spn, Hi and GBS  
*(link to SG3 Vaccination strategy, SG10 Regional surveillance)*               | Support development, licensure, WHO prequalification and introduction of effective, affordable and safe vaccines: additional multivalent meningococcal conjugate vaccines, additional MenB vaccines, additional pneumococcal, Hi and GBS vaccines  | *Nm*  
By 2020, WHO target product profile (TPP) for multivalent meningococcal conjugate vaccine published, including thermostability considerations  
By 2021, WHO Technical Report Series (TRS) for multivalent meningococcal conjugate vaccine published  
By 2022, at least one affordable multivalent (ACWXY) meningococcal conjugate vaccine licensed and WHO prequalified  
By 2023, introduction of vaccination against Nm serogroups ACWY/ACWXY in routine immunization programmes started in >=5 meningitis belt countries; and by 2030, vaccination against Nm serogroups ACWY/ACWXY implemented in meningitis belt countries, as |
per national priorities, with target coverage as defined by Immunization Agenda 2030 and regional prioritization
By 2026, at least one affordable Nm serogroup B vaccine and sufficient sources of affordable multivalent meningococcal conjugate vaccines to ensure security of supply
By 2026, locally relevant meningococcal disease vaccination programmes, including Nm multivalent conjugate vaccines and/or Nm serogroup B vaccines as relevant, introduced in alignment with epidemiological evidence and according to regional policy in >=10 countries

*Spn*
By 2021, WHO TRS for pneumococcal conjugate vaccines (PCVs) updated
By 2021, at least one, and by 2025 at least three, additional affordable PCVs, with coverage consistent with emerging data on serotypes causing invasive disease in LMICs, licensed and WHO prequalified
By 2026, at least one new Spn vaccine with broader coverage – either higher valency PCV or protein containing vaccine - licensed and WHO prequalified

*GBS*
By 2022, regulatory pathways for licensure of GBS vaccines defined, based on consultations with National Regulatory Authorities and WHO Prequalification Team
By 2026, at least one affordable vaccine against GBS licensed and WHO prequalified for maternal immunization during pregnancy
By 2030, GBS vaccine introduced, if licensed/ WHO pre-qualified, with Gavi support where needed, in >=10 countries with an established burden of GBS, in line with WHO policy
<table>
<thead>
<tr>
<th>SG3: Develop evidence-based policy on Nm, Spn, Hi and GBS vaccination strategies that result in optimal individual protection and, where possible, herd protection (link to SG2 New vaccines, SG18 Health care rights)</th>
<th>Improve support to vaccine manufacturers in their efforts to ensure diversification of sufficient quality-assured vaccine production capacity in more countries, including LMICs</th>
</tr>
</thead>
</table>
| | Hi type a (Hia)  
By 2028, at least one vaccine against Hia licensed to address high burden of disease in some communities, e.g. indigenous peoples in N. America and Australia |
| | By 2030, sufficient sources of affordable and high quality Spn and Nm multivalent conjugate vaccines to ensure security of supply |
| | By 2030, sufficient quality-assured vaccine production capacity diversified into >=5 LMICs for Hib, Spn and Nm multivalent conjugate vaccines |
| | Evaluate vaccination strategies for use of multivalent meningococcal conjugate vaccines to achieve herd protection |
| | By 2022, modeling research studies on multivalent meningococcal conjugate vaccination strategy completed and results disseminated with open access to support vaccine introduction strategies |
| | By 2024, cluster randomized studies and/or carriage studies on multivalent meningococcal conjugate to inform vaccination strategy completed and published |
| | Develop global policy for use of MenB and multivalent meningococcal conjugate vaccines and support national policy-making as relevant |
| | By 2022, global policy available for use of MenB and multivalent meningococcal conjugate vaccines |
| | By 2030, global policy updated as new vaccines and evidence become available |
| | Enable and promote sharing of learnings between countries (e.g. on accurate cost-effectiveness models) to support national policy decisions, particularly in low incidence settings |
| | Assess the overall vaccine impact, duration of protection, serotype replacement and indirect effects induced with different pneumococcal conjugate vaccine (PCV) |
| | By 2025, vaccine effects and duration of protection induced with different PCV schedules documented, including feasibility of new |
| SG4: Develop and implement context-specific strategy to prevent GBS infection in infants  
(link to SG8 GBS diagnosis, SG11 GBS surveillance, SG18 Health care rights) | Conduct research to further document transmission patterns of GBS and risk factors for early/late onset GBS disease  
Develop and implement global strategy on preventing GBS transmission to infants considering evidence, burden and feasibility, with consideration for potential impact on AMR, linking with other sepsis, maternal and child health initiatives  
Ensure community/peripheral level health workers are trained and provided with suitable resources to enable them to appropriately identify, and offer prophylaxis against early-onset group B Strep disease | By 2023, study completed on transmission of GBS and risk factors for early/late onset GBS disease  
By 2021, either test-based or risk-based strategies against early onset GBS disease recommended for countries/Regions according to disease burden and feasibility of implementation  
By 2025, global strategy available on GBS prevention  
By 2028, recommended prevention policies implemented in medium/high burden countries as defined in the GBS strategy, unless superseded by a vaccination programme |
|---|---|---|
| schedules to inform vaccination strategies for use of PCVs in order to maintain immunity in populations and to prevent/control vaccine-preventable pneumococcal disease among at-risk individuals  
dosing schedules, catch-up campaigns, and immunization programmes in older age groups to prevent serotype 1 epidemics | Establish immune correlates of protection (serogroup/type specific) for Nm, Spn, and GBS | By 2025, studies to establish further immune correlates of protection in different transmission settings conducted and published for Nm, Spn and GBS |
| Quantify the potential benefits of Nm, Spn, Hi and GBS vaccines on decreasing overall antibiotic use for invasive infections or prophylaxis and on reducing AMR | By 2024, potential benefits of Nm, Spn, Hi and GBS meningitis vaccines quantified on decreasing overall antibiotic use and reducing AMR |
| SGS: Develop and improve strategies for epidemic prevention and response including vaccination, chemoprophylaxis, infection control, and risk communication, inclusive of mass gatherings and humanitarian emergencies  
(link to SG10 Regional surveillance, SG15 Prioritizing meningitis, SG19 Vaccine confidence) | Review and establish WHO definitions for epidemics of meningococcal and pneumococcal meningitis, (and clusters of late onset GBS disease) in all Regions to guide investigation and control measures, including careful consideration of relevant spatial units (e.g. districts, subdistricts)  
Develop and update, and implement strategies on surveillance, preparedness and response to meningitis epidemics with attention to spatial units, including consideration of mass gathering issues, and enhancement of infection prevention and control programmes  
Update strategies on vaccination during and after humanitarian emergencies for preventing epidemics among refugees and displaced persons  
Consider multi-antigen campaigns as part of the above strategies, particularly for areas where population access to vaccination services is limited (e.g. conflict zones), or to populations that are less likely to be included in vaccination campaigns (e.g. people with disabilities)  
Develop strategies to ensure sufficient vaccine stockpile at the optimal level (global, regional, national or subnational), and gradually transition from polysaccharide to affordable multivalent meningococcal conjugate vaccines to respond to epidemics | By 2021, WHO definitions updated or established for meningococcal and pneumococcal meningitis epidemics (and late onset GBS disease clusters) in all Regions  
By 2023, guidelines on surveillance, preparedness and response to meningitis epidemics updated, including updating of reactive vaccination strategies and infection prevention and control programmes  
By 2025, guidelines implemented in >80% of countries  
By 2021, International Coordinating Group (ICG) on Vaccine Provision stockpile of meningococcal vaccines appropriately replenished (quantity, composition, timeliness), building on predictive modeling research, to enable an early response to epidemics in the meningitis belt, as well as globally |
<table>
<thead>
<tr>
<th><strong>Define strategies to prevent / respond to pneumococcal meningitis epidemics</strong></th>
<th>By 2021, WHO strategy for pneumococcal meningitis epidemic prevention and response published and implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conduct research and review policy for use of antibiotic prophylaxis as a control measure during meningococcal meningitis epidemics in the African meningitis belt, with consideration for potential impact on AMR</strong></td>
<td>By 2021, additional study completed on the potential risks and benefits of this strategy of using antibiotic prophylaxis during meningococcal meningitis epidemics in the African meningitis belt. By 2022, revised policy (if necessary) published on antibiotic prophylaxis during meningococcal meningitis epidemics in the African meningitis belt, with possibly time-limit considerations (in consideration and coordination with introduction/availability of multivalent Nm conjugate vaccines)</td>
</tr>
<tr>
<td><strong>Prepare and implement context-appropriate community engagement and risk communication messaging on severity of disease, preventive measures and practices to maximise reach during epidemics through traditional and innovative/digital approaches</strong></td>
<td>By 2020, social and communication channels mapping completed in all high-burden countries. By 2020, guidance for monitoring secondary communication of messages and community rumours on meningitis epidemics available and used globally. By 2021, risk communications with mixed methods of messaging available and used in meningitis epidemics globally</td>
</tr>
<tr>
<td><strong>Monitor secondary communication of messages and rumours via monitoring and accountability mechanisms</strong></td>
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Pillar 2: Diagnosis and treatment

Achieved through improving diagnosis at all levels of health care, health worker training, and prompt and effective management

Laboratory confirmation is well defined for the main bacterial pathogens, culture and real time PCR being the gold standards, but health workers may not be trained or resourced to identify cases of meningitis, cerebrospinal fluid (CSF) samples are often not collected, and laboratory capacity in LMICs is often limited. There is a need for novel rapid diagnostics assays that are highly performing, affordable and deliver accurate and quick results to diagnose bacterial meningitis based on use, impact, target population, and skill level. Antibiotics may be given in the informal sector before patients present for medical care or by health care staff before samples are taken. This emphasizes the need for tests that can identify the causative organism after giving antibiotics. Antibiotic treatment regimens are well established, but WHO guidelines for treatment of adults with bacterial meningitis are not currently available and recommended antibiotics are not always available. A review of the role of adjunctive therapies in LMICs is needed.

The aims of this pillar are to (i) improve diagnosis of meningitis at all levels of care (ii) develop and enable access to diagnostics assays for all levels of care to increase confirmation of meningitis (iii) develop and implement a context specific strategy for diagnosis of maternal carriage, and for diagnosis, treatment & care of infant GBS, particularly for low-resource settings, (iv) provide and implement appropriate, context specific, quality-assured guidance and tools on treatment and supportive care to reduce sequelae, deaths and AMR.
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<tr>
<th>Strategic goals</th>
<th>Key activities</th>
<th>Landmark goals (milestones)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG6: Improve diagnosis of meningitis at all levels of care</strong></td>
<td>Develop and disseminate regionally specific guidance on testing requirements and tools for each level of the health system and according to the required decision-making (e.g. for immediate clinical management, epidemic response, AMR)</td>
<td>By 2022 regionally specific guidance developed on testing requirements and tools for each level of the health system, according to the diagnostic purpose or required decision-making</td>
</tr>
<tr>
<td>(link to SG16 Population awareness, SG10, Regional surveillance)</td>
<td>Evaluate role of blood sampling in diagnosing meningitis/sepsis in LMICs especially in the African meningitis belt</td>
<td>By 2022, studies published on performance of blood testing in the diagnosis of meningitis/sepsis in LMICs, especially the African meningitis belt</td>
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<td></td>
<td>Increase timely collection and testing of diagnostic lumbar punctures (LPs), blood and other specimen samples by ensuring availability of sterile kits, supporting national policies that promote CSF and blood sampling, and increasing acceptance of LPs among communities and health professionals</td>
<td>By 2024, CSF (and blood samples where feasible) collected in all countries from &gt;50% of suspected meningitis cases</td>
</tr>
<tr>
<td></td>
<td>Establish appropriate training and supervision of community/peripheral level health workers for each level of care on timely identification, diagnosis, referral and treatment of meningitis in all age groups</td>
<td>By 2026, a training programme on identification, diagnosis, referral and treatment of meningitis patients (including potential sequelae) established and integrated into existing training &gt;80% of countries</td>
</tr>
<tr>
<td><strong>SG7: Develop and enable access to diagnostics assays for all levels of care to increase confirmation of meningitis</strong></td>
<td>Establish innovative (pooled) funding mechanisms to enable development and uptake of novel rapid diagnostic assays</td>
<td>By 2022, funding mechanisms established to enable development of rapid diagnostic assays and deployment into the field at scale</td>
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<td>SG8: Develop and implement a context specific strategy for diagnosis of maternal carriage, and for diagnosis, treatment &amp; care of infant GBS, particularly for low-resource settings (link to SG4 GBS prevention, SG11 GBS surveillance, SG16 Population awareness)</td>
<td>Develop affordable diagnostic assays, suitable for low resource settings, for (i) maternal GBS carriage (ii) invasive GBS disease in infants</td>
<td>By 2026, a quality assured, affordable and accessible diagnostic assay available to identify (i) maternal GBS carriage and (ii) invasive GBS disease</td>
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<td>Develop and implement a context-specific strategy for diagnosis of maternal carriage and for diagnosis, treatment and care policies/strategies for infant GBS, particularly for low resource settings, integrated into neonatal infection guidelines</td>
<td>By 2026, strategies for diagnosis of maternal GBS carriage and diagnosis, treatment and care of infant GBS disease available for all countries</td>
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<td>By 2030, recommended strategy implemented in &gt;50% of countries</td>
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<td>SG9: Provide and implement appropriate, context specific, quality-assured guidance and tools for treatment and supportive care to reduce sequelae, deaths and AMR</td>
<td>Review the evidence on potential benefit of adjunctive therapies for bacterial meningitis e.g. mannitol, steroids in LMICs</td>
<td>By 2022, potential benefit of adjunctive therapies in LMICs reviewed</td>
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<td>Develop/ensure a mechanism is in place to enable validation, production and adoption of diagnostic assays tailored to the intended populations and need</td>
<td>By 2024 a mechanism is in place to enable validation, production and adoption of diagnostic assays tailored to the intended populations and need</td>
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<td>Develop diagnostic assays (CSF, blood or urine) to support immediate medical decision making at point of care</td>
<td>By 2026, quality assured, affordable and accessible rapid diagnostic assay developed(s) to rapidly detect invasive bacterial vs viral infection to support immediate medical decision-making at point of care</td>
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<td>Develop diagnostic assays that identify the main pathogens of suspected meningitis cases and enable global access to the assays developed</td>
<td>By 2026, quality assured, affordable and accessible multiplex diagnostic test available to identify and distinguish the main pathogens responsible for meningitis</td>
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Develop and implement comprehensive, regionally adapted guidance and recommended tools on patient treatment and care for all age groups and causes of bacterial meningitis from early diagnosis to early identification, treatment and care of sequelae, and addressing AMR

By 2023, evidence-based guidance and recommended tools developed on treatment and care of bacterial meningitis and tailored to all resource settings made available for all Regions; and by 2025, implemented in 80% of countries including LMICs

Ensure that recommended and quality assured antimicrobials and medical supplies needed for supportive care are accessible at country level

By 2028, recommended, quality assured antimicrobials and supplies for supportive care are accessible in >80% of countries
Pillar 3: Disease Surveillance

Achieved by surveillance of all main causes of bacterial meningitis and their sequelae to guide meningitis control policies and accurately monitor progress toward goals

WHO Vaccine Preventable Disease surveillance standards cover three of the main bacterial pathogens (Nm, Spn, Hib). However, guidelines for national surveillance of meningitis pathogens are not uniformly implemented, and most countries have no recommended guidelines for GBS surveillance. In many countries, weak surveillance systems hamper prompt outbreak detection and response and decisions about vaccine introduction. Building from the support of International laboratory networks and EQA, laboratory capacity for diagnostic testing, including molecular characterization and antimicrobial resistance, needs strengthening for effective surveillance.

Accurate data on burden of meningitis is not available in many parts of the world. Disease data reporting to the international level and whole genome sequence (WGS) repositories are needed to strengthen global surveillance. There is very limited data on long-term impact of meningitis and little guidance on, or implementation of, studies and surveys of sequelae e.g. to measure prevalence of deafness. Improving surveillance is key to establishing the baseline data and measuring progress towards the roadmap targets.

The aims of this pillar are to (i) ensure that effective systems for surveillance of meningitis and main meningitis pathogens are in place in each country (ii) develop and implement global guidance for surveillance of invasive GBS disease, including for low income settings (iii) develop and implement surveys and studies to establish the burden of sequelae.
<table>
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<tr>
<th>Strategic goals</th>
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<tr>
<td>SG10: Ensure that effective systems for surveillance of meningitis and detection of main meningitis pathogens are in place</td>
<td>Review or develop surveillance strategy [aligned with WHO VPD surveillance standards] for main meningitis pathogens in each region for all age groups including guidance, conflict settings and epidemics, to be revised as necessary (SG11 covers GBS surveillance)</td>
<td>By 2020, surveillance guidance available in all regions for main meningitis pathogens</td>
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<td>(link to SG2 New vaccines, SG6 Improving diagnosis)</td>
<td>Adopt, integrate and implement minimum standards for surveillance of the main meningitis pathogens at country level on epidemiology [including all age groups], laboratory capacity (including the use of up to date diagnostic and AMR tests), and data management</td>
<td>By 2025, minimum standards for surveillance of main bacterial meningitis pathogens implemented in a target % of LMICs defined by Regions and integrated into national surveillance By 2030, implemented in all countries</td>
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<td>Perform global surveillance of emerging resistance patterns of main pathogens, linking with AMR networks and control strategies</td>
<td>By 2023, monitoring of the AMR pattern of main meningitis pathogens (annual reports, alerts) is integrated into existing global surveillance</td>
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<td>Establish global coordinated mechanism in all Regions for molecular surveillance of bacterial meningitis pathogens allowing for timely strain identification and sharing of information</td>
<td>By 2025, representative proportion (target set by region) of Nm, Spn, Hi and GBS meningitis strains molecularly characterized and data shared in a globally coordinated network</td>
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<td>In collaboration with the WHO collaborating centres and reference laboratories, establish a global genome network for meningitis pathogens (Nm, Spn, Hi, GBS), encourage participation including data sharing of sequence information and associated clinical and epidemiological data with clear governance and guidelines for access and use of strains</td>
<td>By 2023, global genome network functional for each of the four pathogens By 2025 establish governance and guidelines for sharing of strains and associated data, access and use of strains</td>
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| SG11: Develop and implement global guidance for surveillance of invasive GBS disease, including for low income settings  
(link to SG4 GBS prevention, SG8 GBS diagnosis) | Develop epidemiological and economic analyses for burden of GBS, including long term disability, and avertable burden through interventions, including potential vaccines  
Conduct situation analysis on surveillance of GBS invasive disease world-wide | By 2021, publish a value case proportion for GBS based on world-wide data  
By 2021, situation analysis completed on GBS disease surveillance worldwide |
| Develop global and regional guidance and tools for surveillance of GBS disease, including standardized case definitions, ascertainment methodologies and definitions of high, medium and low burden. | By 2022 global and regional guidance for surveillance of GBS disease developed |
| Establish surveillance systems for GBS according to global/regional guidelines | By 2024, surveillance of GBS implemented in high burden regions, and by 2028 in medium/low burden regions |

| SG12: Develop and implement surveys and studies to establish the burden of sequelae,  
(link to SG13 Sequelae management, SG14 Access to aftercare,) | Develop and implement a global strategy and tools for studies and surveys to establish and monitor the burden of sequelae | By 2022, global strategy and tools for studies and surveys to measure burden of sequelae developed, and by 2026 implemented |
Pillar 4: Support and care for people affected by meningitis

Achieved by ensuring that effective systems for timely identification and management of sequelae are implemented and that people and families/carers affected by meningitis can access appropriate support and care services that meet their needs.

It is estimated that at least one third of people surviving an episode of bacterial meningitis have enduring after-effects. Impairments caused by meningitis due to any cause can be wide-ranging and often severe. Common sequelae include seizures, hearing and vision loss, cognitive impairment, neuromotor disability, memory and behavior changes, as well as scarring and limb amputations after meningococcal sepsis. Many people will also experience a range of less serious after-effects that are not always immediately apparent, for example emotional difficulties. Aftercare has a high cost and may not be affordable for families. Policies and services for assessment of sequelae, treatment, rehabilitation and follow up, including those in communities, are often absent or insufficient with inequitable access, especially in LMICs. Appropriate training on timely identification and management of disability and bereavement for health care professionals and community workers is limited, with inadequate numbers of trained staff at all levels of care from community to hospital. Given the global burden of meningitis, it is essential to build and strengthen health systems to provide the necessary care and programmatic support for everyone who needs it. Capacities in educational institutes need strengthening and linkages created for early recognition of less visible, learning, developmental, psychosocial and cognitive after-effects.

This pillar applies to meningitis from any cause. The aims are to (i) strengthen early recognition and management of sequelae in health care and community settings (ii) increase availability and access to appropriate care and support for people affected by meningitis and for their families/carers.
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| **SG13: Strengthen early recognition and management of sequelae after meningitis in health care and community settings**  
(link to SG9 Improving treatment, SG12 Sequelae burden, SG14 Access to aftercare) | Conduct research on (i) socio-economic impact of sequelae on children, adults and their families/carers (ii) effectiveness of aftercare/support interventions  
Develop and implement best practice guidelines for LMICs in detection, monitoring and management of meningitis sequelae before and after discharge from hospital, at all levels of health care and in community settings e.g. schools (including disability sensitization and communication skills)  
Promote community-based programmes to (i) identify sequelae and disabilities, based on standardized instruments (especially for child development and hearing), and refer for assessment and appropriate care  
(ii) to provide care, support and aftercare to individuals, families and communities affected by meningitis e.g. psychosocial support | By 2023, studies completed and published on effectiveness of aftercare/support interventions  
By 2023, global guidelines for LMICs in systematic detection, monitoring and management of sequelae after meningitis developed; and by 2026, adapted and implemented in >50% of LMICs  
By 2028, system of community-based identification of sequelae and disabilities, and referral for assessment and care established in >50% of countries including LMICs  
By 2028, community services for people with long term impairments from meningitis integrated into existing disability inclusion initiatives in >50% of countries including LMICs |
| SG14: Increase availability and access to appropriate care and support (i) for people affected by meningitis and (ii) for their families/carers  
(link to SG12 Sequelae burden, SG13 Sequelae management, SG17 Impact and support) | Map out existing services and support systems available by country for (i) children and people with disabilities, including those with meningitis sequelae and (ii) for families/carers of people those affected by meningitis, identifying barriers to access, availability, and use, involving disabled people organizations and other networks where possible, and undertake gap analysis to improve service provision | By 2023, services and support systems mapped out for (i) people with disabilities including meningitis sequelae and (ii) families/carers of people with meningitis who have recovered or died, with gap analysis in >80% of countries,  
By 2024, gap analysis completed and linked to SG13  
By 2025, guidelines to facilitate access for people affected by meningitis to services on community-based rehabilitation (CBR) and bereavement developed; and by 2028, in place in >50% of countries including LMICs  
By 2027, up-to-date relevant information provided by media, social media, schools, community-based mechanisms etc to people affected by meningitis on access to services and support in >50% of countries including LMICs | Strengthen partnerships between government and CSOs, including disabled people organizations and other networks, so that people with sequelae or disabilities, their families/carers and those bereaved due to meningitis have access to quality and effective services that are in line with international human rights standards and frameworks |
Pillar 5: Advocacy and Engagement

To work with partners to raise public and political awareness of meningitis, its impact and potential to result in disability, in order to improve health-seeking and access to control measures

Advocacy can drive lasting change and makes the case for that change. Advocacy goals for meningitis include better protection against meningitis, better diagnosis and treatment, and better support and aftercare for those who have experienced meningitis and their families. Provision of general information about meningitis to the overall population, at-risk groups and health workers, as well as specific information for people who have directly been affected by meningitis, their families and communities, can play an important role in defeating meningitis, but such information is often lacking. Meningitis poses specific information challenges. Its rapid onset leaves little time to act, increasing the need for good, targeted information on prevention, early management and sequelae. It is frequently confused with other fever-causing diseases such as malaria, and may also present as sepsis or encephalitis, increasing the need for health worker resources and training. Disability is a common feature of life after meningitis, meaning good aftercare information is essential. Effective information can make people aware of the need to seek help based on awareness of the signs and symptoms of meningitis and to increase demand from populations for vaccination and services for after-care.

Meningitis advocacy goals should be integrated into many other UHC goals that are a priority for countries, including health security, ensuring equitable treatment and access to opportunities for those with disabilities and reducing AMR.

The aims of this pillar are to (i) ensure that funders and policymakers at national, regional and global level recognize that the roadmap to defeat meningitis is prioritized and integrated into country plans at all levels (ii) ensure awareness among all populations of signs, symptoms and consequences of meningitis so that they seek appropriate health care (iii) ensure awareness and sensitization of communities around impact of meningitis and available support after meningitis (iv) ensure that people and communities are aware of their right to meningitis vaccines, other prevention and support after meningitis, and that they value and demand them, and (v) maintain high vaccine confidence.
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<td><strong>SG15: Ensure that funders and policymakers at national, regional and global level recognize that the roadmap to defeat meningitis is prioritized and integrated into country plans at all levels</strong> <em>(link to SG18 Health care rights)</em></td>
<td>Raise awareness of meningitis as a health priority among funders and policy makers through national and international champions, CSOs, advocacy groups and health care providers including the disability sector</td>
<td>By 2020, global meningitis dashboard developed and updated regularly to show burden of meningitis, its impact and global roadmap progress</td>
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<td>Identify and create synergies between key activities on strategy, implementation and communication with other initiatives at global, regional and national level, especially for the immunization and disability sectors</td>
<td>By 2020, global collaboration framework for meningitis roadmap developed</td>
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<td>Build a business case for investment in vaccines, surveillance, diagnosis, and treatment of meningitis, and for prevention and management of sequelae, as set out in the roadmap, that is targeted for use by policymakers, decision makers and funders at global, regional and national levels including the disability sector</td>
<td>By 2020, a business investment case available and promoted at global, regional and national level to mobilize resources, with potential for adjustments accounting for progress</td>
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<td>Countries undertake baseline needs assessment on meningitis and its impact, create national action plans that address gaps and are aligned to the global roadmap</td>
<td>By 2022, &gt;80% of priority countries* have undertaken a baseline needs assessment of meningitis and its impact</td>
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<td>By 2024, &gt;80% of priority countries* have a context appropriate meningitis action plan and monitoring</td>
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<td><strong>SG16: Ensure awareness among all populations of the symptoms, signs and consequences of meningitis so that they seek appropriate healthcare</strong>&lt;br&gt;(links to SG6 Improving diagnosis SG8 GBS diagnosis)</td>
<td>Develop communications and engagement strategy and improve global recognition of World Meningitis Day (WMD) and other global health dates (e.g. sepsis, GBS, cerebral palsy, disability), adapt messaging to policy makers as well as the general public, and raise funding for promoting activities that support the roadmap</td>
<td>framework aligned to their national health strategy, budget and global roadmap through to 2030</td>
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<td><strong>SG17. Ensure awareness and sensitization of communities around impact of meningitis and available support after meningitis</strong></td>
<td>Undertake integrated communication programmes and activities that increase population awareness of the risk, symptoms, signs and consequences of meningitis and sepsis and of the recommended health seeking response, and create community awareness of GBS disease and prevention.</td>
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<td>SG18: Ensure that people and communities are aware of their right to meningitis vaccines, other prevention and support after meningitis, and that they value and demand them</td>
<td>Identify, encourage and support civil society organizations that do or could promote the interests of those affected by meningitis, including those with sequelae, and invite involvement in delivering the goals of the roadmap through their communities, engagement with national and regional authorities and international networks of CSOs</td>
<td>By 2025, citizen representation and input to national meningitis annual plans in &gt;30% of priority countries*</td>
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<td>SG19: Maintain high vaccine confidence</td>
<td>Develop risk and communication strategies to address issues of access, acceptance and generation of demand for vaccines</td>
<td>By 2023, risk and communication strategies addressing issues of vaccine access, acceptance and demand developed, integrated into national plans, and implemented in &gt;50% of priority countries*; and by 2026, in &gt; 80% of priority countries*</td>
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*Priority countries to be defined by Regions according to burden of disease and equity of access to services
Connection to other global initiatives

The multi-pathogen, multidisciplinary nature of the *Defeating Meningitis* roadmap provides opportunities for linkage with other global projects and initiatives, which can drive accelerated progress towards mutual or complementary goals. The *Defeating Meningitis* technical task force is actively working to identify potentially complementary initiatives and will establish and maintain linkages with these initiatives to ensure alignment of goals and integrated approaches wherever possible.

Initiatives with potential synergy with the Defeating Meningitis roadmap fall into several categories:

*Maintain active collaboration:*

- WHO Sepsis programme
- Group B Streptococcus Vaccine Development Technology Roadmap
- Global Antimicrobial Resistance Surveillance System (GLASS)
- WHO Vaccines for AMR project (no website yet)
- WHO Package of Rehabilitation Interventions
- WHO Deafness and Hearing Loss programme
- Global Strategy on Comprehensive VPD surveillance
- WHO Global Invasive Bacterial Vaccine Preventable Disease Laboratory Network
- Market Information for Access to Vaccines (MI4A)
- Immunization Agenda 2030 ([link to latest draft](#))
  - Successor to the [Global Vaccine Action Plan](#)

*Maintain communication to identify potential future opportunities:*

- Global roadmap for advancing development of vaccines against sexually transmitted infections
- Japanese Encephalitis Prevention and Control programs ([WPRO, SEARO](#))

*Share information to promote visibility of the Defeating Meningitis roadmap or our goals/targets:*

- WHO Global Observatory on Health Research and Development
- Global Action Plan for Healthy Lives and Wellbeing For All
- IMPRINT – Immunizing Pregnant Women and Infants Network
- BactiVac Network
- The Vaccine Centre, London School of Hygiene and Tropical Medicine
- Global NITAG Network (GNN)

*Maintain awareness of initiative materials and activities:*

- Global Action Plan for Pneumonia and Diarrhoea
- Pocket Book of Hospital Care for Children ([next edition](#))
- WHO Universal Health Coverage Package
- Global Strategy for Women’s, Children’s and Adolescents’ Health ([Every Woman Every Child](#))
- Every Newborn Action Plan
- Africa Health Strategy 2016-30
DRAFT 15 October 2019

- WHO Global Strategy on Human Resources for Health
- Convention on the rights of persons with disabilities

Identify potential for collaboration

- Global Pneumococcal Sequencing Project
- Cryptococcal disease component of the WHO HIV programme
- The End TB Strategy
- WHO Global Influenza Strategy 2019–2030
- WHO Vaccination in acute humanitarian emergencies: a framework for decision making
- Gavi Health system and immunization strengthening support framework
- Global Health Security Agenda
- CEPI (Coalition for Epidemic Preparedness Innovations)
- Advancing Maternal Immunization (AMI)
- Global Hub for Vaccine Acceptance and Demand
- Every Breath Counts Coalition
- Fever diagnostic project (ALIMA, PATH, Unitaid)
- WHO medical devices program
- Africa Collaborative to Advance Diagnostics (AFCAD)
- Vaccine Confidence Project
- UNICEF Immunization Roadmap 2018–2030
- Elimination of Mother-to-Child Transmission of HIV and Syphilis in the Americas (PAHO)
- Confederation of Meningitis Organizations (COMO)
- WHO Essential Medicines programme
- DHIS2 Burden of Disease Modules
Key references


