Investing to defeat meningitis and beyond
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In 2020, all World Health Organization Member States committed to implementing a road map to defeat meningitis.

The road map has benefits beyond meningitis control, by strengthening immunization programmes, and global health security, as well as access to disability support and rehabilitation at the primary health care level, as part of every country’s journey towards universal health coverage.

We are seeing real progress.

WHO remains committed to the fight against meningitis, and to a healthier, safer, fairer world.

Dr Tedros Adhanom Ghebreyesus,
Director-General, World Health Organization
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<td>AMR</td>
<td>Antimicrobial resistance</td>
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<tr>
<td>CSF</td>
<td>Cerebrospinal fluid</td>
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<td>CSO</td>
<td>Civil society organization</td>
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<td>DALYs</td>
<td>Disability-adjusted life years</td>
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<td>Gavi</td>
<td>Gavi, the Vaccine Alliance</td>
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<td>GBS</td>
<td>Group B streptococcus</td>
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<td>GDG</td>
<td>Guidelines Development Group</td>
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<td>GDP</td>
<td>Gross domestic product</td>
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<tr>
<td>Hib</td>
<td><em>Haemophilus influenzae</em> type b</td>
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<tr>
<td>HIV</td>
<td>Human immunodeficiency virus</td>
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<td>HSS</td>
<td>Health systems strengthening</td>
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<td>IA2030</td>
<td>Immunization Agenda 2030</td>
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<td>ICU</td>
<td>Intensive care unit</td>
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<td>LIC</td>
<td>Low-income country</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and evaluation</td>
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<td>MIC</td>
<td>Middle-income country</td>
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<td>MMCV</td>
<td>Multivalent meningococcal conjugate vaccine</td>
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<td>PCV</td>
<td>Pneumococcal conjugate vaccine</td>
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<tr>
<td>SDG</td>
<td>Sustainable development goal</td>
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<td>SSG</td>
<td>Strategy Support Group</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<td>TTF</td>
<td>Technical Taskforce</td>
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<td>UN</td>
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Executive Summary

Investing in meningitis, will prevent cases of disease, cases of long-lasting sequelae and save lives. An investment in meningitis is an investment in primary health care, which will provide benefits far beyond meningitis.

All over the world, meningitis is a high-profile disease that attracts political and media attention when cases occur. Meningitis is deadly and debilitating; it strikes quickly, has serious health, economic and social consequences, and affects 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 of and deaths from meningitis are largely vaccine preventable, but progress in defeating meningitis lags behind that for other vaccine preventable diseases.

Defeating Meningitis by 2030 – A Global Road Map sets out a plan to tackle the main causes of acute bacterial meningitis (meningococcus, pneumococcus, *Haemophilus influenzae* and group B streptococcus). This innovative initiative addresses meningitis not only as an infectious disease that can often be prevented and treated, but also with the absolute need for support and care for people living with disabling sequelae after an episode of meningitis. The three visionary goals are to: (i) eliminate epidemics of bacterial meningitis; (ii) reduce cases of vaccine preventable bacterial meningitis by 50% and deaths by 70%; (iii) reduce disability and improve quality of life after meningitis of any cause. To achieve these goals, World Health Organization (WHO) recommends several key activities and milestones across five pillars of the road map: prevention and epidemic control; diagnosis and treatment; disease surveillance; support and care for people affected by meningitis, and advocacy and engagement.

To defeat meningitis in the shortest period sufficient resources are required at the national, regional, and global level. For the first time, the financing needs to fully implement the road map have been calculated and categorized to maximize the effect of every dollar invested. A catalytic investment of US$ 130 million is needed for the immediate three years to initiate and fast-track priority research activities, update and develop key strategies and policies, and to support targeted countries in all six WHO regions in developing their national meningitis plans, integrating and implementing key activities covered by the five pillars. A further US$ 310 million is needed to fully achieve implementation of the road map.

The gradual implementation of the road map will drive the prevention of 2.75 million cases of meningitis, 780 000 cases of long-lasting sequelae and avert some 920 000 deaths by 2030. This not only has a predicted health care saving of US$ 3.8–10.0 billion, but also economic benefits of US$ 86.0–100.4 billion by 2030 through increased workforce participation and productivity. Investing in defeating meningitis will eliminate major meningitis epidemics. In particular, making the African meningitis belt history is now within reach, after over a century of devastating epidemics. This was the plea of the affected communities, this will be the result of new vaccines and vaccination strategies.

Strong multidisciplinary collaborations allowed the road map design to be one that will generate impact beyond meningitis, particularly by combining efforts with other health initiatives at local, national, regional and global levels. Investment will also accelerate progress in reducing conditions such as sepsis and pneumonia which are caused by the same bacteria causing meningitis and will contribute to containing antimicrobial resistance. Investments called for in this document will strengthen primary health care systems including diagnosis, treatment and care – acting as a powerful lever for recognizing disability and improving access to support and rehabilitation.

Beyond the economic aspects, implementing the road map will have a positive impact on equity and global development, especially for the most vulnerable communities where the catastrophic impact of meningitis is magnified, and for women and girls who disproportionately serve as caregivers. Given the impact of meningitis on health, education, access to decent work and income, and poverty, defeating meningitis directly contributes to the achievement of several Sustainable Development Goals.

All 194 Member States have committed to defeating meningitis by 2030. Now investment is needed to not only reduce the avoidable pain and suffering caused by meningitis but to enable better health outcomes beyond meningitis.
Testimonials

As a paediatrician, my interest in meningitis stemmed from two contrasting clinical experiences in the 1990s: one in Nigeria, the other in the United Kingdom.

In Nigeria, a toddler presented to hospital convulsing having been unwell for 10 days. Mother had administered home remedies and antibiotics purchased from an unregistered local chemist before traveling to the hospital. Pneumococcal meningitis was confirmed, treatment included the appropriate antibiotic. The toddler was later discharged having developed cerebral palsy, with visual and hearing impairments.

In the UK, a school-aged child presented to hospital having been unwell overnight with a fever. Parents had noticed a rash and the “glass test” showed it was non-blanching. Meningococcal meningitis with septicaemia was diagnosed. Clinicians and nurses raced to administer treatment, including ventilator support. The child recovered – but required amputations.

Both children had significant sequelae despite their contrasting access to health care, implying that preventive measures are the bedrock to controlling meningitis. The child in Nigeria contended with delayed health care access: long hospital queues, far distances to health facilities, significant transport and out of pocket hospital costs, and the caregiver’s concern of disrupting their family income. The child in the UK presented early with symptoms known to the well-informed UK public in addition to the ease of navigating a well-resourced health system.

The meningitis roadmap is a crucial framework for enabling stakeholders understand the needs of the populations at risk and in the formulation of policy. The development of new and better vaccines with a focus on the drivers of vaccine equity, overcoming obstacles such as the need for frequent doses, route of administration, cold chain, supply chains, misinformation, and manpower, are central. There must also be a focus on improving the quality of life for those developing sequelae, through structured support and rehabilitation, all of which require substantial funding.

Dr Ekundayo Ajayi-Obe
Nigeria and United Kingdom of Great Britain and Northern Ireland

Our first child, Avnee, was born on 06 May 2013. Avnee was healthy, vibrant, and perfect in every way. Her first five months of life were filled with family, fun, and lots of love. During the early morning hours of 17 October 2013, Avnee suddenly developed a fever, followed by a small rash.

Avnee was taken to our local paediatric hospital where she received excellent medical care. However, her condition rapidly worsened, and she began having seizures. She required a breathing tube. Unbelievably, the infection continued despite the very best medical efforts. Less than 15 hours after the first sign of fever, Avnee passed away.

Following her passing, we learned that our precious baby girl was lost due to Meningitis B. Just over a year later, in late 2014, the vaccine to protect against Meningitis B was approved in the United States. We have made it our mission to educate, advocate, and vaccinate to beat Meningitis B. It is our hope that others can be saved from what is now a preventable loss.

Amit and Melissa Rawal
United States of America
My son, Zubin, was my first child. He died when he was 3 years, 1 month, and 4 days old. He was the love of my life. On a Friday night, he began vomiting, and we went to see a doctor at a private hospital in the middle of the night. We were sent home; the doctor said there was nothing to worry about.

We went back to the hospital the next afternoon – things were clearly not right. My son was lethargic and groaning. The sounds he made continue to haunt me. However, the doctors and nurses ignored us for many hours. On Sunday morning, less than two days later, he was transferred to a public hospital. I watched as he was resuscitated numerous times. He died on Sunday, 31 May 2009. From beginning to end, the nightmare lasted less than 48 hours.

The shock to my system was huge. I continue to be his mother, but he does not live with me. It is hard to explain. My husband still cannot talk about Zubin’s death, and we grieve separately. I am not able to work the same way I used to; I feel tired more easily and I feel pain in places I did not know could hurt, especially around anniversaries. Even my happy moments are now bittersweet.

Zubin’s death was a loss of a life, but it also was the loss of my life with him, our lives with him as a family, and all the potential that was taken away from us. Worst of all is the suffering that Zubin endured – as his mum, this is the part that is hardest for me.

In September 2009, I fell sick, with symptoms that mimicked malaria (e.g., headache and fever). The following day, I went to see the doctor, who put me on malaria treatment. I completed my course of medication, but my condition did not improve. I went to a different hospital, where they did a full blood count; they found nothing, and once again I was put on malaria treatment. I finished my dosage, but this time my condition worsened.

I decided to visit a third hospital, where – once again – I was put on malaria treatment. My condition continued to worsen, and ultimately the medical team decided to test for meningitis. They took samples, but the facility did not have the equipment to carry out the test. My wife took the samples to a private lab, where they found that I had contracted meningitis. I was immediately put on treatment and proceeded to lose consciousness for a week. When I regained consciousness, I had lost my memory, did not know who I was, could not walk, and had lost part of my sight.

I am now partially sighted. My left eye is completely blind, and my right eye is partially sighted. My day-to-day life is affected because I must rely on others. Meningitis also affected my career – before I became ill, I was studying insurance and working as an insurance clerk. I had to quit, leaving for a cleaning job that didn’t require a computer. It is also challenging to describe my conditions to others – and to have them judge and stigmatize me.

Huge damage can be prevented if our hospitals possess the right equipment to diagnose meningitis at the earliest possible time. This disease is killing so many people and is not receiving adequate attention. I am lucky that I survived, but I lost three close relatives to the disease. We need a meningitis-free world – and we can achieve it together.

Shalini Mahtani
Hong Kong SAR, China

John Jussah
Malawi
My name is Cat, and I am a mum of five. My children vary in ages from 12 to 26. Very sadly, I lost my daughter, Meah, to GBS (Group B Streptococcus) in 2009.

I discovered that I was positive for GBS by chance, while I was 37 weeks pregnant with my second child. At an earlier pre-natal check, I presented with urine infection symptoms, and swabs were taken. As a young 23-year-old mum of one, I asked the consultant what GBS was, and he told me, “Oh, nothing to worry about, you’ll need to present early in labour, and you’ll be given antibiotics with no problems.” I took him at his word, as I did not know how serious GBS could be.

As requested, I presented early in labour, and Callum (my second child), Louis (my third) and Ella (my fourth) were all delivered with no problems. Like the consultant said, I received IV antibiotics and stayed in the postnatal ward for 24 hours, where we were monitored before being discharged home.

My fifth pregnancy started with no problems. They took pelvic swabs at 12 weeks and, again, GBS was detected. Between the fifth and sixth months, I started to suspect that I was losing amniotic fluid – it was a strange sensation. I went to the antenatal clinic twice with these symptoms. They felt it was a urine leak and swabbed to see if the fluid was from around the baby. However, the leaks were sporadic and were not present when I appeared in the clinic. I was discharged – and within 24 hours, I noticed that the sporadic leaking had turned a pale green.

The next day, I went into labour while I was at work. I went to the hospital and was told that my baby would not survive. At that point I remember the fear and anguish – fear of not knowing what was to come and anguish that I would meet my baby just before she passed away. My instinct had been right.

The next 12 hours were a blur. I gave birth to Meah, who was born alive and lived for one hour before passing away in my arms. She weighed just under two pounds, and she was perfect. As she was born alive, I had the awful task of registering her birth and death at the same appointment. I returned home not pregnant and without my baby.

After a very hard six weeks I met with my consultant, following a post-mortem investigation. My waters were infected with the GBS infection – and so was Meah. GBS was listed as her cause of death.

I became pregnant three months later and I worried endlessly that I could not stop the same thing happening again. How could I stop it if I couldn’t keep Meah safe? Thankfully, after an anxious consultant-led high-risk pregnancy, my beautiful daughter Dolcie was born safely.

We never forget Meah; she came and went, but she is a part of our family. She existed. Each year, we remember her on 04 February. This year, she would have become a teenager.

GBS testing would not have saved Meah, but a vaccine preventing GBS could have.

Cat Shehu
United Kingdom of Great Britain and Northern Ireland
João Marcos was diagnosed with meningococcal meningitis in July 2017, at just two months old. One morning he was very restless, crying a lot, and with a temperature of 38.5°. We took him to the hospital; in less than 24 hours, he had a few spots on his leg (which looked like burst veins), and he was soon taken to the ICU, where our nightmare began.

As first-time parents, my husband and I had no idea about meningitis. We did not know the different types, nor that it could be prevented through vaccines.

João spent more than 100 days in the ICU fighting for his life, with a 1% chance of surviving.

In February 2018, he returned home with a tracheostomy, transtibial amputation of the left leg, half and sole of the right foot, without eight distal phalanges of the little hands, and with a lesion in the right frontal lobe.

He started rehab as soon as he returned home. Respiratory and motor physiotherapy, occupational and speech therapy were necessary, in addition to medical follow-ups.

He started using prosthesis and orthosis when he was six months old, giving him a sensational adaptation, which enables a better quality of life. As he grows, he undergoes surgery to correct the stump, which is a normal part of the life process for an amputee.

Despite all this, he has always taught us a lot. His strength and will to live has driven us to always seek beauty in the most difficult parts of this process. In addition, even with the losses and sequelae, he has a life like all children; he goes to school, plays with other children, and participates in sports.

We believe that inclusion starts at home. Although we have daily challenges, we know that with faith and lightness we can overcome them. João is a true warrior - and like every warrior, he carries with him marks and scars from the war against meningitis. He also carries hope that the disease can be prevented.

Suelen Caroline
Brazil
I was wrapping one last present on the afternoon of Christmas Eve when I began to feel colder and colder. Climbing into bed didn’t help, nor did my wife Julie’s initial first aid. When I finally came downstairs, I looked like a ghost with blue lips.

Emergency services took a while to respond but did get an ambulance quickly dispatched once they connected. It was hard to make any form of diagnosis, but my family insisted on the trip to hospital.

I quickly landed in Intensive Care. They measured my vital functions – my son, Rory, counted 26 tubes or lines sticking in me. “Does Mike usually look like this?” asked a registrar, referring to a rash that appeared on my face. The rash did not blanch – it was meningitis. The diagnosis could not be confirmed by test due to the antibacterial drugs already administered.

It was the early hours of Christmas Day. “Mike is not responding to any of the medication. It is unlikely he will make it.” Julie was told three more times that I would not make it. Rory made sure he said everything he wanted to tell me. When they held my hand, I said I could not feel it. In fact, my body’s defences had made sure there was blood to my heart and brain, but my hands and feet were dying.

Ten weeks in Intensive Care – that’s seventy days and nights on the edge of survival. On then to the vascular ward, knowing my feet and hands were dead. Legs went one week, hands the next. The hands took seven hours alone and they did not know at the outset whether I would wake up needing yet another operation.

As soon as I awoke from 70 days in intensive care, I wanted to get back as much mobility and independence as I could. Even whilst unconscious, the physiotherapist had manipulated my body, and we continued the exercises throughout my wound healing. The goal was to be as fit as possible, ready for rehabilitation.

It is a grieving process when you lose a limb; grief for the loss itself and for what you no longer can do. Everyone’s grieving is a little different and takes as long as is necessary. I can now see the often-listed stages I went through: denial that anything happened, anger that it happened to me, bargaining for the return of limb if I only do better, depression at my situation, and eventually acceptance and peace with how I now am.

Six months later, I came home. Adaptations had to be made to the house, particularly grab posts to help me up the stairs and the installation of a bio-bidet – a toilet that gives you back your dignity by washing and drying you after use. But without all that focus on healing, strengthening, and learning at hospital I found reality at home very different and very difficult. Tiredness was ever present as my body continued to carry the effects of the hospital stay. I used to sit on the edge of my bed at night, take my legs off and wonder how on earth I was going to get through the next day.

Exhaustion meant sleep came easily. My dreams were always without limb-loss – happily pursuing the activities that had been so natural for all my life. In the morning, it became more and more tempting to stay in bed. In that warmth I could feel as though my limbs were still there. I could feel safe. I could feel as though nothing had happened to me… until reality dawned each day, and with it the most overwhelming and depressive feelings of despair. Sleep became avoidance of reality – at night and during the daytime.

One day, I flatly refused to get out of bed to attend hospital for the necessary and life-saving dialysis I was having three days a week. With chronic kidney disease, refusing dialysis ultimately results in deterioration and death. However, it is not classed as suicide. There it was – a legal way out of the misery I was suffering and the misery I felt I was causing to my loved ones. I did not realize at the time how much my actions were creating the misery for my family. They made sure I got to dialysis.

In my darkest moments I would think, how would I ever shower, toilet, eat breakfast, drink tea, go shopping, walk places, catch a bus. But overcoming each of these challenges was another little victory. I learned to accept my situation and be at peace with it. In fact, I am really pleased with the new me, and find I take on greater challenges all the time - to drive a car again, give talks in public, go on radio, go on TV, become an ambassador for a charity. There are so many new things to experience in life, so many challenges. It’s not “I can’t” … it is “How can I?”

Mike Davies
United Kingdom of Great Britain and Northern Ireland
Meningitis: a disease that affects everyone, everywhere

Meningitis is deadly and debilitating; it strikes quickly, causes serious health, economic and social consequences, and affects people of all ages in all parts of the world. It can infiltrate all facets of life, affecting not only those who are sick, but also their family members, caregivers, and entire communities.

Many pathogens can cause meningitis with an estimated 2.5 million cases reported globally in 2019. This includes 1.6 million cases of bacterial meningitis which resulted in approximately 240,000 deaths (1).

Bacterial meningitis is one of the deadliest and most disabling forms of meningitis (2):

- **1 in 6** people affected will die – and death can occur in less than 24 hours. Although meningitis affects all ages, young children are most at risk with around half of cases and deaths occurring in children under 5 years of age.

- **1 in 5** people surviving acute infection will suffer from long-lasting disabilities, often including deafness, epilepsy, paralysis, or cognitive impairment, as well as limb amputation and skin scarring. Globally, meningitis is the fourth-ranked contributor to neurological disorders burden (behind stroke, migraine, Alzheimer disease and other dementias). Meningitis is the second-ranked contributor to neurological disorders in sub-Saharan Africa (3).

Meningitis outbreaks and epidemics occur across the world. The most severe and recurring epidemics happen within the “meningitis belt” of 26 countries stretching from east to west sub-Saharan Africa. Epidemics have also recently been reported in other countries – such as Chile, Fiji, Kyrgyzstan and Tajikistan. Epidemic risk increases in crowded settings such as universities, youth camps, military housing, mining sites, mass gatherings and refugee camps. Yet while meningitis epidemics are devastating, causing severe disruptions of health systems, over 80% of cases around the world are spontaneous cases that are not associated with an outbreak.
A largely vaccine-preventable disease

There are four pathogens that cause most bacterial meningitis — *Neisseria meningitidis* (meningococcus -Nm), *Haemophilus influenzae*, *Streptococcus pneumoniae* (pneumococcus - Spn) and *Streptococcus agalactiae* (Group B Streptococcus, also known as Group B strep or GBS) — accounting for three-quarters of bacterial meningitis deaths. Safe and effective vaccines are available against the first three of these pathogens and vaccines against GBS are in advanced development.

These vaccines have dramatically accelerated progress in decreasing the burden of meningitis. For instance, meningococcus serogroup A has been eliminated as an epidemic threat from the meningitis belt as a result of the strong commitment of countries in implementing vaccination programmes. Similarly, the roll-out of vaccines against *Haemophilus influenzae* type b (Hib) and pneumococcal conjugate vaccines (PCV) have significantly decreased the global meningitis burden. Because these vaccines significantly reduce transmission of the pathogens, they also help to protect the entire population, including non-immunized persons. In addition, given that the four main bacterial pathogens that cause meningitis can also cause other serious infections including most notably sepsis and pneumonia, the vaccines have a far-reaching impact.

Despite these enormous successes, the speed of reducing the meningitis burden lags behind that of some of the other vaccine-preventable diseases. From 2000 to 2019 deaths caused by meningitis fell by 39%, while deaths related to tetanus and measles fell by twice as much (i.e. 77% and 86% respectively, Figure 1). The access to, and use of, existing meningitis vaccines should be expanded, and new vaccines developed and implemented to reduce the existing gaps.

1 in 6 people affected by bacterial meningitis die

1 in 5 people surviving bacterial meningitis suffer from a long-lasting disability

15–20 million people were living with meningitis-induced long-lasting disabling sequelae in 2019

16.3 million disability-adjusted life years (DALYs) in 2019 because of bacterial meningitis, with >95% in low- and middle-income countries

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1 Meningitis is a life-threatening disease caused by inflammation of the membranes that surround the brain and spinal cord and is predominantly caused by infection with bacteria and viruses.

2 Estimated cases and deaths due to tuberculous and cryptococcal meningitis are categorized under tuberculosis, HIV or other infectious diseases and are not included in these figures.

3 Editorial note. Global meningitis burden data, including cases, deaths, DALYs and percentages of disabilities are limited. Baseline cases, deaths and DALYs in this document are estimates calculated by the Institute for Health Metrics and Evaluation (IHME) in the Global Burden of Disease Study 2019 (http://ghdx.healthdata.org/gbd-results-tool). Estimation of the burden in 2030 is a projection based on these numbers. Efforts have been taken to ensure the most accurate assumptions, based on literature and internal and external consultations, for the calculation of the impact of meningitis and the impact of the road map. A summary of the methodology is described in Annex 2. For ease of reading, final numbers have been rounded to the closest 10 000. Thus, even if not explicitly mentioned across the document, all historical, current and future numbers should be considered as estimates, noting that the implementation of the road map will also contribute to the generation of more accurate and robust data on the burden and cost of meningitis.
Immediate and long-term health system costs

The cost of meningitis to health systems, communities and families is staggering. Meningitis treatments can include weeks of intensive care and can be followed by rehabilitation regimens to support persons with impairments and other long-term disabling sequelae. The costs vary in affordability by community, health system and region, and can be very significant. For instance, across the meningitis belt, the direct cost of managing the sole acute phase of one meningitis case can represent 20–40% of per capita gross domestic product (GDP), and resulted in total direct medical costs of US$ 1.4–2.6 billion during 2010–2019, despite sub-optimal coverage for diagnosis and treatment, though without considering the cost incurred by the management of sequelae.

In other regions, the direct medical costs for a single case of bacterial meningitis infection can typically range from US$ 7 500 in middle-income countries (i.e. up to 60% of GDP per capita) to US$ 15 000–30 000 (and well beyond) in high-income countries. Health-care costs of short- and long-term sequelae may accumulate exponentially over the life course of a person affected by meningitis. These are likely, on average, to rise to 10–15 times the cost of acute care (6–20).

When meningitis presents as an epidemic, the costs to health systems are tremendous. Epidemics require rapid responses and considerable resources for the treatment of acute patients and the roll-out of preventive measures to the local population (via dissemination of antibiotics to contacts, emergency-mandated mass vaccination campaigns etc.). Even small outbreaks can result in substantial cost expenditures as immediate efforts to contain an outbreak are significant: in one instance, two bacterial meningitis cases at a university led to expenditures amounting to US$ 1.3 million (21). In addition to direct costs, meningitis epidemics cause substantial opportunity costs; as health systems respond to meningitis epidemics, other health-care efforts – such as noncommunicable disease prevention and treatment services – may be severely disrupted.

Life-long economic and social costs

Beyond its direct impact on people’s health and countries’ health systems, meningitis causes considerable economic and social damage to individuals and communities. School-aged children who have contracted meningitis, including those for whom after-effects have not been identified, are more likely to fail examinations and drop out of school – which means they are less likely to pursue higher education, in turn limiting their earning potential and, eventually, their fulfilment. Adults have a lower probability of economic self-sufficiency and employment one year after infection – corresponding to an increased likelihood of welfare dependency. In low-income countries, the inability to study and work is certainly more dramatic, with limited social systems, however this is not well documented. Children and adults with sequelae may also face decreased participation in family, social and civic life, thereby experiencing ongoing social barriers throughout their lives. In addition, family members who are forced or choose to become caregivers experience losses of income, health, social support and other factors.

Figure 1. Global trend of deaths due to meningitis and some other vaccine-preventable diseases

Deaths in 2000, 2010 and 2019 due to Measles, Tetanus and Meningitis
The weaknesses in health system financing structures – particularly across the meningitis belt – can result in most of the families paying a substantial amount of the overall costs related to an episode of meningitis. Too many meningitis cases are left untreated, and even those who can initially afford the cost of treatment and care may experience catastrophic health expenditures and push households towards poverty. The situation is worsened if another household member contracts the disease and the family is not in the financial position to treat the second case.

The impact on equity and global development

Meningitis reinforces the inequity that is already a reality for the world’s most marginalized groups, thus contributing to the stunting of global development. The level of disease awareness – including education, resources, and tools for prevention and control – differs greatly across countries, helping to reinforce meningitis inequities.

The incidence of meningitis is highest where equity and access to health care are lacking. The likelihood of dying from the disease or its complications is greatest for people of low-socioeconomic status. In 2019, the burden of bacterial meningitis in low-income countries (LICs) and middle-income countries (MICs) corresponded to 244 disability-adjusted life years (DALYs) per 100 000 population, compared with 15 per 100 000 in high-income countries (1).

This means that vulnerable populations already experiencing inequality are further impacted because of meningitis infection.

- Worldwide, less than 20% of countries surveyed by WHO reported specialized neurorehabilitation services (22).

People with disabilities have lower access to rehabilitative care (as compared to non-disabled people who need rehabilitation to recover from an accident or injury) which is even less available to women, the poor and rural populations. People in low-resource areas who recover from meningitis face the highest risk of developing long-lasting disabling sequelae, as well as the lowest chance of accessing efficient and affordable long-term support. For instance, only 5–15% of people in need for assistive devices in LIC and MIC receive them (23).

- Stigma and discrimination experienced by persons affected by sequelae are inextricably linked to poor health outcomes. This is particularly true for people with meningitis-related developmental/intellectual disabilities because their needs are often inadequately understood and frequently unmet.

- Meningitis fosters inequality between genders. Women and girls disproportionately serve as caregivers to relatives with meningitis sequelae, thus perpetuating their disenfranchisement as they are prevented from attending school, earning incomes, and pursuing careers. Carrying a disproportionate burden of care, women and girls often do not prioritize their own health needs.

- Refugees and migrants are at increased risk of meningitis due to lack of, or cramped housing, close contact with large numbers of people and potentially decreased access to vaccination and health services.

The impact of meningitis can be profound, affecting health, education, access to decent work and income, and poverty. The effects can exacerbate existing inequities, which can further challenge the progress in achieving the corresponding Sustainable Development Goals (SDGs).
Lack of prioritization and cohesive approach

Preventing, diagnosing, and treating meningitis and its sequelae can be multifaceted and complex. The disease is often given less priority than other diseases that can be tackled more easily. However, there is a now a growing sense of urgency and political awareness of the economic and societal impact of meningitis on communities and countries. Further action is needed to increase the demand for change and to influence society and policymakers to prioritize efforts to defeat meningitis.

The epidemiology and etiology of meningitis are varied and affect different population groups. Until now, this has led to pathogen-specific efforts and have not prioritized meningitis in its entirety.

For the first time ever, the Defeating meningitis by 2030 global road map presents a multidisciplinary and cohesive strategy that encompasses all facets of meningitis.

Inadequate surveillance and data

Many regions and countries lack surveillance strategies, systems, and standards for each of the main meningitis pathogens for all age groups. Public health surveillance for meningitis and associated pathogens is hampered by a lack of specimen collection, diagnostic tests and transport, laboratory capacity, reporting timeliness and completeness, sustained financing, and human resources. Many countries also lack guidance on how to conduct surveillance during conflicts or epidemics. Infections with bacterial meningitis pathogens may escape detection and diagnosis in newborn babies because the clinical presentation can overlap with that for other infections.

Surveillance generates data, but gaps and challenges in disease surveillance can lead to an underestimation of the real burden of the disease and impede efficient response to epidemics. Effective data management is essential and local capacity in data analysis often needs to be improved. Increased investment can build effective systems for meningitis surveillance and for the use of data to inform decision-making at all levels, including for the development of local prevention and control programmes, and resource allocation.

Too low vaccination uptake

The broad portfolio of meningitis vaccines is not fully implemented. This is partly due to lack of global access and concerns about affordability, as observed for multivalent meningococcal conjugate and meningococcal serogroup B vaccines.

Despite steady progress and a WHO recommendation for its use in all countries, PCV – which prevents pneumococcal meningitis and other conditions such as pneumonia – reaches only half of the world’s children, with the greatest gaps in middle-income countries. These countries lag behind Gavi-supported and high-income countries in their decisions to introduce PCV. Enhanced efforts are needed to increase uptake of recommended vaccines.

Incomplete vaccine portfolio

Vaccines are not yet available for all causes of meningitis. Additionally, vaccines against pneumococcus, meningococcus and – to a lesser extent – Haemophilus influenzae prevent most but not all serotypes/serogroups that cause meningitis. Significant opportunities exist to
invest in vaccine research, development, and production to ensure complete coverage and access to affordable vaccines.

In addition, global and national guidelines, policies and strategies should be completed or adjusted as new evidence and innovations become available to optimize protection at the individual and population levels and use during outbreaks.

**Suboptimal diagnostic tests**

The lack of simple, reliable, and affordable point-of-care diagnostic tests for the pathogens that cause meningitis complicates timely case diagnosis, impairs outbreak detection, and delays management, particularly where resources are limited.

In low-resource settings and rural areas, the lack of trained medical professionals and insufficient laboratory capacity limit the ability to recognize and diagnose suspected meningitis cases. The lack of rapid and reliable diagnostic tests means that meningitis cases are often treated without laboratory confirmation. Further access to diagnostics capacity, including new tests, will increase the ability to identify the causative pathogen and ensure appropriate treatment.

**Lack of resources for disease management**

Community health facilities – especially in low-resource areas – are often ill-equipped to diagnose and treat meningitis. The shortages of medical supplies and trained health-care workers are a common concern. While these factors may impair effective diagnosis and treatment, antimicrobial therapies are readily available and effective if properly administered in a timely manner. Further access to supplies and trained health-care workers will also have significant benefits across health systems.

**Poorly addressed meningitis-associated sequelae and disability**

In many settings, there is no follow-up of patients after an acute episode of meningitis. This hampers the detection, management, and care of sequelae. Too few health-care workers are appropriately trained in the specialized skills needed to recognize and manage disabilities (e.g. deafness, which is one of the most common sequelae). There is an opportunity to strengthen support both within and outside the health sector – including increasing provisions for special educational support for children post-infection, and social support for patients and families who are left to deal with the consequences and costs of meningitis on their own.
Meningitis & Climate Change: The Perfect Storm

The optimal climate for meningitis transmission is in the savannah, south of the Sahel, where there is an annual precipitation index of 300–1100 mm, with extremely dry but warm winter seasons and a relatively abrupt onset of the rainy season. Every year during the dry season, dusty winds from the Saharan desert, cold nights and upper respiratory tract infections increase the risk of bacterial meningitis that can result in epidemics. Modelling from climate scientists at the National Centre for Atmospheric Research found that as future temperatures increase, due to climate change, the duration and severity of the meningitis season may also increase. Furthermore, with the rise in temperatures, leading to more climate emergencies and intensifying the displacement of people and overcrowded conditions, meningitis risk is expected to increase.
The cost of inaction
Unless we make a serious effort, the following will occur in the year 2030 alone:

2 050 000 cases of bacterial meningitis, including 1 350 000 cases of vaccine-preventable meningitis globally;

360 000 deaths due to bacterial meningitis, including 275 000 deaths due to vaccine-preventable meningitis

400 000 more people will suffer from a long-lasting disability caused by meningitis

Even with suboptimal coverage for diagnosis, treatment and care, direct medical costs related to meningitis will amount to

US$ 1.9–4.7 billion globally
What we can do now: Supporting action towards a world free of meningitis

Key Messages

• In 2020, the world committed to defeat meningitis by 2030 (all 194 Member States of the WHO)
• WHO with partners developed a cutting-edge road map and identified three visionary goals; to eliminate bacterial meningitis epidemics, reduce cases of vaccine-preventable bacterial meningitis by 50% and deaths by 70% and to reduce disability and improve the quality of life after meningitis due to any cause.
• These visionary goals will be achieved by integrated action across five pillars: prevention and epidemic control, diagnosis and treatment, disease surveillance, care and support and advocacy and engagement.
• This approach not only addresses meningitis as an infectious disease that can often be prevented and treated, but also puts a strong focus on support and care for people living with sequelae and disabilities. The road map is a multidisciplinary and cohesive strategy against meningitis, encompassing all facets of the disease.
• The fight against meningitis fits naturally into primary health care for the mutual reinforcement of actions and health systems in general.
• A strong governance and well-established collaborative infrastructure will ensure successful implementation and impact beyond defeating meningitis.

The Defeating Meningitis by 2030 global road map: towards a world free of meningitis

The Defeating Meningitis by 2030 global road map was approved by the Seventy-third session of the World Health Assembly in November 2020 and was officially launched in September 2021. It focuses on three visionary goals, namely to:

1. Eliminate bacterial meningitis epidemics.\(^6\)
2. Reduce cases of vaccine-preventable bacterial meningitis by 50% and deaths by 70%.\(^7\)
3. Reduce disability and improve quality of life after meningitis due to any cause.

To achieve these goals by 2030, the road map identifies strategic goals, key activities, and milestones across five pillars of action, that respond to challenges that have impeded progress so far (Figure 2).

\(^6\) 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. Each region will set its own definitions for epidemics/outbreaks and targets for reduction according to local epidemiology.

\(^7\) The baseline year for these global targets is 2015. The targets were derived by assessing the likely impact of the road map milestones in consultation with experts across the world and will be measured by reductions in incidence and mortality rates. Vaccine-preventable bacterial meningitis refers to all acute bacterial meningitis caused by Nm, Spn, Hi and GBS whatever the serotype/group.
Figure 2. The pillars of the road map respond to current challenges and lead towards a world free of meningitis

The five pillars are interconnected and their beneficial outputs build upon each other. For example, improved disease surveillance (pillar 3) will lead to: earlier diagnostic and treatment (pillar 2); earlier detection of epidemics and response to meningitis outbreaks (pillar 1); better data to guide the design of prevention, support, and communication programs (cross-cutting); and better documentation of the high burden of sequelae (pillar 4 and pillar 5).

- **The focus of the road map** is on meningococcus, pneumococcus, *Haemophilus influenzae* and GBS, which are collectively responsible for over 75% of bacterial meningitis deaths as well as causing other devastating diseases such as pneumonia and sepsis. Meningitis caused by other bacteria or non-bacterial pathogens is additionally included in some strategic goals (e.g., detecting and managing sequelae or intensifying advocacy and awareness). Therefore, the road map broadly benefits all people affected by meningitis, including people living with HIV who are affected by cryptococcal meningitis or TB meningitis – two important causes of meningitis, particularly in parts of southern Africa.

- **The development of the road map** has involved hundreds of experts, representatives of Member States, global health partners, research institutions, private sector representatives, civil society organizations and people affected by meningitis through numerous multidisciplinary consultations. Based on the latest available evidence and building on best practices, the road map provides a clear action plan to overcome current challenges.

- **The impact of the road map** will be maximized through concerted action across the five pillars. Implementation will be based on the best available evidence.
Defeating meningitis: integration with primary health care

The added value of the road map on health systems

While meningitis manifests differently in different areas and among different populations, global coordination and concerted efforts will help generate best practices and synergies that are globally beneficial. Simultaneous implementation of activities under the five pillars will accelerate progress towards the shared goals of the road map.

Primary health care is the most effective approach to resolve current challenges and is fundamental to achieving the shared goals of universal health coverage, as well as the relevant SDGs.

Using multiple simultaneous approaches to ensure success

**Complementary approach**

- This holistic approach encapsulates the entire patient pathway – from acute infection to long-lasting sequelae.
- The road map reinforces and complements wider initiatives – including universal health coverage, primary health care and health system strengthening.
- As a multidisciplinary approach, it offers opportunities to link with other projects and disease initiatives.
- Demand for meningitis vaccination can contribute to improving coverage of co-administered vaccines.
- Global health security, antimicrobial resistance, and the rights of people living with disabilities will also be supported.

**Diagonal approach**

- The road map aims to capitalize on the synergies of both the vertical approach (where efforts focus on a disease-specific area) and the horizontal approach (where efforts aim to strengthen health systems overall).
- The diagonal approach is crucial, as the integration of meningitis prevention and control efforts into primary health care is critical to achieving the goals of the road map.
- It will drive thus sustainable impact much beyond meningitis.
Supporting implementation and leveraging success

Supporting implementation and leveraging success

Partnerships

National ministries of health and their implementing departments and technical agencies are committed to achieve the road map goals. Member States will need coordinated and synergistic support to be successful.

WHO is engaging partners from a wide range of sectors to contribute knowledge and expertise to implementation of the global road map. There is strong collaboration with research institutions and implementing partners who have extensive experience in scaling up vaccination, surveillance, and rehabilitation programmes in a wide range of settings. Partnerships with global institutions, development partners, and multilateral and bilateral entities will play a crucial role – particularly in resource mobilization and policy dialogue.

Ongoing work with the United Nations organizations such as UNICEF and with other international health bodies – including Gavi, the Vaccine Alliance – will be strengthened.

Partnerships with professional associations and academic institutions will contribute to capacity-building, the transfer of skills and strengthening of existing collaboration between low- and high-resource settings.

Partnership with civil society is fundamental. Meningitis support groups, people affected by meningitis, nongovernmental organizations and a wide range of local networks are working to ensure the successful uptake of services at community level. Innovative ways must be found to secure sustainable resources for these partnerships.

Accountability for impact

The cross-organizational nature of the road map will help ensure better-aligned support for implementation (Figure 3).

WHO’s secretariat will work closely with Member States to bring together different stakeholders – including multilateral and bilateral development agencies, foundations, philanthropies, civil society organizations, the private sector, the research community, academic institutions, health professionals’ associations and a wide range of non-State actors in official relations with WHO.

Efforts to establish new and innovative partnerships to support and sustain implementation involve two key bodies – the Technical Taskforce (TTF) and the Strategy Support Group (SSG).

• The TTF comprises partners and international experts under the general authority of WHO. It is responsible for leading and coordinating the road map’s implementation – both globally and regionally – by providing a forum for technical exchange and cooperation.

• The SSG is made up of representatives from Ministries of Health, global and regional donors, and civil society organizations highly committed to defeating meningitis by 2030. The SSG supports WHO and its partners politically and financially in the global implementation of the road map. The SSG will support relationship-building between donors and Member States and will champion the road map in global forums.

Context-specific adaptations of the road map

The road map was created to be adaptable to different contexts and populations.

All six WHO regions have – or are developing – regional plans to defeat meningitis. The plans reflect diverse challenges and offer opportunities to scale up all five pillars of the prevention-to-care continuum to maximize positive outcomes. Each region has a range of partnerships, agencies, and institutions with context-specific expertise to support implementation of the road map.

In addition, community and sub-national opportunities, for instance at provinces, districts or municipalities levels, should be considered to further understand local environments and context, and knowledge of available local resources as well as acceptability of approaches, possibly through the piloting of actions and activities.

To ensure alignment with the global road map, the WHO secretariat, in collaboration with partners, will also support Member States to develop and implement context-specific plans, as mandated by the World Health Assembly.

“Civil Society Organizations play a critical role in defeating meningitis and achieving the landmark goals set out in the WHO Defeating meningitis by 2030 – a global road map.”
Targeted countries to drive impact

While the road map is applicable worldwide, a number of countries will be given priority assistance in each region according to their burden of meningitis, vaccine coverage rates, strength of health systems, access to health services, level of equitable treatment and other factors. These countries are being identified through WHO regional office-led processes in close collaboration with Member States. This approach will drive success by demonstrating the feasibility and impact of the road map in those countries where meningitis needs and expected road map impact are greatest. The targeting of specific countries will support an equitable approach to resource dissemination.

Figure 3. Governance and implementation framework
Rehabilitation in Tajikistan. Patient in her wheelchair within the urban environment of the city of Dushanbe in Tajikistan. © WHO / NOOR / Sebastian Liste
Key Messages

- Coordinated action across the five pillars of the road map will drive impact and ensure the achievement of the road map’s visionary goals by 2030 and beyond.
- Gradually achieving the visionary goals by 2030 will translate into averting 2,750,000 meningitis cases and 920,000 deaths, and preventing 780,000 persons from living with long-lasting disabling sequelae, equating to 72.5 million DALYs averted.
- Beyond 2030, maintaining the impact over the following decade 2031–2040 will additionally avert 7.4 million meningitis cases, 2.5 million deaths and 2.1 million cases of disabling sequelae, equating to 200 million DALYs averted.
- The elimination of major meningococcal meningitis epidemics is now within reach. This would be a major achievement for global health and development and would make the “meningitis belt” become history. This will be a tremendous public health achievement to build on.

The Defeating Meningitis by 2030 global road map provides a plan for achieving three visionary goals:

- eliminate bacterial meningitis epidemics;
- reduce cases of vaccine-preventable bacterial meningitis by 50% and deaths by 70%; and
- reduce disability and improve quality of life after meningitis of any cause.

Achieving the three visionary goals will have a dramatic impact in reducing the overall meningitis disease burden. This chapter describes the impact and the value of each visionary goal.

**Visionary Goal 1: Eliminate bacterial meningitis epidemics**

Well-designed, evidence-based vaccination programmes can prevent epidemics. Across the meningitis belt, the broad roll-out of a meningococcal conjugate vaccine against serogroup A has eliminated serogroup A meningitis epidemics, which previously accounted for 80% of meningitis outbreaks. By contrast, outbreaks caused by other serogroups of meningococcus or by pneumococcus continue to occur.

The elimination of major meningococcal meningitis epidemics is now within reach. This would be a major achievement for global health and development and would relegate the “meningitis belt” to the history books after more than a century of devastation. Beyond the meningitis belt, implementing the road map will reduce the frequency, size, and duration of meningitis outbreaks throughout the world.

**How will investing in implementation of the road map foster elimination of bacterial meningitis epidemics?**

Recognizing that the road map’s visionary goals and pillars are interconnected, and mutually beneficial, essential action areas aligned with Visionary Goal 1 will be instrumental in eliminating bacterial meningitis epidemics by:
• ensuring that minimum surveillance standards are in place and that surveillance is continuously strengthened – from conducting lumbar puncture of suspected cases to laboratory confirmation – leading to swift and robust detection and documentation of epidemics (Box 1.);
• supporting the development and roll-out of rapid diagnostic tests for faster identification of outbreaks and epidemics and more efficient responses;
• developing optimal global and national policies to prevent and respond to meningococcal and pneumococcal meningitis outbreaks in different populations;
• supporting efficient replenishment and use of the emergency vaccine and treatment stockpiles at the appropriate level (International Coordinating Group and subregional or national level);
• broadening the protection against the main epidemic-causing meningococcal serogroups and pneumococcal serotypes globally – e.g. by expanding vaccination against specific meningococcus serogroups and switching to multivalent meningococcal conjugate vaccines (MMCV) where appropriate (Box 2.).

Activities and the pathway for their implementation are described in detail in the road map document.

Box 1. 
Focus: Increased surveillance capacity for early detection of meningitis outbreaks

The global road map provides an opportunity to strengthen surveillance for bacterial meningitis pathogens, in an integrated approach. For quick and robust detection and documentation of epidemics, it is necessary to ensure that minimum surveillance standards are in place and that surveillance is continuously strengthened – from conducting lumbar puncture of suspected cases to laboratory confirmation.

Many surveillance efforts and programmes are already in place for the main bacterial meningitis pathogens. Existing surveillance systems can be harnessed under the umbrella of the global road map and in some settings can be expanded to capture outbreak alerts, GBS, additional clinical presentations of the pathogens, and more granular data such as circulating serotypes and antimicrobial resistance (AMR) patterns.

As the baseline status of surveillance, pathogen distribution, surveillance priorities and needs for epidemic detection vary by region, a key initial step will be to develop global guidance and adapt it for implementation at regional and national levels. This includes:

• updated strategies on integrated surveillance, preparedness and response to meningitis epidemics;
• setting standards for GBS surveillance (which is not implemented in many settings);
• setting minimum standards for surveillance of the main bacterial meningitis pathogens;
• guidance for surveillance in conflict and refugee settings;
• surveillance of emerging resistance patterns;
• molecular surveillance;
• strategies and tools for studies and surveys to establish and monitor the burden of sequelae.

Countries will require varying degrees of technical or financial support to incorporate these activities into their national surveillance systems.
Box 2.  
Focus: The roll-out of multivalent meningococcal conjugate vaccines (MMCVs) in the meningitis belt

Epidemics caused by meningococcus serogroup A have been eliminated, but epidemics of other serogroups (mainly C, W and X) still strike in the meningitis belt. Vaccines protecting a broader range of serogroups are currently unaffordable and unavailable in the quantities necessary to prevent outbreaks in the meningitis belt, where the disease burden and epidemic risk are the highest. Building on the successful roll-out of meningococcal serogroup A conjugate vaccine, the introduction of affordable MMCVs will be a game-changer, yielding quick and dramatic benefits across the region.

Vaccination campaigns mounted in response to outbreaks and epidemics – i.e. conducted to limit the spread once an outbreak has begun – though critical, are much less effective and efficient than a preventive vaccination programme which is conducted to prevent an outbreak from breaking out. Shifting from reactive to preventive vaccination in epidemic-prone areas will help to stop the carriage and transmission of bacteria, which in turn will avert the burden and cost of epidemics. The high coverage of campaigns against serogroup A demonstrated a high demand from the population, indicating that the roll-out of MMCVs could be a lever to increase coverage of co-administered vaccines, especially in the second year of life.

To make this happen, the road map provides a unique forum to coordinate efforts and avoid delays. Indeed, vaccine development, regulation, development of evidence-based policies and programmatic aspects are all very much interconnected. This integration provides a shared vision and clear path to end the scourge of meningitis epidemics.

<table>
<thead>
<tr>
<th>Research and Development</th>
<th>Research for policy and policy development</th>
<th>Implementation</th>
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<tr>
<td>Support development and licensure of affordable and appropriate MMCVs, and foster competition for more supply and less expensive vaccines.</td>
<td>Gather, generate, and analyze evidence (modelling and field studies), and develop optimal risk-based vaccination strategies to achieve herd protection.</td>
<td>Support countries for MMCV roll-out, including switching from monovalent serogroup A prevention, supporting decision-making and the development of national policies, applying to Gavi (as relevant), supporting optimal integration in national immunization strategies, supplying vaccines, training health workers, addressing cold chain requirements, and strengthening communication and social mobilization.</td>
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Stakeholder coordination

Member States, research institutes, manufacturers, Gavi, UNICEF, WHO and other partners
Visionary Goal 2: Reduce cases of vaccine-preventable bacterial meningitis by 50% and deaths by 70%

By 2030, the comprehensive gradual implementation of the road map will avert 2.75 million meningitis cases and more than 920,000 deaths – when compared with a scenario where no action is taken. Together with a reduction of sequelae, it will translate into 72.5 million DALYs averted.

By maintaining the impact over the following decade (2031–2040), an estimated additional 7.4 million meningitis cases and 2.5 million deaths could be averted. Together with reduction of sequelae, it will translate into an additional 200 million DALYs averted.

Reduction of the disease burden will extend to other widespread conditions caused by the same bacteria, such as sepsis and pneumonia, thus multiplying the benefits of the road map.

How will investing in implementation of the road map foster the reduction in cases and deaths from vaccine-preventable bacterial meningitis?

All activities leading to achievement of Visionary Goal 1 (elimination of bacterial meningitis epidemics) will make a direct contribution to achieving Visionary Goal 2. Additional essential action areas that will be leveraged to support the achievement of Visionary Goal 2 are:

- universal introduction and increased coverage of PCV (Box 3.) and Hib vaccines, and uptake of meningococcal vaccination programme with increased focus on fragile states and settings, leveraging Immunization Agenda 2030 (IA2030) vision, strategic priorities, core principles and overall efforts;

- prevention of GBS infection in neonates and infants via screening and risk-based strategies, and through maternal immunization when a vaccine becomes available (Box 4.);

- development and implementation of global and national guidelines and tools regarding treatment and care of bacterial meningitis;

- establishment of innovative funding mechanisms to facilitate the development and uptake of novel, affordable and reliable diagnostic assays to support immediate medical decision-making at the point of care (Box 5.);

- support to strengthen surveillance – including with updated policies and tools – to design and implement locally-relevant evidence-informed prevention policies;

- monitoring of the antimicrobial pattern and molecular characterization of the main meningitis pathogens strains shared through a global genome partnership; and

- increased awareness about meningitis to foster health-seeking behaviour as soon as the first symptoms appear, and increased demand for vaccination and care.

Activities and the pathway for their implementation are described in detail in the road map document.

2,750,000 meningitis cases and 920,000 deaths averted by 2030

72.5 million disability-adjusted life years averted by 2030

Immunization Agenda 2030

The road map engages the priorities and impact goals of IA2030 to fast-track the impact to defeat meningitis while simultaneously strengthening immunization systems to reduce mortality and morbidity from all vaccine-preventable diseases throughout the life course, increase equitable access and use of existing and new vaccines and ensure good health and well-being for everyone. Investing to defeat meningitis is an investment in the success of IA2030.
Box 3.
Focus: Universal introduction and high-level coverage of PCV

In 2019, one third of bacterial meningitis deaths were due to pneumococcus. Among the bacterial meningitis pathogens, it has the highest fatality rate and causes frequent and severe sequelae. It causes pneumonia – one of the leading causes of death in children under 5 years of age – and ear infection, and also causes a high burden of disease in older populations.

Despite the severity and burden of disease due to pneumococcus – and although WHO recommends PCV introduction within childhood immunization programmes in all countries – only half of the eligible children were fully vaccinated with PCV globally in 2019. Almost 90% of high-income countries and Gavi-eligible countries have introduced PCV nationwide, yet vaccination coverage rates are variable and uneven. In contrast, less than 65% of non-Gavi-eligible middle-income countries have introduced PCV vaccine, often lagging behind due to the challenge of affordability.

Universal introduction of PCV in childhood vaccination schedules with high coverage will significantly reduce the circulation of pneumococcus, thus protecting children directly and adult populations indirectly. Widespread PCV dissemination will also reduce morbidity and mortality due to pneumonia.

To increase PCV uptake, effectiveness and efficiency, the road map activities will focus on:

- supporting countries to increase PCV introduction and coverage, especially in fragile states and middle-income countries, synergizing efforts with IA2030 activities;
- supporting the development of new and affordable PCVs and fostering competition to reduce the price of PCVs and broaden the protection against additional pneumococcal serotypes; and
- updating vaccination policies on the schedule and number of doses for PCV to increase both direct and indirect protection.

Box 4.
Focus: GBS prevention (context-specific antibiotic-prophylaxis strategies and vaccination)

While commonly found in healthy persons, GBS can cause severe maternal and newborn infections, leading to high rates of mortality and long-lasting disability, as well as stillbirths. Administering intravenous antibiotics to pregnant mothers who are carrying GBS can prevent mother-to-child transmission. Additionally, the development of GBS vaccines suitable for maternal immunization in LICs and MICs was identified as a priority by WHO in 2015. The global road map aims to have at least one affordable vaccine against GBS licensed and prequalified by WHO for maternal immunization during pregnancy by 2028.

Further roll-out of context-specific GBS prevention strategies will be implemented through direct support to antenatal care and maternal and child health. It will be fostered and facilitated by:

- research to inform the development of strategies regarding GBS disease burden, epidemiology and transmission, health service infrastructure and access, antibiotic supplies, and optimal screening or risk-based policies to inform antibiotic use for GBS prevention, especially in LICs and MICs;
• development of global policies on preventing GBS transmission in infants, considering evidence, burden and feasibility, with consideration for the potential impact on AMR and linking with other sepsis and maternal and child health initiatives; and

• development of affordable diagnostic assays – suitable for low-resource settings – to detect both maternal carriage of GBS and infant GBS infection.

GBS vaccine development has been shown to be financially sustainable and is likely to be profitable for global manufacturers – subject to adoption in high-income countries. Development, licensure and introduction of safe, effective and affordable GBS vaccines for maternal immunization during pregnancy to prevent invasive GBS disease in neonates and infants will be a gamechanger. To this end, work will be done to:

• define correlates of protection to facilitate GBS vaccines licensure;

• develop global policy on GBS vaccines;

• support country-level decision-making on GBS vaccines; and

• support the introduction of the vaccine while strengthening maternal immunization.

Box 5.
Focus: Access to improved diagnostic tools for better decision-making

The gold standard for confirming bacterial meningitis is culture or real-time polymerase chain reaction (PCR) from cerebrospinal fluid (CSF) samples. However, access and capacity to perform these techniques may be limited in LICs and MICs, especially where meningitis outbreaks are more frequent. There is a need for novel, rapid high-performance diagnostic assays that are affordable and easy to use. Better diagnosis will result in better clinical management (e.g. whether or not to use antibiotics) and a better public health response (e.g. improved targeting of vaccines), both of which will have an impact on the burden of meningitis.

Quality-assured, affordable, and accessible novel diagnostic assays are needed for several specific uses, namely:

• to detect invasive bacterial versus viral infection rapidly in order to support immediate medical decision-making as close as possible to the patient’s bedside;

• to identify and distinguish the main pathogens responsible for meningitis via multiplex assays; and

• to detect maternal carriage of GBS and infant GBS infection in low-resource settings.

The road map provides a unique forum to coordinate efforts between countries, technical partners and donors to achieve better meningitis diagnostics. Innovative (pooled) funding mechanisms to facilitate the development and uptake of novel rapid diagnostic assays will be developed with the aim of having these available to countries by 2028. Countries will need support to procure these tests and to ensure their deployment at the peripheral level, including the development of national policies for testing, optimal integration of the assays in national surveillance strategies, and training of health workers.
Recent progress in vaccine development to foster achievement of road map goals

Since the road map was launched in 2021, there has been notable progress in vaccine development for bacterial meningitis pathogens. For instance:

• Additional, including higher valency, PCVs are becoming available: a 14-valent PCV was licensed in India for use in infants, a 15-valent PCV was licensed for use in infants and adults in Europe and the United States of America (USA), and a 20-valent PCV was recommended for use in infants and adults in the USA, and several higher valency products are in various stages of development.

• A pentavalent ACWXY meningococcal conjugate vaccine – containing serogroup X – was licensed in India and WHO prequalified; while WHO issued recommendations for its use in countries of the African meningitis belt.

• Leading GBS vaccine candidates – both polysaccharide-protein conjugate and protein subunit vaccines – are in advanced clinical development.

• A vaccine targeting *Haemophilus influenzae* serotype A is in early clinical development.
Visionary Goal 3: Reduce disability and improve quality of life after meningitis due to any cause

The gradual implementation of the road map will avert a cumulative 780 000 cases of long-lasting sequelae by 2030. By maintaining the impact over the following decade (2031–2040), additional 2.1 million persons will be prevented from long-lasting sequelae.

Children and adults with disabilities such as those resulting from meningitis are less likely to have access to routine medical care, including vaccinations, and have lower health literacy levels due to interrupted or discontinued education.

Improving these factors will enhance the health and well-being of people affected by meningitis, will provide them with a positive educational and economic outlook, and will boost the quality of life for patients and caregivers alike.

This will also generate increased awareness of the consequences of meningitis and empower people to access the care they need, including the millions of people who became disabled by meningitis in the past and who still have no or limited support and care, and whose lives could be improved.

How will investing in the road map's implementation foster the reduction of disabilities and the improvement of quality of life after meningitis?

All activities leading to achievement of visionary goals 1 and 2 will have a direct contribution to achieving visionary goal 3 (Figure 4). Reduction of disability and improvement in quality of life after meningitis (regardless of the cause) will also be furthered by the following essential action areas:

- conducting research on the effectiveness of adjunctive therapies to reduce the probability of sequelae;
- promoting systematic follow-up of patients for early detection of sequelae;
- developing and implementing diagnosis, treatment and care guidelines (Box 6.);
- increasing awareness at community level to identify sequelae and improve community services for those living with disabilities and their caregivers (Box 7.);
- increasing supply of and access to medical services, medicines and other health products for diagnosis, treatment and care of sequelae;
- developing strategies and tools to establish and monitor the burden of sequelae; and
- liaising with other initiatives to advocate for the rights of persons with disabilities.

Activities and the pathway for their implementation are described in detail in the road map document.

780 000 cases of long-lasting sequelae due to meningitis averted by 2030
Box 6. **Focus: Developing and implementing the first comprehensive meningitis diagnosis, treatment and care guidelines**

Meningitis case fatality remains high, despite well-established antibiotic treatment regimens. Additionally, many people who have suffered from meningitis have severe complications with long-lasting sequelae. Despite these severe health impacts, data and guidance on the diagnosis, treatment, and care of patients with meningitis are scarce. Notably, there are currently no WHO guidelines for the treatment of adults with bacterial meningitis or for follow-up of patients beyond the acute meningitis phase. Therefore, WHO is developing the first-of-its-kind comprehensive global guidelines for the diagnosis, treatment, and care of meningitis.

An expert Guideline Development Group (GDG) has been formed to review current evidence and develop guidelines on meningitis diagnosis, treatment, and care. In particular, the GDG will review evidence on the role of adjunctive therapies to prevent neurological sequelae in LICs and MICs, as well as evidence for the detection, monitoring and long-term management of sequelae such as impairment of hearing and vision, epilepsy and rehabilitation for disability. Regions, countries, and communities will be supported to adapt and implement these guidelines locally.

The guidelines will primarily target health-care providers working at a first- or second-level health facilities, including basic outpatient and inpatient services, particularly in LIC and MIC settings. The guidelines and their derivative products will also have implications for policymakers, health-care planners and programme managers, as well as the general population.

The guidelines will be developed closely with other WHO action plans and strategies (i.e. the Intersectoral global action plan on epilepsy and other neurological disorders). This work will be aligned with WHO’s move towards making health services more people-centered. It will contribute to the attainment of Sustainable Development Goal 3.8 and the achievement of quality essential health-care services (promotive, preventive, curative, rehabilitative and palliative) in the context of universal health coverage. It will also strengthen connections with other disease areas that successfully leverage the rehabilitation community.
Box 7.
Focus: Improving sequelae awareness and access to services at community level

The most common sequelae of bacterial meningitis include loss of hearing and vision and seizures. In addition, cognitive impairment is also a frequent sequelae, however, it is likely underestimated – particularly in children in low-resource settings and including subtle neurocognitive symptoms that might contribute to behavioural or learning disabilities. It is crucial to increase awareness of the sequelae of meningitis and how those sequelae can dramatically affect survivors’ performance in school or at work.

As a first step to increase awareness of meningitis sequelae among the public, the global road map includes activities to fill gaps in data on the socioeconomic impact of sequelae on children, adults and their families/caregivers, and the effectiveness of aftercare/support interventions in reducing this impact. Additionally, work will be done to map pre-existing community services that could benefit individuals and families managing the after-effects of meningitis and to strengthen connections with other disease areas that successfully leverage the rehabilitation community. Identifying the gaps and barriers in access to services and creating links and referral networks in both the health sector and the community (e.g. schools, workplaces) will help to target improvements in services for people living with disabilities. These activities will work within cultural contexts to educate about the dangers of stigma and discrimination and to ensure that efforts to map and improve access to resources are culturally suitable, inclusive, and adaptable.

Improving disabled people’s rights and accessibility options is a priority for WHO and its partners, as indicated in the UN Resolution on Disability Rights. Meningitis can be a useful vehicle for driving these efforts forward, particularly in LICs and MICs.
The impact of the road map beyond the visionary goals

Key Messages

• The road map will have a tremendous impact well beyond meningitis, and each pillar will contribute to achieving other key global health objectives.

• Defeating meningitis will reduce the burden of conditions caused by the same bacteria such as sepsis and pneumonia, thus multiplying the benefits of the road map and its actions. It will contribute to antimicrobial resistance containment, will strengthen health systems and put primary health care at the centre, and will act as a powerful lever for recognizing disability and improving access to support and rehabilitation.

• Gradual implementation of the road map will translate into health care savings through reduced cases and sequelae equating to US$ 3.8–10.0 billion by 2030.

• Economic benefits through increased workforce participation and productivity (from the cases, sequelae and deaths averted) equate to US$ 86–100.4 billion by 2030. This does not account for those working in the informal sector.

• Beyond monetary aspects, implementing the road map will have a positive impact on equity and global development, especially for the most vulnerable communities where the catastrophic impact of meningitis is magnified, and for women and girls who disproportionately serve as caregivers.

• Given the impact of meningitis on health, education, access to decent work and income, and poverty, defeating meningitis directly contributes to the achievement of several SDGs.

Direct impact on other diseases

Limiting the impact of meningitis-causing pathogens on other diseases

The road map focuses on the four pathogens that cause most of the bacterial meningitis cases and deaths. They can also cause other devastating diseases. Pneumococcus is the leading cause of global pneumonia mortality. GBS causes sepsis, resulting in an even greater number of cases than GBS meningitis cases – especially in neonates. Pneumonia, meningitis, and neonatal sepsis are three of the top 10 causes of mortality in children under five years of age.

The wider use of vaccines against Hib, PCV, Nm and GBS through the road map efforts will thus also reduce the burden of pneumonia, sepsis, and other invasive disease.

Limiting the rise in antimicrobial resistance (AMR)

The spread of AMR constitutes a significant threat to global health. Most recent estimates suggest that 1.27 million deaths were attributable to AMR in 2019 (24). Antimicrobial resistance is a growing issue, declared by WHO as one of the top 10 global public health threats facing humanity. Mainly driven by the misuse and overuse of antimicrobials – including antibiotics, antivirals, antifungals and antiparasitic – AMR allows bacteria, fungi, and parasites to mutate and become less responsive to treatment, thus increasing the risk of disease spread, severe illness and death. Treating resistant infections has socioeconomic consequences such as prolonged hospital stays, the need for intensive care or use of more expensive antibiotics.

During the 2015 World Health Assembly, Member States committed to the framework of the Global Action Plan on Antimicrobial Resistance, which focuses on the development and implementation of multisectoral national action plans. Currently, over 138 countries have WHO-approved AMR national action plans. In 2020, WHO published an Action Framework Leveraging vaccines to reduce antibiotic use and prevent antimicrobial resistance, stating that the increased uptake of PCV and Hib vaccines, among others, should be prioritized for their impact on antibiotic use and AMR.
Vaccines can have an impact on AMR by reducing drug-sensitive and drug-resistant infections, secondary infections, antibiotic use, and evolution and transmission of resistant genes. For instance, PCVs are estimated to confer nearly 20% protection against antibiotic-treated episodes of acute respiratory infection. Under current vaccination coverage levels, PCVs prevent 23.8 million episodes of antibiotic-treated illness among children under five years of age in LICs and MICs each year. If all children aged 2–5 years in LICs and MICs were vaccinated with PCVs, an additional 21.7 million episodes of antibiotic-treated acute respiratory infections could be prevented.

The road map’s efforts towards introducing vaccines, increasing vaccination coverage, improving diagnostics and developing global meningitis treatment guidelines will make great strides towards combatting AMR in alignment with global health priorities.

The broader impact on societies

Impact on health-care costs

The savings of health-care costs due to the reduction of 920,000 cases and 780,000 persons with long-lasting sequelae by 2030 with gradual implementation of the road map are estimated to be between US$ 3.8 billion and US$ 10 billion. A more accurate figure is difficult to estimate because of the scarcity of data on costs and coverage, especially for the management of sequelae.

- The averted direct medical costs of treatment for the acute phase directly due to the reduction of cases are estimated to be in the range US$ 1.7–3.0 billion.
- The averted direct medical costs for those with sequelae would be in the range US$ 2.1–7.0 billion, amongst which about half within the first year after the infection. While the number of people with sequelae – as well as related medical costs – will significantly decrease thanks to the road map, a portion of the savings should be used to improve access to care and increase the quality of life of those with sequelae.

Impact on economies and family income

Beyond the health consequences and direct medical costs, meningitis represents a heavy economic cost due to inability to work and loss of productivity – primarily for patients and their families.

- Adult patients are unable to work during the acute phase of the disease which usually lasts several weeks, and often much longer. When a child has meningitis, the parents are often unable to work in order to care for the child or because of the emotional turmoil – and too often because of bereavement. Reduction of 920,000 cases resulting from the gradual implementation of the road map by 2030 translates into economic benefits of US$ 220–370 million because of absence from work averted. These economic benefits apply primarily to patients and families, and to a lesser extent to the insurance services, where applicable, that otherwise may have to cover these losses.
- Once fully implemented by 2030, the road map will foster an expected 63% global reduction in deaths due to all bacterial meningitis (and 70% for the four pathogens of focus). Most people whose lives will be saved will also be able to work and generate revenues for themselves and their families. The reduction of 920,000 deaths gradually averted by 2030 are estimated to be worth approximately US$ 66.8–71.3 billion in economic benefits over the working life course of people whose life will be saved.

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8 All costs in this section are discounted costs. Discounting allows the future costs to be valued in the present time, assuming that one unit of money (e.g. one dollar) would be worth less in the future that it is today, according to the concept of the time value of money or preference for the present time. We used a discounting rate of 3% and the discounting formula is Discounted_Cost_2023 = Cost_Year_N / (1 + 3%)^N-2023. It implies that a US$100 cost in 2024 is reported as US$97 in 2023, a US$100 cost in 2030 is reported as US$81 in 2023, a US$100 cost in 2070 is reported as US$25 in 2023. Long-term costs for sequelae run until 2070 for a meningitis case occurring in 2030.
Disabilities following meningitis represent an important loss of revenue for patients and their families. Persons with sequelae may be partially or totally unable to work. Their income may be reduced because of lower productivity, absenteeism due to time spent on medical follow-up and care, and because of wage-discrimination against persons with disabilities. In addition, caregivers pay a heavy price because of time spent caring, including sometimes having to give up their job or career. The road map could generate an additional US$ 19.0–28.7 billion in economic benefits for patients and caregivers.

In total, the road map could generate US$ 86.0–100.4 billion in economic benefits for the cases and sequelae gradually averted by 2030. These estimates are significantly underestimated as they do not take into account the loss of wages for those working in the informal sector, which yet represents a high portion of the families revenues in the most affected areas.

In addition, the implementation of the road map will translate in savings of other indirect costs that have not been quantified, such as averting special education costs for those with sequelae. Higher education performance and better career opportunities for those with minor cognitive disabilities will also generate additional economic benefits.

Impact on equity and global development

With implementation of the road map, fewer children will suffer from disabilities and those who do will be better supported to grow and prosper into adulthood. These children and their caregivers will be more likely to pursue educational opportunities, leading to greater career advancement.

People suffering from long-lasting sequelae will benefit from the increased, sustained support outlined in the road map, particularly via activities that aim to leverage participation in society. The road map’s prioritization of non-discrimination, inclusion, respect, and acceptance aligns with the principles of the UN Convention on the Rights of Persons with Disabilities.

Ultimately, the social impacts of defeating meningitis will contribute to an overwhelmingly positive impact on the world’s poorest and most marginalized communities. A meningitis diagnosis is always catastrophic, but people living in poverty are less likely to receive rapid and adequate care, causing them to suffer more severe consequences. Poor communities lack many supportive services, making it exponentially more challenging to deal with long-lasting sequelae.

The savings generated by the road map will be important for households that are at risk of catastrophic spending if hit by an unforeseen health-related issue such as meningitis infection. Better prevention and control of the disease can protect home wealth and avoid poverty. In particular, households may not need to resort to measures such as limiting the disposable income for medical care, selling family assets or removing siblings from school.

Defeating meningitis will positively impact multiple Sustainable Development Goals (SDGs), particularly the following:

- **No poverty (1)**
- **Good health and well-being (2)**
- **Quality education (3)**
- **Sustainable cities and communities (11)**
- **Clean water and sanitation (6)**
- **Ensure availability of clean water and sanitation (6.1)**
- **Ensure availability of safe, affordable, and clean energy (7)**
- **Ensure access to affordable, reliable, modern energy services (7.2)**
- **Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all (8)**
- **Achieve full, productive employment and decent work for all (8.1)**
- **Reduce inequality within and among countries (10)**
- **Revive the global partnership for sustainable development (17)**
- **Ensure peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable institutions (16)**
- **Peaceful and inclusive societies for sustainable development (16.1)**
- **Inclusive institutions for sustainable development (16.2)**
- **Partnerships for the goals (17)**
- **Promote the整 line of peace and justice, strong institutions, and inclusive societies (16)**
- **Strengthen the capacity of all countries, especially developing countries, for local and global peacebuilding (16.4)**
- **Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable institutions (16.1)**
- **Ensure availability of clean water and sanitation (6.1)**
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Defeating meningitis to support gender equity

People who contract meningitis are often reliant on family members for care; these caregivers are overwhelmingly mothers, sisters, grandmothers, or aunts, leading to gender inequity with women and girls being more likely to drop out from school, give up career opportunities, and suffer from mental and emotional strain due to meningitis.

For youth populations, meningitis-related costs often preclude the possibility of educational attainment. For instance, a study in the United Kingdom found that educational costs following severe infection could be upwards of US$ 300 000 (due to costs for special education, transportation, adaptation costs for accessibility etc.) (25). When these costs cannot be met, young people are more likely to drop out of school, which means they will instead be at home where they require full-time care, more likely from female caregivers.

In South Africa’s Western Cape, 35% of mothers who were previously employed and had a child who survived tuberculosis meningitis with permanent disabilities had to stop working to care for the child (26).
A pioneer center for children suffering from deafness and hearing impairment in Burkina Faso

The Centre d’Éducation et de Formation Intégré des Sourds et des Entendants (CEFISE – Integrated Education and Training Center for the Deaf and Hearing), founded in 1988 by Pastor Abel Kafando, is one of the pioneering institutions for the integration of deaf children in West Africa. CEFISE seeks to promote inclusive education and rehabilitation for people who are deaf or hearing-impaired, or who live with other disabilities, in an inclusive framework. It enrolls children from pre-school to secondary school in general or technical curricula, and prepares people living with a disability for employability through appropriate socio-professional training that takes account of their disability.

As its name suggests, CEFISE is all about helping children living with a disability to cohabit with those who do not. Pupils share games and school benches, and can learn sign language together. A tutoring approach is set up between children, whether between children living with a disability or between children living with and without a disability, depending on the skills each has to offer. “Our credo is to put a smile on everyone’s face and never leave anyone on a negative note”, says Madame Thérèse Kafando, General Director of CEFISE, adding that “it’s everyone’s contribution that gives results”.

For a close follow-up, in addition to education and training, CEFISE has set up specialized services for its students, including audiology, speech therapy and psychology.

When it was founded, the center had fewer than 20 children. Today, CEFISE is active in several regions of Burkina Faso, and its 4 sites welcome 5,300 pupils, including over 800 children with disabilities, most of whom experience deafness or hearing impairment, or visual impairment. “For most of the children with deafness and hearing impairment, this is linked to meningitis”, reports Madame Kafando, “and often, the children at CEFISE who have sequelae linked to meningitis are not only deaf, but have other major disabilities that require psychological follow-up and specific support”.

For CEFISE’s General Director, awareness raising about meningitis is never enough, whether at the level of caregivers, individuals or communities: “You have to be reactive and not delay in taking the case seriously”. The same is true for awareness of the after-effects: “we need to get familiar with the first steps, which are to take patients to consultations”, even if she acknowledges that “there is often a huge lack of funds for the management of illnesses – we need more resources for that”.

School children. © CatherineLProd, Shutterstock
Pillar specific impacts on global health

The road map was designed to generate impact beyond its three visionary goals, particularly by combining meningitis efforts with other health initiatives at local, national, regional and global levels. A collaborative approach across the five pillars strengthens health systems overall and puts primary health care at the centre.

Each pillar contributes to the achievement of the road map’s goals, and each pillar will have a significant impact on health beyond those goals (Table 1).

Table 1. The five pillars: their impact on meningitis and health more broadly

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Overview</th>
<th>Contribution to visionary goals</th>
<th>Health impacts beyond meningitis</th>
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</table>
| **Pillar 1: Prevention and epidemic control** | Development of (and enhanced access to) affordable vaccines, effective prophylactic strategies and targeted control interventions | • Refined policies to respond to outbreaks  
• Elimination of epidemics through stronger prevention  
• Fewer cases, deaths and disabilities due to stronger implementation of evidence-informed preventive measures | • Lower burden on health systems by avoiding outbreak-related disruption  
• Increased vaccine demand overall (with meningitis vaccines serving as a driver)  
• Prevention of sepsis, pneumonias and other conditions caused by meningitis-causing pathogens  
• Reduction of AMR by reduced use of antimicrobials, thanks to a reduction in cases (Hib, pneumococcus, GBS) |
| **Pillar 2: Diagnosis and treatment** | Improved diagnosis at all levels of health care; health worker training; prompt and effective case management | • Decreased fatality rate and lower probability of sequelae thanks to earlier and better diagnostics and treatment | • Stronger primary care through integration in national plans of diagnostic and treatment services at community level  
• AMR containment due to more appropriate use of antimicrobials |
| **Pillar 3: Disease surveillance** | Surveillance of all major pathogens causing bacterial meningitis and its sequelae, to guide meningitis control policies and monitor progress towards goals | • More and better data to inform prevention policies at global, regional, and national levels  
• More timely response to outbreaks, thanks to earlier detection and confirmation of cases  
• Better data on the burden of sequelae to inform policies | • Strengthening of integrated surveillance systems  
• Improved surveillance of other diseases, including epidemic-prone diseases |
| **Pillar 4: Support and care for people affected by meningitis** | Effective and timely identification and management of sequelae, complemented by access to appropriate support and care for all those affected by meningitis | • Lower impact of sequelae due to their systematic detection, and access to care for rehabilitation  
• Better quality of life due to availability of long-term support | • Lower burden on health of caregivers  
• Better access to care and support for those living with disabilities, whatever the cause  
• Empowerment and political support for disability rights including equitable access to health |
| **Pillar 5: Advocacy and engagement** | Multi-stakeholder engagement to raise public and political awareness of meningitis and its long-lasting impacts, in turn improving health-seeking behaviour and access to prevention and care | • Increased acceptance of vaccines  
• Better awareness of meningitis, leading to swifter care in case of symptoms, thus improving disease outcomes  
• Stronger recognition of meningitis as a public health issue at all decision-making levels | • Overall improvements in rates of vaccination and preventive health care  
• Improved and earlier access to care  
• Reinforced political support at all levels |
Implementing the road map will defeat meningitis, but investments and political commitments are urgently needed.

A catalytic investment of US$ 130 million is needed for the immediate three years.

Catalytic investment will allow initiation of priority research activities, update and development of key strategies and policies, awareness raising of meningitis at all levels, and support to targeted countries in all six WHO regions.

An estimated further US$ 310 million is needed to comprehensively implement the road map until 2030.

The road map is focused on country-level impact, which is accordingly reflected in the distribution of needed funds: for every US$ 1 required by WHO and partners, US$ 4 is needed for Member States.

The world now has a clear, actionable and achievable plan to defeat meningitis by 2030. Time for action is now.

The road map – developed by a diverse group of stakeholders – is an evidence-based and concrete plan that is ready for implementation. It will have a substantial impact on global health outcomes – both meningitis-specific outcomes and beyond.

How countries allocate resources to meningitis control will continue to vary. Nevertheless, the extra investment required globally to achieve a powerful and equitable impact is relatively modest. The investment will concentrate most on countries with the greatest needs – on the assumption that the current level of national investment will be maintained in all countries. Annex 1 presents the investment in more detail.

The estimated resources required to implement the entire road map by 2030 reflect the following assumptions:

- Investments in health systems strengthening (HSS), primary health care and universal health coverage will have an impact on the road map’s implementation, and vice versa.
- The required resources are for activities led by Member States, WHO and partners.
- All road map milestones have been included in the estimate of resources (see below).
- The estimated resources for in-country activities focus on expected support provided to Member States. Domestic resources (fiscal and physical) vary between countries. Beyond activities to be covered by the investment, further mobilization of domestic resources – and strengthening of primary health care and health systems – will ensure sustainable impact and will be defined in national plans.
- The financial estimates in this document, however, do not include existing and ongoing donor commitments – typically those aiming at supporting vaccine introduction.

Appropriate mechanisms will ensure efficient distribution of available financial support to Member States, partners and stakeholders while also allowing donors to maximize investment impact aligned with their own funding priorities, whether global or bilateral.
Catalytic investment will jumpstart the road map

A catalytic investment of US$ 130 million will jumpstart implementation of the road map.

This figure (Figure 5) consists of:

- **US$ 89 million** for Member States, focusing on targeted countries; and
- **US$ 41 million** for WHO and partners of the Technical Taskforce. These funds are key for research and policy activities during the inception phase, which will support subsequent implementation activities in countries.

Support will focus on a three-year period and will include:

- initiating all priority research activities;
- updating existing strategies and policies, and developing strategies and policies in areas where they are critically needed;
- raising awareness of meningitis at all levels; and
- supporting targeted countries in all six WHO regions to develop their national plans to defeat meningitis and to implement key activities covered by the five pillars.

To ensure full global implementation of the road map, the catalytic investment will allow the meningitis community to:

- immediately launch activities that will drive impact;
- demonstrate the relevance of the road map;
- monitor and evaluate lessons and experiences from initial countries;
- refine the estimate of needs on the basis of early implementation; and
- continue driving momentum to energize stakeholders and support further fundraising efforts.

Catalytic investments are further detailed in Annex 1.

**Figure 5. Overview of the catalytic ask by type of activities**

Looking to 2030: investments and needs

Investing beyond the catalytic ask

From now until 2030, an estimated US$ 440 million (including the catalytic investment of US$ 130 million and US$ 310 million of scaling-up investment) will be required to ensure full implementation of the road map. The total investment is described below (Figure 6) and is further described in Annex 1.

The US$ 440 million can be separated as follows:

- **US$ 90 million** for activities led by WHO and Technical Taskforce partners (including the US$ 41 million catalytic investment), half of which is for direct technical support to countries;
- **US$ 350 million** for in-country activities led by Member States (including US$ 89 million catalytic investment)

The road map is focused on country-level impact, which is accordingly reflected in the distribution of needed funds: for every US$ 1 required by WHO and partners, US$ 4 is needed for Member States.
An iterative process will refine needs and increase efficiency

Calculation of the investments required by 2030 will be refined as the process unfolds over the coming years (Figure 7). The catalytic investment will enable countries to analyse their own situation, develop a national plan and start implementing it, and identify a more accurate picture of what is required to fully implement the road map. In addition, research outcomes, new policies and strategies, and lessons from development and implementation of context-specific national plans will support the gradual refinement of overarching needs (e.g. new products such as rapid diagnostic tests will have the potential to reduce the cost of implementation).
Unpacking the Ask: focus on activities led by WHO and TTF partners

Some US$ 90 million is needed through 2030 to cover activities conducted by WHO, TTF partners and additional organizations, and includes the US$ 41 million catalytic investment. This amount will be used primarily for the following:

- **Research.** Research will be conducted by WHO and TTF partners while some of the funds will be allocated to external partners to increase efficiency. Coordination across different workstreams – such as research, policies, regulatory issues and field implementation – is also critical to ensure uptake of interventions.

- **Strategy and policy.** A key area of activity for WHO is the development of normative guidance, strategies and polices based on the best available evidence, for all five pillars of the road map.

- **Implementation of global activities.** WHO and TTF partners will have a key role in implementing global activities – mainly focused on facilitating data collection, management and sharing.

- **Direct support to countries.** Given that the impact of the road map will materialize via field activities, WHO and TTF partners will provide and finance direct technical support at the country level. This will first include supporting and conducting situation analyses, assisting with the development of national plans, and providing technical support for achieving country-related road map milestones, and will be then more specific to each activity.

- **Coordination of global efforts.** This will include fundraising, governance (see Accountability for impact), project management and M&E.
The Research Agenda

The road map has been developed to generate impact – available tools and evidence-based strategies that work and should be further used. Research must be sustained to continue development and improvement of vaccines, diagnostics and treatments – including making them more accessible to countries where the meningitis burden is highest – and to continue to optimize strategies and policies. Meanwhile, research is paramount for sustained and increased impact. The road map includes 36 milestones including research and development, and operational research.

Research activities will be implemented by a variety of stakeholders – including Member State representatives – and will be coordinated appropriately.

The research agenda is estimated at US$ 22 million. This does not include the costs of research and development for products, which will be undertaken primarily by the private sector, but includes some seed-funding to initiate product development partnerships.

Priority Research agenda for the road map

<table>
<thead>
<tr>
<th>Prevention and epidemic control</th>
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</thead>
<tbody>
<tr>
<td>Development of new vaccines against bacteria causing meningitis and septicemia</td>
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<tr>
<td>Evaluation of the optimal preventative approach for GBS neonatal infections in different epidemiological situations</td>
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<tr>
<td>Re-evaluation of the potential of chemoprevention in outbreak control</td>
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</tr>
<tr>
<td>Determining optimal strategies to prevent/respond to pneumococcal meningitis epidemics</td>
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<tr>
<td>Evaluation of vaccination strategies to achieve herd protection by using multivalent meningococcal conjugate vaccines</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Diagnosis and treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation of the reasons for underutilization of lumbar puncture in patients with suspected meningitis, and related potential solutions (applies to specific settings)</td>
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</tr>
<tr>
<td>Development and evaluation of novel CSF/blood diagnostic tests for a) rapid differentiation between patients eligible to receive antibiotic treatment as well as rapid referral (peripheral level); b) rapid field detection of outbreak causes (peripheral level); and c) informed case management (hospital level)</td>
<td></td>
</tr>
<tr>
<td>Development and evaluation of simple tests to monitor antibiotic sensitivity</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Disease surveillance</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Development and evaluation of new tools to improve estimates for meningitis incidence, etiology, mortality and pattern of sequelae (including data management and development of new diagnostic tests)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Support and care</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and evaluation of methods to ensure early referral of suspected meningitis cases, especially in settings where referral is suboptimal</td>
<td></td>
</tr>
<tr>
<td>Development and evaluation of novel methods for reducing the impact of sequelae on affected persons, their families and communities (especially in limited-resource settings)</td>
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</tr>
<tr>
<td>Mapping of facilities providing different types of care/support to people with sequelae and related accessibility</td>
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</table>
Unpacking the Ask: aligning investments with the pillars of the road map

Funding needs to be allocated in line with the needs of each pillar and the activities it covers. For each pillar, the amounts below have been calculated for both the catalytic investment and the total investment. The summary below presents an overview of salient aspects of the investment, but the requested funds allow for the implementation of all key activities described in the road map. The details of the investment under each pillar are described in Annex 1.

Pillar 1: Prevention and epidemic control
Total investment: US$ 103.9 million
Catalytic investment: US$ 29.6 million

Fragile states. In addition to technical support to all countries in the meningitis belt, the investment will provide a specific “helping hand” to fragile states in the belt that have not yet introduced meningococcal vaccines. This represents a marginal amount compared to the total cost of increasing uptake and coverage of monovalent A meningococcal conjugate vaccine and rolling out the multivalent meningococcal conjugate vaccine (borne jointly by Member States and Gavi). Similarly, specific support will be provided to fragile states that have not yet introduced PCV (whether or not they are eligible for Gavi support).

GBS prevention. A significant component of the investment is for GBS prevention through context-specific strategies and through vaccination. The first vaccine is expected to be available by 2028. The roll-out may be supported by Gavi, pending a decision of its board.

Integration and support to other platforms. Synergies and integration with other health interventions will be essential for the success of the road map and the overall strengthening of health systems and primary health care. For instance, implementation of context-specific GBS prevention strategies in medium- and high-burden countries will be achieved by strengthening antenatal care and maternal health, while GBS vaccine introduction will be achieved by strengthening maternal immunization platforms.

Innovation. Research and development or updating of evidence-based policies and strategies, especially for new vaccines and for outbreak prevention and response, are paramount for this pillar.

Pillar 2: Diagnostics and treatment
Total investment needed: US$ 83.1 million
Catalytic investment needed: US$ 21.3 million

Integration of meningitis diagnosis and treatment into PHC. Guidelines for diagnostics and treatment will be updated based on the latest available evidence. They will be comprehensive (i.e. they will include GBS meningitis diagnostics and treatment) and will aim to integrate follow-up of patients after meningitis. Guidelines will be developed at global and regional levels and will be adapted by each country to local settings. Most of the investments relate to the actual implementation of the guidelines (i.e. to support diagnostics and treatment of meningitis in countries), which can include support to laboratories and procurement processes in laboratory and medical supplies. A particular focus will be to further integrate diagnostics and treatment at peripheral level and, more generally, into primary health care. Advocacy and communication activities under Pillar 5, such as increasing awareness of meningitis symptoms among the population, will support effective diagnosis and treatment.

Improved diagnostic tool. In addition to support countries, another important activity will be to foster the development of new diagnostic tests, such as point-of-care diagnostics, including through development of partnerships.

Pillar 3: Disease surveillance
Total Investment needed: US$ 95.2 million
Catalytic investment needed: US$ 32.2 million

Strengthened surveillance. In-country activities will focus on strengthening or building robust meningitis surveillance, outbreak detection networks and more resilient health systems. An initial key focus will be the development or updating of surveillance strategies for bacterial meningitis pathogens in each region, aligned with WHO Vaccines-Preventable Disease Surveillance Standards and other WHO surveillance guidelines. Global and regional strategies and tools will be developed for surveillance of GBS disease, including standardized case definitions and ascertainment methodologies, along with operational research on GBS surveillance. The overall investment will support case detection, investigation and response, laboratory equipment and supplies for advanced diagnostics, laboratory training, supervision and monitoring, and data analysis and reporting to inform decision-making. Investment priority will be given to targeted countries with weak surveillance systems and major gaps in existing provision.
Generation and sharing of advanced data. The investment will support global and regional surveillance activities, including a globally coordinated mechanism for molecular surveillance of bacterial meningitis pathogens. Funding will also be invested in global surveillance of emerging resistance patterns of the main pathogens, with a link to antimicrobial resistance networks and control strategies.

Burden of meningitis sequelae. Studies and surveys to establish and monitor the burden of sequelae will also be conducted and, as far as possible, surveillance of sequelae will be established in certain settings.

Pillar 4: Support and care
Total investment needed: US$ 97.6 million
Catalytic investment needed: US$ 29.0 million

Recognition, support, and care of those suffering from sequelae of meningitis are applicable to meningitis from any cause (including TB and HIV-related cryptococcal meningitis).

Guidance for context-specific detection of sequelae and care. While comprehensive global guidelines will be developed to detect sequelae and provide appropriate care and support, the investment will also focus on the context-specific adaptation and implementation of guidelines, mapping existing care and support services, training of health workers (i.e. targeted health workers and inclusion of specific training modules in national curricula), and developing or maintaining community-based identification of sequelae, and rehabilitation and bereavement services.

Equipment and support for actual care and support. The investment also covers equipment to diagnose meningitis sequelae (audiometers, electroencephalograms, packs for diagnosing cognitive and vision impairments) and support to contribute to the actual care and rehabilitation of persons with sequelae. This includes support for families to access external caregivers.

Pillar 5: Advocacy and engagement
Total investment needed: US$ 37.5 million
Catalytic investment needed: US$ 9.9 million

Raising awareness and fostering behavioural changes. A significant part of the investment will be used to increase awareness of meningitis and its consequences at all levels – and especially in communities – including through regular campaigns and dedicated activities for special days such as World Meningitis Day. Research to maximize the impact of communication and foster behavioural changes, especially in connection with care-seeking and vaccine acceptance, will also be conducted.

Empowerment of civil society organizations (CSOs). CSOs and patient groups will be supported financially and empowered to contribute to raising awareness and direct implementation of national meningitis plans.

Cross-pillar: Coordination/monitoring and evaluation
Total investment needed: US$ 22.7 million
Catalytic investment needed: US$ 7.8 million

The funds requested will support coordination costs, at both global and local levels, to cover critical coordination activities, as well as monitoring and evaluation.

National coordination. At the country level, funds to support coordination will primarily be used to cover:

- the time of dedicated coordinators in targeted countries and minimal costs for key coordination activities;
- support to countries for the development of national plans to defeat meningitis (included in WHO- and partner-led activities across all pillars) through intercountry and national workshops, and other direct support to countries; this is a critical activity that will allow implementation to be initiated at the country level (with coordination costs including the update of national plans) in a country-driven approach; and
- Monitoring and evaluation – strengthening health information systems to collect and analyze reliable data to inform decision-making by local, national and global partners.

Coordination of global efforts. The requested amount will allow for support to core staff of the road map secretariat, meetings of the TTF and SSG, other general coordination and transversal costs (e.g. communication), and monitoring and evaluation at both global and regional levels (including mid-term evaluation).
Conclusion

The *Defeating Meningitis by 2030* global road map provides the global community with a clear plan of action to combat this devastating disease. Funding is critically needed to implement the road map fully and successfully. As outlined in this document, concrete activities have been identified for each visionary goal and pillar, making the road map both feasible and achievable.

Global action to implement this road map and achieve the ambitious goals to defeat meningitis is needed now. Strong commitments from countries, partners and donors are essential to success.

*We must defeat meningitis. And together, we can.*
References


Bibliography


## Annex 1:
Unpacking the Ask

### PILLAR 1. PREVENTION AND EPIDEMIC CONTROL

<table>
<thead>
<tr>
<th>WHO &amp; partner-led activities</th>
<th>Member States-led activities</th>
<th>Consolidated ask</th>
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<td>Increased uptake of meningococcal A conjugate vaccine (MenACW) and roll-out of MMCV in the meningitis belt (includes research, development of policy, technical support to all countries for the introduction)</td>
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<td>Universal introduction of PCV vaccine by 2025, and increased coverage as of 2030</td>
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<td>Implementation of context-specific prevention GBS policies in medium/high burden countries</td>
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### PILLAR 2. DIAGNOSTICS AND TREATMENT

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For information: WHO- and partner-led activities by type of activity

- Covers all milestones of the road map.
- The Ask is for WHO headquarters and regional offices and partners in the Technical Taskforce.
- It also includes funds to be channelled to other institutions (e.g. research institutions) and field costs for technical support to countries.
### PILLAR 3. DISEASE SURVEILLANCE

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<th>Member States-led activities</th>
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<td><strong>... among which, specifically for GBS surveillance or burden assessment</strong></td>
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- Research: 1 170 000
- Policy and strategy: 890 000
- Global implementation: 2 090 000
- Direct support to countries: 10 370 000

### PILLAR 4. SUPPORT AND CARE FOR PEOPLE AFFECTED BY MENINGITIS

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<td><strong>Development and maintaining of system of community-based identification of sequelae and disabilities, and community-based rehabilitation and bereavement services</strong></td>
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<td><strong>Equipment, at appropriate level of care, for diagnosis of sequelae after meningitis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6 590 000</td>
<td>6 320 000</td>
<td></td>
</tr>
<tr>
<td>Catalytic</td>
<td>3 220 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Training of health workers on guidelines and practices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9 280 000</td>
<td>4 540 000</td>
<td></td>
</tr>
<tr>
<td>Catalytic</td>
<td>4 540 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contribution to covering medications and/or devices and/or support for external carers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>40 270 000</td>
<td>8 300 000</td>
<td></td>
</tr>
<tr>
<td><strong>Other WHO and partner-led activities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5 890 000</td>
<td>65 870 000</td>
<td>97 580 000</td>
</tr>
<tr>
<td>Catalytic</td>
<td>2 450 000</td>
<td>24 520 000</td>
<td>29 060 000</td>
</tr>
</tbody>
</table>

**For information: WHO- and partner-led activities by type of activity**
- Research: 2 120 000
- Policy and strategy: 1 140 000
- Global implementation: 850 000
- Direct support to countries: 760 000

Covers all milestones of the roadmap. The Ask is for WHO headquarters and regional offices and partners in the Technical Taskforce. It also includes funds to be channelled to other institutions (e.g. research institutions) and field costs for technical support to countries.
## PILLAR 5. ADVOCACY AND ENGAGEMENT

<table>
<thead>
<tr>
<th>WHO &amp; partner-led activities</th>
<th>Member States-led activities</th>
<th>Consolidated ask</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Catalytic</td>
<td>Total</td>
</tr>
<tr>
<td>Awareness and sensitization campaigns</td>
<td>2 960 000</td>
<td>970 000</td>
<td>18 720 000</td>
</tr>
<tr>
<td>Support to national Civil Society Organizations, including for citizen representation and input to national meningitis annual plans</td>
<td>1 900 000</td>
<td>360 000</td>
<td>3 360 000</td>
</tr>
<tr>
<td>Other WHO and partner-led activities</td>
<td>10 560 000</td>
<td>4 480 000</td>
<td>10 560 000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15 420 000</strong></td>
<td><strong>5 810 000</strong></td>
<td><strong>22 080 000</strong></td>
</tr>
</tbody>
</table>

**For information: WHO- and partner-led activities by type of activity**

<table>
<thead>
<tr>
<th></th>
<th>WHO &amp; partner-led activities</th>
<th>Member States-led activities</th>
<th>Consolidated ask</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>Total</td>
<td>Catalytic</td>
<td>Total</td>
<td>Catalytic</td>
</tr>
<tr>
<td>Policy and strategy</td>
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<td>440 000</td>
<td>1 620 000</td>
<td>1 120 000</td>
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<tr>
<td>Global implementation</td>
<td>9 930 000</td>
<td>3 200 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9 990 000</strong></td>
<td><strong>3 420 000</strong></td>
<td><strong>22 690 000</strong></td>
<td><strong>4 410 000</strong></td>
</tr>
</tbody>
</table>

## COORDINATION AND MONITORING AND EVALUATION

<table>
<thead>
<tr>
<th>WHO &amp; partner-led activities</th>
<th>Member States-led activities</th>
<th>Consolidated ask</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Catalytic</td>
<td>Total</td>
</tr>
<tr>
<td>Coordination and monitoring &amp; evaluation</td>
<td>7 040 000</td>
<td>2 470 000</td>
<td>8 120 000</td>
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<tr>
<td>Monitoring &amp; evaluation (M&amp;E)</td>
<td>2 950 000</td>
<td>950 000</td>
<td>4 570 000</td>
</tr>
<tr>
<td>Global level - M&amp;E of the initiative</td>
<td>1 350 000</td>
<td>470 000</td>
<td>1 350 000</td>
</tr>
<tr>
<td>Regional and country levels</td>
<td>1 690 000</td>
<td>480 000</td>
<td>4 570 000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9 990 000</strong></td>
<td><strong>3 420 000</strong></td>
<td><strong>12 690 000</strong></td>
</tr>
</tbody>
</table>
Annex 2: Methodology overview

The annex gives an overview of the methodology used to estimate the cumulated impact of gradual implementation of the Visionary Goals in 2030, on (i) meningitis morbidity and mortality cases, deaths, sequelae and DALYs; (ii) savings in direct medical costs; (iii) economic benefits generated by increased workforce participation and productivity. While scarcity of data is a challenge for accurate estimation of the impact, particularly its economic aspects, the methodological assumptions have been incorporated in a conservative approach, so as not to inflate the estimations. The annex also presents the approach used to estimate the resources required for the successful implementation of the road map. More information on the methodology, as needed, can be provided upon request.

1. Estimation of road map impact on cases, deaths, sequelae and DALYs (YLL and YLD)

Following a World Health Organization (WHO) Global Health Estimates (GHE) / Institute for Health Metrics and Evaluation (IHME) workshop, and consultations with WHO Data Analytics and Delivery for Impact (DDI), it has been agreed to use IHME estimates that offer appropriate granularity. As a result, the disease-burden data from IHME Global Disease Burden 2019 (GBD 2019) have been used. For each of the 204 countries and territories included in the analysis (as per IHME classification), the number of cases, deaths and Years of Life Lost (YLL) was made available for meningococcal meningitis, pneumococcal meningitis, Hib meningitis, GBS meningitis, other bacterial meningitis and viral meningitis. Of note, as GBS-specific estimates were not readily available, a preliminary set of estimates from the 2021 GBD data, kindly provided by IHME, was used to estimate the portion of the GBS burden that was at first indistinctly merged with that of other bacterial etiologies. As the road map is expected to have a lesser impact on viral meningitis, the estimation of its effect has been limited to bacterial meningitis.

The impact of full achievement in 2030 was estimated. Impact in 2030, regarding cases, deaths, sequelae, YLL and Years Lived with Disability (YLD), is estimated as the difference of the burden between a ‘counterfactual scenario’ (where incidence and case-fatality rates for each country remain stable) and a scenario where the Visionary Goals are fully achieved – the ‘road-map scenario’. For the counterfactual scenario, cases, deaths and YLL were estimated as an extrapolation of the baseline year (2015) against which the Visionary Goals will be measured, adjusted to the population growth projection. The YLD have then been estimated based on (i) distribution of the main types of long-lasting disabilities; (ii) their respective Disease Weight (also extracted from IHME GBD 2019); (iii) lifelong duration of the sequelae, estimated as similar to the average YLL (country-dependent) for a single case that would have led to death. It should be noted that minor sequelae, such as cognitive deficiencies, hearing loss, visual impairments, motor deficits or behavioural disorders (all of which are minor and can be totally or substantially managed within a few years) are not included in the estimation.

The achievement of Visionary Goal 2 (to reduce cases of vaccine-preventable bacterial meningitis by 50% and deaths by 70%) results in the reduction, compared to the counterfactual scenario, in the incidence of vaccine-preventable meningitis by 50%, in the case-fatality rate (CFR) by 40% for all bacterial meningitis, in the YLL by 70% for vaccine-preventable meningitis and 40% for other bacterial meningitis. The achievement of Visionary Goal 3 (to reduce disability and improve quality of life after meningitis due to any cause) translates into the reduction in the risk of sequelae, at a rate that depends on the income-group of each country, so as to take into account the difference with the baseline situation, and consequently a reduction in YLD. Investment cases for similar initiatives often assume that the full impact applies over the entire period, that is, from the first

\[\text{Requests should be sent to meningitis2030@who.int}\]
implementation year. Such a methodological assumption would likely have led to a significant overestimation of the impact, given that not all activities can be implemented everywhere in the short term, especially since some tools instrumental to achieving the Visionary Goal (for example new vaccines) will only become available for large-scale deployment during the next few years. Instead, the rate of achievement of the road map was estimated for each year from 2023 to 2030, based on (i) expected progress in reducing cases due to vaccination programmes for each of the road map pathogens and their respective weight in the baseline disease burden; (ii) the expected momentum in reducing the CFR. To estimate the cumulative impact of the gradual implementation of the road map for each year from 2023 to 2030, the year-specific rate of achievement was then applied up to a virtual full achievement (estimated, as described above, for 2030 alone).

The estimation of sustained impact over the period 2031 to 2040 was made with the assumption of an achievement rate of 100%.

2. Estimation of the road map impact on direct medical costs

Data on direct medical costs are scarce and the scope and methodology vary significantly across published studies aiming at their estimation. However, a literature review conducted by PriceWaterhouseCoopers Switzerland (PwC) in 2022, covering a variety of geographical and income-group countries, showed a correlation between direct medical costs for the treatment of the acute phase of a meningitis case and the gross domestic product (GDP) per capita, in a range of around 20% to 60% of GDP per capita, excluding a few outliers with much higher values. Hence, taking a conservative approach, the direct medial costs per country were calculated based on an assumption of 25% to 35% of GDP per capita for a case of meningitis diagnosed and treated (in the acute phase). This includes direct medical costs incurred by the health sector and the patients but excludes overheads and is irrespective of the payer. The 2020 GDP per capita for each country was used and adjusted on a yearly basis based on GDP growth and population growth projections.

The literature is also sketchy for the direct medical costs pertaining to the treatment and care of sequelae, plus there is a variety in the type of sequelae. Based on literature review, and supported by international experts, the analysis undertaken by PwC showed that, in one case, the direct medical costs related to sequelae were most often 10 to 15 times those for the acute phase. Long-term costs were split over a period of 40 years.

It is common practice when assessing the economic impact of such an initiative to consider that all cases averted would have been treated, so that any single case averted generates a savings in health expenditure. A more conservative approach was taken to account for cases that could escape treatment and care. This is especially true for the treatment of sequelae that can be poorly addressed in some parts of the world. With such a methodological assumption, an averted case does not systematically generate direct medical cost savings. Therefore, sets of low and high coverage assumptions for each WHO region (with a difference between North America and the rest of the Americas region) were applied for (i) treatment during the acute phase; (ii) treatment of sequelae. In the absence of
data, coverage estimates supported by international experts were applied. While the lack of robust data is a limitation, the approach applied minimizes the risk of overestimating the savings.

To estimate the savings in direct medical costs generated by the achievement of the Visionary Goals, these costs were applied to the number of cases and sequelae respectively, gradually averted on a year-by-year basis (as per Section 1 above) and adjusted by the coverage assumption. Sensitivity analysis was conducted on the percentage of GDP per capita used, to estimate the direct medical cost for the acute phase, the coverage assumptions and the multiplying factors between the costs for the acute phase and the sequelae. All costs have been discounted (3% discounting rate) for a present value in 2023.

3. Estimation of the road map impact on indirect cost

To estimate the economic benefits due to increased workforce participation and productivity, the Human Capital Approach was applied. These economic benefits are (i) increased workforce participation, by either the patient or their caregiver, during the acute phase of the disease, due to the cases averted; (ii) increased workforce participation due to the deaths averted; (iii) increased workforce participation and productivity of the patient and/or their caregiver due to sequelae averted.

As a baseline, the average (male and female) salary for each country in 2020 (5) was used. These data were then indexed over time to account for GDP growth as a proxy indicator for salary growth. The following were applied in all the estimations below (i) an average of male and female country-specific Labour Force Participation (LFP) rate (6) to exclude from the estimates those who are of working age but are not actively engaged in the labour market; (ii) an average of male and female country-specific Employment Rate (ER) (7), to exclude from the estimate those who are not employed. Such adjustments take into account that not all cases/deaths/sequelae averted will translate into economic benefits, because the patient and/or the caregiver would have been off work anyway. In the absence of projections, we kept the LFP and the ER stable over time – 2023 or most recent value. All economic benefits have been discounted (3% discounting rate) for a present value in 2023. Of note; as the Human Capital Approach was applied, all those working in the informal sector, which still represents a high portion of the revenues in the most affected areas, were excluded from the analysis. This limitation likely significantly underestimated the impact on workforce and productivity, given more than 61% of the world’s employed population – two billion people – earn their livelihoods in the informal sector. In Africa, 86% of employment is informal. The proportion is 68% in Asia and the Pacific, 69% in the Arab States, 40% in the Americas and just over 25% in Europe and Central Asia (8).

3.1 Economic benefits due to cases averted

Based on literature and expert consultations, a conservative assumption of 1.5 to 2.5 weeks of work lost by the patient or the caregiver at the time of the acute phase of meningitis, was determined. For each country and every year, the average 1.5 to 2.5 week’s salary was applied to the number of cases gradually averted, adjusted by the LFP and the ER as explained above, in order to exclude from estimations those who would not have worked and generated revenues (in the formal sector).

3.2 Economic benefits due to deaths averted

The average numbers of working years lost by a single death has been estimated based on the age distribution of death from meningitis and an assumption of the number of working years over a lifetime. For this, two baseline assumptions of a full working life were taken; the primary one running from 15 to 65 years, and a secondary one from 20 to 65 years, to account for where working life starts later. For each country and every year, the number of additional years of work to the respective average annual salary and to the number of deaths gradually averted, adjusted by the LFP and the ER as explained above, was applied.

3.3 Economic benefits due to sequelae averted

The indirect costs due to sequelae can be estimated as the loss of years of work by the patient and the caregiver, and a valuation of YLD (across working life only).

To consider economic benefits of additional years worked by the patient, or primarily by the caregiver, because of the sequelae averted, an assumption is made of five to ten additional years of work per case of sequelae gradually
averted, with a country-dependent average salary, and adjusted by the LFP and the ER as above.

Some assumptions to distribute the YLD over the remaining years of life of the cases were made, to be able to restrict the valuation of the YLD only to those that would have run across the working years, also taking into account the age distribution of the cases, as in 3.2 above. To estimate the economic benefits for each country and every year, the respective average of annual salaries was then applied to the working years of the YLDs gradually averted, adjusted by the LFP and the ER as explained above.

Of note; the other indirect costs (such as additional costs for special education for those with cognitive impairments, hearing loss or vision loss) can be substantial, but have not been considered because of lack of data.

4. Estimation of required resources for the implementation of the road map

The road map includes a series of milestones that relates primarily either to national-level activities or to global activities. Of note; inflation has not been considered in the estimation of the resources.

4.1. Resources required for Member States

As many activities at the country level can be strongly interconnected, the main areas of each intervention have been defined to avoid double counting of the required resources that could have occurred on a milestone per milestone approach. The areas of each intervention are those presented for each pillar in Annex 1. Most of them have been divided into sub-areas to allow a more accurate estimation of the required resources.

Also, as explained in Chapter 5, the portion of financial resources to be borne respectively by donors and national governments can vary significantly across countries. While sustainable domestic funding should support the activities in the long term, the required resources in this investment case correspond to activities that can typically be supported by donors, totally or partially, to achieve the Visionary Goals in 2030. The cost of activities for which donors’ support has already been committed, has not been included in the ask. For example, as per the 2018 Gavi Board in-principle decision to support a targeted approach to expand the current meningococcal vaccine programme in the meningitis belt to other serogroups, this investment case does not include ask for financial support to roll out multivalent meningococcal conjugate vaccines in the meningitis belt, but only a very limited amount for extra support that may be needed in fragile States in the meningitis belt that have not yet started any routine meningococcal vaccination programme.

Using the example of Pillar 4, milestones and key activities have been translated into four main areas of intervention at country level (as described in Annex 1). Several cost items have been identified for each area of intervention, and a set of assumptions have been taken to determine the value associated to each cost item – some being dependent on the population size (for example, equipment, community-based activities and services), some dependent on the number of persons developing sequelae (for example, supplies) and some fixed (for example, development of national guidelines). Required resources using these assumptions have been estimated for each LIC and MIC, with some stronger level of resource in the 40 targeted countries that were randomly identified but representative of each region. Considering the assumption that not all countries will fully implement road map Pillar 4 activities, that some road map milestones correspond to achievements fully obtained in a given proportion of countries, and finally that some countries will depend less than others on external support, the required resources estimated for each country have then been weighted by applying a reduction of between 50% and 60%, depending on the areas of intervention. The total of the weighted resources is the amount estimated for country-led activities for Pillar 4.

The number of countries involved for each activity, may vary depending on the activity, in order to align with road map milestones, and also taking into account current levels of implementation for existing activities. As another illustration completing the Pillar 4 example above, the required resources for introducing GBS vaccine have been limited to ten countries, with the assumption of a vaccination programme starting, on average, three years before the end of 2030, for an average annual number of pregnant women in representative countries, including assumptions on price per vaccine dose as per the Full GBS Vaccine Value Assessment (9) for Gavi-eligible countries, immunization coverage, vaccine wastage and delivery costs.

As alluded to in the core document, these estimations allow for assessing the scale of support necessary to conduct the ‘typical’ activities required to achieve the milestones.
and Visionary Goals. However, at the national, and even sub-national level, actual needs and activities tending to these achievements may vary significantly across settings. Based on the situation analysis and country plans, needs will be further specified for each country where alternative activities appear relevant.

4.2. Resources required for WHO and Technical Taskforce (TTF) partners

The resources required for the WHO and TTF partners relating to the achievement of global activities, have been estimated on a milestone-by-milestone basis. Required resources have been estimated in close collaboration with TTF members. Using this milestone-per-milestone approach, resources have also been considered to provide direct support to countries in the implementation of some of the country-led activities – for example, it includes funds to conduct workshops to develop national meningitis plans, consultants to contribute to the development of national guidelines, or small grants for local civil-society organizations to raise awareness of meningitis within communities. To conduct and/or coordinate these activities, a minimum critical mass of staff has also been considered, primarily at WHO (headquarters and regional offices) and also in some TTF member organizations responsible for leading some of the key activities. So as to optimally reflect what these resources will be used for, they have been split across areas (the five technical pillars plus coordination) and across types of activities.

References


