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Contents

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The development of this publication was led and coordinated by Francesco Venuti (Consultant, Department of Noncommunicable Diseases and Mental Health), under the supervision of Nicoline Schiess (Department of Noncommunicable Diseases and Mental Health). Technical support was also provided by Nicolò Binello (Department of Epidemic and Pandemic Management).

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Abbreviations

ABCDE	airway, breathing, circulation, disability and exposure
AMR	antimicrobial resistance
APL	*Priority assistive products list*
AST	antimicrobial susceptibility testing
AVPU	alert, voice, pain, unresponsive
CrAg	cryptococcal antigen assay
CRP	C-reactive protein
CSF	cerebrospinal fluid
DOI	declaration of interest
DR-TB	drug-resistant tuberculosis
DS-TB	drug-susceptible tuberculosis
ERG	External Review Group
GCS	Glasgow Coma Scale
HIV	human immunodeficiency virus
HSV	herpes simplex virus
ICP	intracranial pressure
IITT	Interagency Integrated Triage Tool
IM	intramuscular
IV	intravenous
LMIC	low- and middle-income countries
LP	lumbar puncture
PCR	polymerase chain reaction
PCT	procalcitonin
PIR	*Package of interventions for rehabilitation*
SAMPLE	symptoms and signs, allergies, medications, past medical history, last oral intake, events
TB	tuberculosis
UI	unit interval
WHO	World Health Organization
VZV	varicella-zoster virus

Executive summary

Community-acquired acute meningitis continues to pose a public health threat globally, despite successful prevention and control efforts in several regions of the world. The burden of mortality and morbidity, including the risk of neurological and physical sequelae, remains high, particularly in low- and middle-income countries, and during large-scale epidemics and humanitarian emergencies.

With a view to eliminating meningitis as a public health problem, the World Health Organization (WHO) – together with global partners and experts – coordinated the development of *Defeating meningitis by 2030: a global road map*, which was approved by the Seventy-third World Health Assembly (resolution WHA73.9). Under this framework, the *WHO guidelines on meningitis diagnosis, treatment and care* were published to provide evidence-based recommendations for the clinical management of children aged over 1 month, adolescents and adults with community-acquired acute meningitis.

Recognizing the urgent need to translate these recommendations into implementation guidance, particularly in resource-constrained settings, WHO has developed this practical manual, which provides comprehensive guidance to inform clinical activities at the point of care. This manual will serve as a practical resource for health care professionals working in first- or second-level health care facilities, including emergency, inpatient and outpatient services. It is also intended for use by a broad spectrum of health care providers, including general medicine and primary care doctors, nurses and other members of the health care workforce routinely involved in the care of individuals with acute meningitis.

This manual primarily focuses on acute bacterial meningitis in children aged over 1 month, adolescents and adults. However, because of shared clinical features and overlapping diagnostic and treatment strategies, the manual also includes initial guidance on acute bacterial meningitis in neonates, viral meningitis, tuberculous meningitis, HIV-associated cryptococcal meningitis and cerebral malaria.

1. Introduction

1.1 Background

Meningitis continues to pose a significant public health threat globally. The burden of morbidity and mortality from meningitis remains high, particularly in low- and middle-income countries (LMIC), and in settings experiencing large-scale, disruptive epidemics. In 2019, there were an estimated 2.51 million cases and 236 000 deaths due to meningitis worldwide. The burden was greatest among children aged below 5 years, with 1.28 million cases and 112 000 deaths (*1*). In 2021, the burden of premature mortality and disability caused by meningitis was estimated to exceed 15 million disability-adjusted life years worldwide (*2*).

To address this urgent public health problem, the World Health Organization (WHO) – together with global partners and experts – coordinated the development of the publication *Defeating meningitis by 2030: a global road map*, with the vision of eliminating meningitis as a public health problem by 2030 (*3*). In November 2020, that road map was approved by the Seventy-third World Health Assembly (resolution WHA73.9).

Following the mandate of the road map to improve the clinical management and long-term care of people with meningitis, the *WHO guidelines on meningitis diagnosis, treatment and care* were developed (*4*). Published in April 2025, the guidelines provide evidence-based recommendations for the clinical management of adults, adolescents and children aged over 1 month presenting with suspected acute meningitis of both bacterial and viral etiologies.

To support implementation activities and operationalize the recommendations included in the guidelines, this document, the *WHO practical manual on meningitis diagnosis, treatment and care*, also referred to as "the practical manual", was created. Other related products include an online training course and the publication *Preparedness and response to bacterial meningitis outbreaks: toolkit for frontline healthcare workers (5)*.

1.2 Scope

The primary objective of this manual is to serve as a practical resource for the effective field implementation of the *WHO guidelines on meningitis diagnosis, treatment and care* (*4*). The manual provides a variety of job aids – including evidence-based decision-making algorithms – to support clinical operations for diagnosing, treating and managing sequelae in people with suspected or confirmed acute meningitis.

This manual primarily focuses on acute bacterial meningitis in children aged over 1 month, adolescents and adults. However, because of shared clinical features and overlapping diagnostic and treatment strategies, this manual also includes initial guidance on and consideration of acute bacterial meningitis in neonates, viral meningitis, tuberculous (TB) meningitis, HIV-associated cryptococcal meningitis and cerebral malaria. The result is a comprehensive resource that provides easy access to initial recommendations on these conditions and directs readers to specialized documents for more detailed guidance when needed.

The principles and guidance provided in this practical manual are valid globally, although specific considerations for resource-limited settings are given where relevant.

Finally, this manual mainly targets non-epidemic settings. Specific guidance for settings facing recurrent bacterial meningitis epidemics is provided in the *Preparedness and response to bacterial meningitis outbreaks: toolkit for frontline healthcare workers (5)*.

1.3 Target audience

The target group for this practical manual is health care professionals working in first- or second-level health care facilities, including emergency, inpatient and outpatient services. That group includes general medicine and primary care doctors, nurses and other members of the health care workforce. In addition, the manual may be of value for quality improvement teams across multiple levels of the health system, including individuals responsible for training and capacity-building activities for the management of people with acute meningitis.

1.4 How should this practical manual be used?

The primary purpose of this manual is to support health care workers in their routine clinical activities. The manual is organized into sections and subsections to facilitate quick access to specific information. Each part is designed to function independently, allowing users to consult individual sections as needed.

This practical manual is designed for use on mobile devices such as smartphones and tablets, and its graphic layout has been optimized accordingly.

1.5 Topics excluded from the scope of this manual

Given the significant differences in clinical manifestations and management strategies, the manual does not address the following disease categories:

- hospital-acquired, nosocomial and health care associated meningitis;
- subacute and chronic meningitis, including parasitic meningitis; and
- noninfectious meningitis, including drug-induced meningitis and meningitis associated with malignancies and autoimmune diseases.

2. Methodology

The content developed for this practical manual was primarily derived from the *WHO guidelines on meningitis diagnosis, treatment and care*, which were prepared in accordance with the *WHO handbook for guideline development* (*4*, *6*). Additional WHO technical products providing relevant information and guidance on acute meningitis were also used for content development (Table 1).

2.1 WHO Steering Group

A WHO Steering Group was established to guide and oversee the development process of the practical manual. It included members from the Department of Noncommunicable Diseases and Mental Health; the Department of Epidemic and Pandemic Management; the Department of Immunization, Vaccines and Biologicals; and other relevant divisions and departments from WHO headquarters and regional and country offices. The Steering Group identified the scope of the practical manual, developed the visual concept, prepared the draft proposal and determined the composition of the External Review Group (ERG).

2.2 External Review Group

The ERG was established to review, validate and provide technical input into the draft document. The ERG comprised a diverse group of individuals with technical expertise in clinical practice, microbiology, laboratory methods and research, as well as people with lived experience of meningitis. The ERG members were selected with careful consideration of gender and geographical balance.

In accordance with WHO procedures for declarations of interests (DOIs), all members of the ERG were asked to declare in writing any competing interests (academic, financial or other) at the time of the invitation to participate in the development process. Each expert completed and signed the standard WHO DOI form and confidentiality agreement forms, and sent them electronically to the WHO Technical Team before participating in the development process of the product.

2.3 Document preparation and peer review

The WHO Technical Team developed the content of this publication based on existing WHO guidelines, norms and standards. Most of the content is directly derived from the *WHO guidelines on meningitis diagnosis, treatment and care* (*4*). A list of other relevant resources used as reference material can be found in Table 1. In addition, technical experts from relevant departments at WHO headquarters and regional and country offices were consulted to ensure that the document reflects multidisciplinary expertise and aligns with current recommendations and practices.

Table 1. Other relevant WHO resources (please check regularly for updates)

WHO guidelines on meningitis diagnosis, treatment and care, 2025 (*4*)
Preparedness and response to bacterial meningitis outbreaks: toolkit for frontline healthcare workers, 2026 (*5*)
Standard case definitions of acute bacterial meningitis and invasive meningococcal disease for routine and outbreak surveillance, 2025 (*7*)
Meningitis - fact sheet [website], 2025 (*8*)
Standard operating procedures for surveillance of meningitis preparedness and response to epidemics in Africa, 2019 (*9*)
Laboratory methods for the diagnosis of meningitis caused by Neisseria meningitidis, Streptococcus pneumoniae and Haemophilus influenzae, 2011 (*10*)
Encephalitis: global threats, trends and public health implications: a technical brief, 2025 (*11*)
The WHO AWaRe (access, watch, reserve) antibiotic book, 2022 (*12*)
WHO Model Lists of Essential Medicines (*13*)
WHO Model List of Essential In Vitro Diagnostics (*14*)
Pocket book of hospital care for children: guidelines for the management of common childhood illnesses, 2nd ed., 2013 (*15*)
WHO recommendations for management of serious bacterial infections in infants aged 0–59 days, 2024 (*16*)
Mental Health Gap Action Programme (mhGAP) guideline for mental, neurological and substance use disorders, 2023 (*17*)
mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings (Version 2.0), 2016 (*18*)
Basic emergency care: approach to the acutely ill and injured, 2018 (*19*)
WHO guidelines for malaria, 2025 (*20*)
WHO consolidated guidelines on tuberculosis: module 3: diagnosis, 2025 (*21*)
WHO consolidated guidelines on tuberculosis: module 4: treatment and care, 2025 (*22*)
WHO consolidated guidelines on tuberculosis: module 5: management of tuberculosis in children and adolescents, 2022 (*23*)
Guidelines for diagnosing, preventing and managing cryptococcal disease among adults, adolescents and children living with HIV, 2022 (*24*)
Consolidated guidelines on HIV prevention, testing, treatment, service delivery and monitoring: recommendations for a public health approach, 2021 (*25*)
Package of interventions for rehabilitation: module 1: introduction, 2023 (*26*)
World report on hearing, 2021 (*27*)

WHO: World Health Organization.

3. Etiology

Community-acquired acute meningitis can be caused by various infectious pathogens, and its clinical presentation is often unspecific. Knowledge of common etiologies as well as the local epidemiology is crucial for guiding initial clinical management and therapeutic decisions. The most common pathogens causing acute meningitis are listed in Table 2.

Table 2. Common infectious pathogens responsible for community-acquired acute meningitis

Pathogen	Main transmission mode	Age groups affected
Bacteria		
Streptococcus pneumoniae	Through the air (direct deposition of infectious respiratory particles)	All ages
Neisseria meningitidis	Through the air (direct deposition of infectious respiratory particles)	All ages
Haemophilus influenzae type b	Through the air (direct deposition of infectious respiratory particles)	Children <5 years
Streptococcus agalactiae (Group B *Streptococcus*)	Intrapartum Direct contact	Infants <3 months Older adults (>60 years)
Escherichia coli	Intrapartum Direct contact	Neonates
Listeria monocytogenes	Foodborne	Older adults and neonates
Non-typhoidal *Salmonella*	Faecal–oral (foodborne, waterborne or person-to-person)	Infants and children
Mycobacterium tuberculosis complex	Through the air (airborne transmission)	All ages
Viruses		
Enteroviruses • Echovirus • Coxsackievirus	Faecal–oral (foodborne, waterborne or person-to-person) Through the air (direct deposition of infectious respiratory particles)	All ages
Herpesviruses • HSV-1/2 • VZV	Through direct contact with herpetic skin lesions and mucosal secretions	All ages
Arboviruses	Exposure to infected mosquitoes or ticks	All ages
Fungi		
Cryptococcus neoformans	Through inhalation of cryptococcal spores or desiccated cells present in the environment (e.g. soil contaminated by avian faeces)	All ages

HSV: herpes simplex virus; VZV: varicella-zoster virus.

3.1 Predisposing conditions and risk factors

- Colonization of the nasopharyngeal tract constitutes the first step in developing invasive disease caused by *Neisseria meningitidis*, *Streptococcus pneumoniae* and *Haemophilus influenzae* type b (*28-31*). However, invasive infections can also occur within days of the acquisition of highly virulent strains by a susceptible individual (*28-31*).
- Otitis media is a frequent source of infection in people with community-acquired bacterial meningitis, with *S. pneumoniae* being the predominant causative pathogen (*32*, *33*).
- People with anatomical or functional asplenia (e.g. sickle cell disease) are at increased risk of developing invasive disease caused by encapsulated bacteria, such as *S. pneumoniae*, *H. influenzae* type b and *N. meningitidis* (*34-36*).
- Immunocompromising conditions and immunosuppressive treatment increase the risk of developing acute meningitis due to bacterial and viral pathogens:
  - individuals with congenital or acquired complement deficiencies are at increased risk of developing invasive meningococcal disease (*37*);
  - reduced humoral immunity increases the risk of invasive pneumococcal disease and *H. influenzae* type b meningitis (*38*, *39*);
  - being less than 1 month of age or over 60 years, pregnancy and immunocompromised state increase the risk of *Listeria monocytogenes* infection (*40-43*); and
  - severe neuroinvasive infections due to herpesviruses and enteroviruses have been described in people with advanced HIV disease, solid organ transplant recipients, people with congenital or acquired B-cell immunodeficiencies and bone marrow transplant recipients (*44-46*).
- People living with HIV are at increased risk of developing invasive meningococcal and pneumococcal disease (*47-51*). Similarly, HIV infection constitutes a risk factor for invasive disease due to *Mycobacterium tuberculosis*, *Cryptococcus neoformans*, non-typhoidal *Salmonella* and *L. monocytogenes* (*52-55*).
- In neonates, risk factors for *Streptococcus agalactiae* and *Escherichia coli* meningitis include preterm birth, low birth weight and intra-amniotic infection (*56-58*). Additionally, colonization of the maternal genital tract by *S. agalactiae* increases the risk of developing invasive disease after delivery (*59*).
- Although all ages can be affected, neuroinvasive disease (including meningitis and meningoencephalitis) from certain arthropod-borne encephalitis viruses such as West Nile virus and dengue virus tends to be more common in older age groups (*60-62*). Further information on arthropod-borne encephalitis viruses responsible for neuroinvasive disease can be found in *Encephalitis: global threats, trends and public health implications. A technical brief* (*11*).

4. Clinical presentation

No combination of signs and symptoms has been established to definitively identify a person with acute meningitis on clinical grounds only. The clinical presentation can vary substantially based on the etiology and the age of the affected person. Owing to the nonspecific clinical presentation – especially in neonates, young children and the elderly – health care workers should maintain a low threshold for suspecting acute meningitis.

Generally, acute meningitis is characterized by the rapid onset of fever (Box 1), headache, neck stiffness, vomiting, photophobia or altered mental status, ranging from sensory obtundation to confusion (sometimes described as a "blank staring look" in neonates and young children), lethargy and coma (*63*). The classic bacterial meningitis triad – constituted by fever ≥38.0 °C, altered mental status and neck stiffness – is present in less than half of individuals with acute bacterial meningitis. Conversely, the absence of all these clinical features considerably reduces the probability of a bacterial cause (*63-65*).

Clinical presentation is even more variable and nonspecific in individuals at the extremes of age (i.e. neonates, young children and the elderly). In these individuals, common symptoms and signs, such as headache and neck stiffness, are less frequent or more difficult to assess. Overlap in clinical presentation with other neurological diseases, such as acute encephalitis, poses an additional challenge to clinicians when establishing a provisional diagnosis. Finally, from the clinical presentation alone it is not possible to distinguish between different infectious etiologies, such as bacterial and viral meningitis.

Clinical features that should prompt suspicion of acute meningitis, especially when presenting in combination, include:

- acute onset of fever (≥38.0 °C);
- headache;
- signs of meningeal irritation (e.g. neck stiffness, photophobia, Brudzinski's sign and Kernig's sign);
- altered mental status (e.g. confusion, lethargy or coma);
- focal neurological deficits (e.g. aphasia, hemiparesis or monoparesis, or cranial nerve palsies); and
- new-onset focal or generalized seizure.

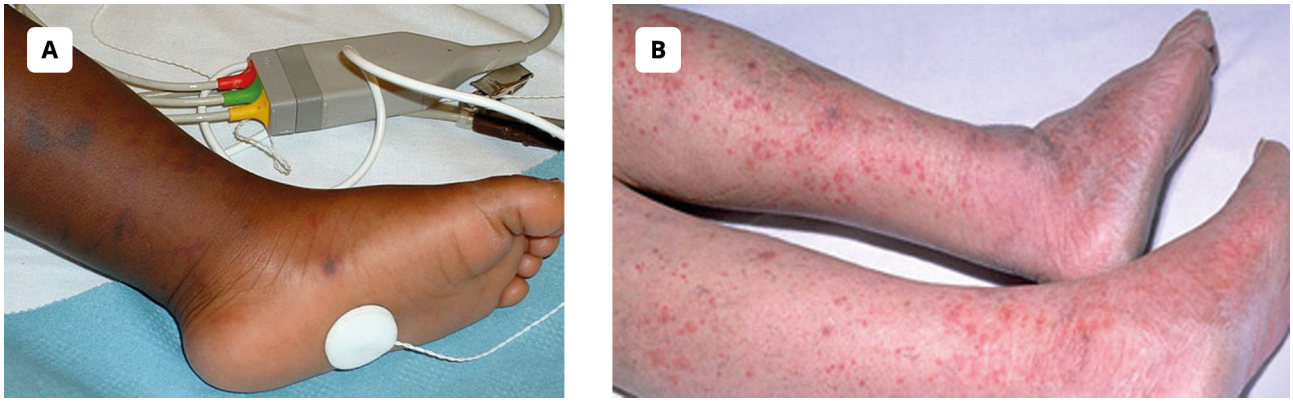
Less specific clinical manifestations (e.g. malaise, fatigue, nausea, vomiting, abdominal pain or back pain) can be observed in people with acute meningitis and should be interpreted in combination with more specific clinical signs and symptoms (e.g. neck stiffness).

In individuals with meningococcal meningitis and bacteraemia, a characteristic haemorrhagic, non-blanching skin rash may appear as petechial or purpuric lesions on the trunk, lower extremities, mucous membranes (e.g. conjunctiva) and, less commonly, the palms and soles (Fig. 1A and 1B) (*66*).

Some people with acute meningitis may develop increased intracranial pressure (ICP) owing to the presence of severe cerebral oedema, obstructive hydrocephalus or a space-occupying lesion (e.g. brain abscess, subdural empyema). Signs and symptoms of increased ICP include severe headache, vomiting, depressed consciousness, cranial nerve deficits, papilloedema, or a triad of bradycardia, respiratory depression and hypertension. The most severe complication of intracranial hypertension is cerebral herniation and death.

In neonates and young infants, common signs and symptoms of meningitis include fever or hypothermia, bulging fontanel, lethargy or irritability, poor feeding, vomiting, abnormal (continuous weak or high-pitched) cry, signs of respiratory distress (e.g. apnoea, tachypnea or grunting) and seizures (*67*, *68*). Neck stiffness is uncommon in this population.

Fig. 1. Meningococcal rash on A) dark skin; B) light skin



Courtesy of Meningitis Research Foundation. Available at: https://www.meningitis.org/

Box 1. Special considerations for fever

There is no single approach to fever that is right for all emergency conditions. Infection should always be considered in a person with fever, bearing in mind that the absence of fever does not exclude infection. People with overwhelming infection or immune system problems, or at the extremes of age, may not be able to produce a fever and may have a normal or low body temperature.

5. Initial assessment

Key message
Acute meningitis is a medical emergency. Individuals with suspected acute meningitis should be rapidly identified and urgently managed, since the condition is associated with high morbidity and mortality in case of delayed management.

Relevant WHO resources (please check regularly for updates)
Basic emergency care: approach to the acutely ill and injured, 2018 (*19*)
Interagency Integrated Triage Tool (*69*)
Paediatric emergency triage, assessment and treatment: care of critically ill children, 2016 (*70*)

5.1 Triage for acute meningitis

Acuity-based triage involves sorting and prioritizing patients based on estimation of the severity of their condition. It is used as the basis for identification of those patients who require immediate medical intervention and those who can safely wait, or those who may need to be transported to a specific destination based on their condition.

The *Interagency Integrated Triage Tool* (IITT) is a triage tool developed by WHO in collaboration with the International Committee of the Red Cross and Médecins Sans Frontières (*69*). The IITT is used to assist in the recognition of individuals with high-risk vital signs and symptoms who need immediate review by the supervising clinician.

5.2 ABCDE approach to the acutely ill

The ABCDE approach provides a framework for the systematic and organized evaluation of acutely ill patients, to rapidly identify life-threatening conditions and intervene using the following categories:

A – Airway: check for and correct any obstruction to movement of air into the lungs.

B – Breathing: ensure adequate movement of air into the lungs.

C – Circulation: evaluate whether there is adequate perfusion to deliver oxygen to the tissues; check for signs of life-threatening bleeding.

D – Disability: assess and protect brain and spine functions.

E – Exposure: identify all injuries and any environmental threats and avoid hypothermia.

The WHO publication *Basic emergency care: approach to the acutely ill and injured* recommends using the ABCDE approach in emergency care to assess "undifferentiated" patients; that is, those with acute symptoms for which the cause may not be known (*18*). This approach is partially modified in the context of care for critically ill neonates, where emergency signs relate to airway, breathing and circulation (ABC), coma, convulsions and dehydration (*70*).

5.2.1 The SAMPLE history

Assessment of emergency signs and symptoms should be followed by gathering a rapid medical history. The SAMPLE approach is a standard way of rapidly collecting key elements related to the illness and is particularly useful in critically ill patients. The SAMPLE history categories are:

S – Symptoms and signs

A – Allergies

M – Medications

P – Past medical history

L – Last oral intake

E – Events

The WHO publication *Basic emergency care: approach to the acutely ill and injured* (*19*) recommends that the SAMPLE history be combined with the ABCDE approach to the acutely ill. Once the SAMPLE history has been taken, the next step should be a secondary examination that looks for changes in the patient's condition or less obvious causes that may have been missed during the ABCDE assessment.

5.2.2 Checklist for past medical history

When acute meningitis is suspected and the person's condition allows, a more thorough collection of past medical history using the SAMPLE approach may provide useful information to guide initial clinical management.

Table 3 provides a checklist to facilitate history collection on predisposing conditions and risk factors that are typically associated with specific infectious etiologies of acute meningitis. Although certain conditions or risk factors should prompt suspicion of specific causative pathogens (e.g. mass gatherings and *N. meningitidis*), they should NOT be considered sufficient to exclude other infectious causes before microbiological confirmation.

Table 3. Checklist for medical history

Predisposing conditions and risk factors	Typically associated infectious pathogens
☐ Asplenia (anatomical or functional)	*S. pneumoniae*, *H. influenzae*, *N. meningitidis*
☐ Sickle cell disease	*S. pneumoniae*, *H. influenzae*, *N. meningitidis*, non-typhoidal *Salmonella*
☐ HIV infection	*S. pneumoniae*, *N. meningitidis*, *C. neoformans*, *M. tuberculosis*, non-typhoidal *Salmonella*, *L. monocytogenes*
☐ A recent or current sinusitis or otitis media	*S. pneumoniae*, *S. aureus*, *H. influenzae*, anaerobic bacteria, Gram-negative bacilli
☐ Alcohol use disorder	*S. pneumoniae*, *L. monocytogenes*
☐ Vaccination history	*S. pneumoniae*, *N. meningitidis*, *H. influenzae* type b
☐ Recent use of antibiotics	Drug-resistant *S. pneumoniae*
☐ Participation at mass gatherings	*N. meningitidis*
☐ History of recent injection drug use	*S. aureus*
☐ Penetrating head trauma	*S. aureus*

Table 3 *continued*

Predisposing conditions and risk factors	Typically associated infectious pathogens
☐ Contact with animals	*Streptococcus suis* (swine), *Brucella* spp. (e.g. cattle, swine, sheep, goats), *Capnocytophaga* spp. (dog bite)
☐ Exposure to arthropods (e.g. mosquitoes, ticks, mites)	Arboviruses (e.g. West Nile virus, dengue virus, tick-borne encephalitis virus), *Borrelia* spp., *Orientia tsutsugamushi*
☐ Consumption of unpasteurized dairy products	*Brucella* spp., *L. monocytogenes*

5.3 Neurological assessment

A rapid neurological assessment should be conducted as part of the initial assessment. It should include assessment for meningeal irritation, mental status and focal neurological signs, and a fundoscopy examination when available.

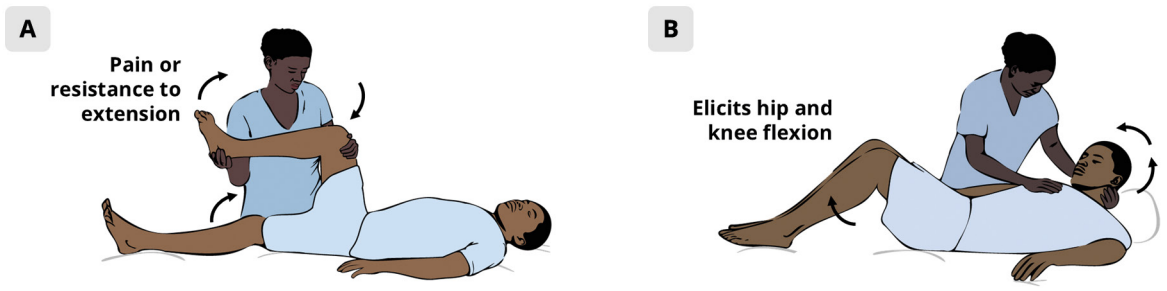
5.3.1 Assessing for meningeal irritation

In children and adults with suspected acute meningitis, signs of meningeal irritation (e.g. neck stiffness, photophobia, Brudzinski's sign and Kernig's sign) should be assessed. Neck stiffness (also called nuchal rigidity) can be seen by people having difficulty in passively or actively flexing the neck to touch the chin to the chest.

Brudzinski and Kernig's maneuvers are well-known techniques that were developed to assess whether the meninges may be inflamed; their sensitivity is generally suboptimal, but a positive sign in an adult is strongly suggestive of acute meningitis (*71*, *72*). The Kernig's sign is elicited by passively extending the knee while keeping the hip flexed at 90 degrees, with the patient in the supine position (Fig. 2A). Resistance to this manoeuvre with flexion of the opposite knee is considered a positive finding. A positive Brudzinski's sign is seen when the passive flexion of the neck elicits a passive flexion of the hips (Fig. 2B).

Signs of meningeal irritation, such as neck stiffness, are much less common in neonates (*67*).

Fig. 2. A) Kernig's sign; B) Brudzinski's sign



5.3.2 Glasgow Coma Scale

The Glasgow Coma Scale (GCS) is a 15-point scale for assessing the level of consciousness; While originally used in the context of trauma and brain injury, it has been used as a prognostic indicator for several neurological conditions, including acute bacterial meningitis (*63*). The person is assessed for eye opening, and verbal and motor response, then given a score for the highest level of function in each area. The totals are combined to determine the overall score. The score ranges between 3 and 15, which indicate the worst and the best scores, respectively. The motor response is tested on the upper limbs, on the better side if one side is less mobile. Table 4 describes how to calculate the GCS.

Table 4. Glasgow Coma Scale

Test	Response	Score
Eye opening	Open spontaneously	4
	Open to command	3
	Open to pain	2
	None	1
Verbal response	Oriented	5
	Confused conversation	4
	Inappropriate words	3
	Incomprehensible sounds	2
	None	1
Motor response	Obeys command	6
	Localizes pain	5
	Withdrawal (flexes limbs normally to pain)	4
	Abnormal flexion to pain	3
	Abnormal extension to pain	2
	None	1

5.3.3 AVPU scale

The AVPU scale is a simplified assessment that can give an indication of level of consciousness by assessing response to stimuli:

A – Alert. People who are fully awake and interactive (even if not fully oriented).

V – Voice. Those who are not fully alert before stimulus (may have eyes closed or appear sleepy) but do respond to voice without being touched (the response may be words, moaning or movement).

P – Pain. Those who do not respond to voice, but do respond to pain: hard chest (sternal) rub in adults, pinch to the sole of the foot in children, or pinch to bridge of nose in suspected spinal injury. The response may be words, moaning or movement.

U – Unresponsive. Those who do not make any movement or verbal response to painful stimuli.

The AVPU scale is particularly useful for children and infants.

For any patient who is P or U on the AVPU scale, rapid intervention may be needed to protect the airway and ensure breathing.

6. Diagnosis

Key messages
Lumbar puncture (LP) is a safe procedure with few contraindications.
Cerebrospinal fluid (CSF) and blood samples should be obtained as soon as possible, ideally before antimicrobial treatment is initiated.
Definitive confirmation of the causative pathogen is based on culture and molecular tests (PCR) performed on CSF and blood samples. These tests include: ▪ CSF culture ▪ CSF PCR ▪ Blood culture ▪ Blood PCR
Antimicrobial therapy should not be delayed if it is not possible to perform LP or collect blood samples in advance.

6.1 When to perform lumbar puncture

Lumbar puncture (LP) allows for the collection and examination of cerebrospinal fluid (CSF), which is crucial for diagnosing or excluding acute meningitis. CSF investigations enable the identification of the causative pathogen and inform therapeutic decisions. Owing to the nonspecific clinical presentation, clinicians should maintain a low threshold for suspecting acute meningitis and performing LP.

LP should be performed as soon as practically possible, preferably before the initiation of antimicrobial treatment, because the yield of CSF cultures is lower once antibiotics have been administered (*73*, *74*).

LP is a safe procedure in most cases. However, in the rare occurrence of a space-occupying lesion or severe cerebral oedema, there can be an increased risk of brain herniation. This risk can be reduced by identifying clinical features (i.e. relative contraindications) that may indicate a patient is at increased risk of brain herniation (see Table 5) and by performing cranial imaging. When cranial imaging is required before LP but is not available, or if there is no adequate capacity to interpret the radiological findings, LP should be deferred until relative contraindications have resolved.

When LP is not initially performed owing to absolute or relative contraindications, empiric treatment should be initiated promptly (see Chapter 7). If these contraindications can be resolved, the attending physician should reassess the need for LP on a case-by-case basis.

Table 5. Absolute and relative contraindications to LP

Absolute contraindications
LP should not be performed in the presence of any of the following: ▪ Ongoing haemodynamic instability (until stabilized) ▪ Ongoing respiratory failure (until stabilized) ▪ Severe bleeding disorder ▪ Skin or soft tissue infection overlying or close to puncture site and spina bifida lesion in neonates ▪ Epidural abscess close to puncture site

Table 5. *continued*

Relative contraindications
A set of clinical criteria can be used to select at-risk individuals (children and adults) who require cranial imaging before LP to rule out the presence of cerebral space-occupying lesions with midline shift, obstructive hydrocephalus or severe cerebral oedema: ▪ GCS <10 ▪ Focal neurological signs ▪ Cranial nerve deficits ▪ Papilloedema ▪ New-onset seizures (in adults) ▪ Severe immunocompromised state

GCS: Glasgow Coma Scale; LP: lumbar puncture.

6.2 CSF collection

Key message

The collection of CSF through a lumbar puncture (LP) should be performed by adequately qualified and trained health care workers, under aseptic conditions.

Relevant WHO resources (please check regularly for updates)

Laboratory methods for the diagnosis of meningitis caused by Neisseria meningitidis, Streptococcus pneumoniae and Haemophilus influenzae: WHO manual, 2nd ed., 2011 (*10*)

Three tubes of CSF (at least 1 mL each) should be collected for cellularity, biochemistry, microbiology (including Gram staining and culture) and molecular testing where available. If only one tube of CSF is available, microbiology testing should be prioritized.

If CSF cannot be immediately analysed in a microbiological laboratory, Trans-Isolate (T-I) medium should be used for collection and transport (*9*, *10*).

6.2.1 Checklist for LP and specimen collection kit

Table 6 provides a checklist of essential items that should be part of a CSF collection kit. Additional items should be included based on resource availability.

Table 6. Checklist for LP

Essential items
☐ Safety box for syringes and needles
☐ Waste disposal container
☐ Surgical mask
☐ Surgical gloves, sterile
☐ Eye protection
☐ Compressed gauze, sterile
☐ Antiseptic skin cleansing agent (e.g. povidone-iodine or chlorhexidine)
☐ Adhesive patch
☐ Syringe, Luer lock, sterile (3 mL or 5 mL)
☐ Spinal needle, Luer lock, styleted (20–22 gauge for adults, 22–23 gauge for children)[a]
☐ Collection tubes
☐ Adhesive labels for tubes
Additional items
☐ Tray
☐ Kidney dish
☐ Sponge holder
☐ Gown, surgical, single-use
☐ Fenestrated drape, sterile
☐ Non-sterile gloves for examination
☐ Local anaesthetic agent (e.g. lidocaine 1%) and hypodermic needle, Luer lock (25 gauge)
☐ Manometer, sterile
☐ Three-way stopcock, Luer lock, sterile
☐ Connector, biconical, sterile

LP: lumbar puncture.

[a] Where atraumatic needles are available, they should be preferred to cutting needles, provided sufficient expertise in their use is in place (*75*).

Adapted from *Laboratory manual for the diagnosis of meningitis caused by Neisseria meningitidis, Streptococcus pneumoniae and Haemophilus influenzae* (*10*); *Standard operating procedures for surveillance of meningitis preparedness and response to epidemics in Africa* (*9*); and *Managing meningitis epidemics in Africa: a quick reference guide for health authorities and health-care workers* (*7*).

6.2.2 LP technique

CSF pressure is generally measured when performing LP in the lateral decubitus position (Fig. 3). The step-by-step guide shown in Table 7 should be considered when performing LP.

Table 7. How to perform an LP: step-by-step

1	Explain the procedure to the person (or to the caregiver for neonates and children), answer any questions and obtain consent.
2	Position the person in the sitting position or lying on their side with knees drawn up to chest and back flexed towards the health care provider (Fig. 3A).
3	Label the collection tubes with relevant ID information and date and time of collection.
4	Wear a surgical mask, wash your hands and put on sterile gloves.
5	Ensure that the person is comfortable and unlikely to move during the procedure.
6	Clean the skin overlying the lumbar spine with povidone-iodine or chlorhexidine (0.5% in 70% alcohol) and allow it to dry completely.
7	Identify the right and left posterior superior iliac crests by palpation, then trace the fingers medially towards the spinal midline.
8	Locate the puncture site at the midline, between L4 and L5 or L3 and L4 intervertebral space (Fig. 3B).
9	Infiltrate the skin and subcutaneous tissue with local anaesthetic (e.g. 1% lidocaine) where available.[a]
10	Insert the needle[b] into the skin at the midline between the two vertebral spines with the bevel facing up.
11	Advance the needle incrementally, following an imaginary line towards the umbilicus.
12	Periodically remove the stylet to check for CSF flow and reinsert the stylet for each advancement.
13	If the person is lying on their side, consider attaching the manometer to the hub of the needle with a 3-way stopcock and recording the peak value of CSF opening pressure.
14	Remove CSF (1 mL minimum, 3–5 mL if possible)[c] and collect into sterile screw-cap tubes. If 3–4 mL or more of CSF are available, use 3 separate tubes and place at least 1 mL into each tube.
15	Replace the stylet and slowly withdraw the needle.
16	Cover the insertion site with an adhesive dressing and instruct the person to lie flat for approximately 30 minutes.
17	Discard the needle in a puncture-resistant, autoclavable container.

CSF: cerebrospinal fluid; ID: identification; LP: lumbar puncture.

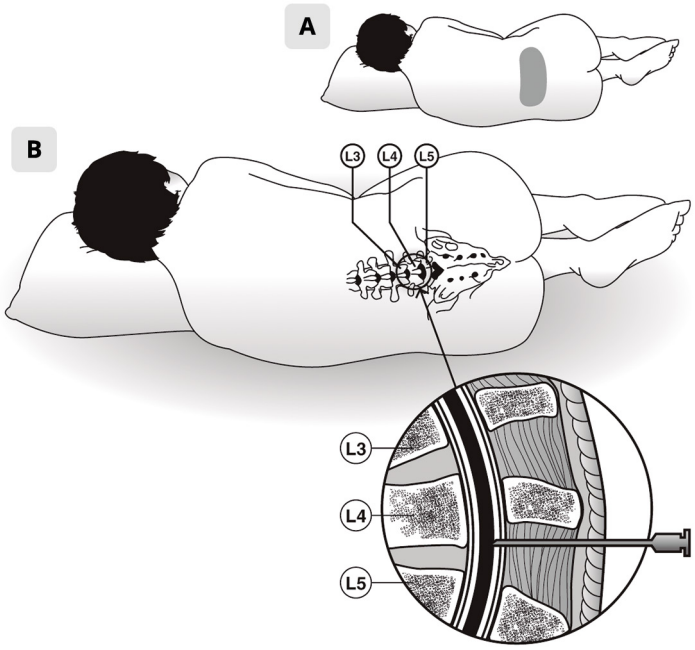
[a] Oral sucrose can also be used as analgesic for neonates before LP. If given, blood glucose levels should be measured beforehand.

[b] Atraumatic needles should be preferred to cutting needles when they are available, provided that adequate expertise in their use is available.

[c] Up to 20 mL of CSF can be safely collected.

Adapted from *Managing meningitis epidemics in Africa: a quick reference guide for health authorities and health-care workers* (6).

Fig. 3. A) The lateral decubitus position; B) How to perform LP



Source: *Managing meningitis epidemics in Africa: a quick reference guide for health authorities and health-care workers* (7)

Estimating CSF opening pressure in the absence of a manometer

In low-resource settings, the availability of and access to a manometer can be limited, making it challenging to reliably measure ICP. Alternative methods to measure ICP have been proposed in these circumstances, particularly in situations where therapeutic LP is of proven value, such as for cryptococcal meningitis. These methods, which have not been fully validated, include counting drops of CSF flowing from a spinal needle or using a marked intravenous (IV) tubing set (*76*-*78*).

6.3 CSF investigations

In addition to the examination of CSF macroscopic appearance and measurement of CSF pressure (reference range 8–20 cm H_2O), CSF specimens should be sent for laboratory investigations, which are crucial to support and potentially confirm the diagnosis of acute meningitis (Fig. 4). However, CSF investigations should not be interpreted in isolation from other clinical and laboratory data. Recommended initial laboratory investigations are as follows:

- glucose;
- total protein;
- white blood cell count (total and differential);
- red blood cell count;
- lactate (Box 2);
- Gram stain;
- culture (bacterial) and antimicrobial susceptibility testing (AST); and
- molecular tests (polymerase chain reaction [PCR - singleplex or multiplex]) for bacterial and viral pathogens.

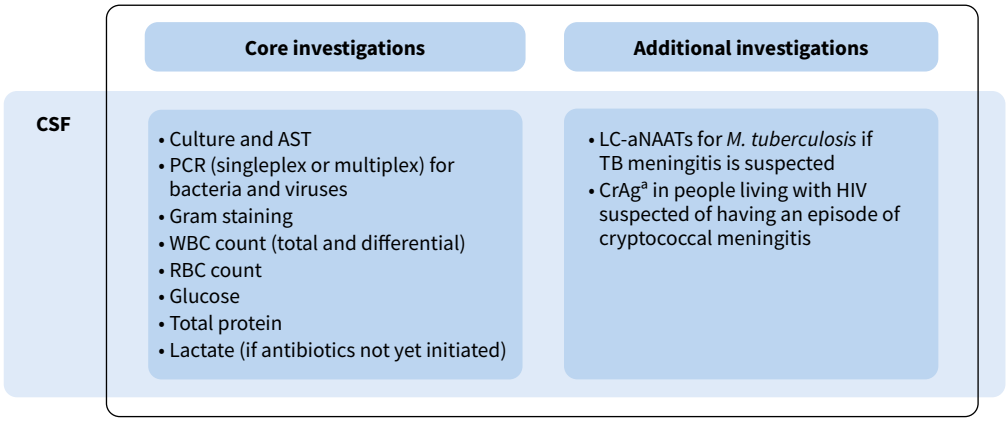
Box 2. CSF lactate

CSF lactate levels may help in differentiating between bacterial and viral meningitis when performed before the initiation of antibiotics. However, the diagnostic value and clinical applications of CSF lactate are limited once antibiotic administration has started or other central nervous system diseases are present.

6.3.1 Additional CSF tests based on specific considerations

- Low-complexity automated nucleic acid amplification test (LC-aNAAT) for *M. tuberculosis*, such as Xpert® MTB/RIF Ultra, is recommended in people with suspected TB meningitis and should be used for the diagnosis of TB meningitis rather than microscopy or culture. Where possible, culture may be performed in addition to automated NAAT testing, to maximize the opportunity for diagnosis and detection of DR-TB (*21*).
- Rapid CSF cryptococcal antigen assay (CrAg) – or India ink in situations where CrAg is not available – is recommended in people with advanced HIV disease suspected of having cryptococcal meningitis (*24*).

Fig. 4. Core and additional CSF investigations



AST: antimicrobial susceptibility testing; CrAg: cryptococcal antigen assay; CSF: cerebrospinal fluid; HIV: human immunodeficiency virus; LC-aNAAT: low-complexity automated nucleic acid amplification test; PCR: polymerase chain reaction; RBC: red blood cell; TB: tuberculosis; WBC: white blood cell.

[a] India ink can be used where CrAg is not available.

Bacterial antigen detection tests

Antigen detection tests, including latex agglutination tests and lateral flow assays can be performed on CSF, as they provide quick results (i.e. 20-30 minutes) against a subset of potential causative pathogens and can support surveillance efforts. However, their diagnostic value has been questioned because the diagnostic performance varies based on the setting and the specific pathogen targeted, requiring further studies to support their widespread use in clinical settings (*79-81*). A positive test result from any antigen detection test should be confirmed with culture or molecular testing to establish a definitive diagnosis.

6.3.2 Interpretations of initial CSF findings

Macroscopic appearance, cellularity, glucose (both CSF and serum) and total protein should be performed in all suspected cases of acute bacterial meningitis, as the combination of results can provide diagnostic clues and inform clinical decision-making. Guidance on how to interpret initial CSF findings in children and adults is provided in Fig. 5.

Fig. 5. Interpretation of initial CSF findings in children and adults

Interpretation	Normal CSF findings	Acute bacterial meningitis	Viral meningitis[a]	TB meningitis	HIV-associated cryptococcal meningitis
Opening pressure	8-20 cm H_2O	↑/↑↑	N/↑	↑/↑↑	↑↑
Appearance	Clear	Cloudy, turbid or purulent	Clear	Clear	Clear
WBC count[b]	<5/mm^3 or <5/µL	↑ ↑	↑/↑↑	↑/↑↑	N/↑
Predominant cell type	–	Neutrophils	Lymphocytes	Lymphocytes	Lymphocytes
CSF to blood glucose ratio[c]	0.4-0.7	↓ ↓	Normal	↓/↓ ↓	N/↓
Glucose	40-70 mg/dL or 2.2-3.9 mmol/L	↓ ↓	Normal	↓ ↓	N/↓
Total protein	40-70 mg/dL or 0.15-0.45 g/L	↑ ↑	N/↑	↑/↑↑	N/↑

↑: mildly elevated; ↑↑: markedly elevated; ↓: mildly decreased; ↓↓: markedly decreased; N: normal; CSF: cerebrospinal fluid; LP: lumbar puncture; RBC: red blood cell; TB: tuberculous; WBC: white blood cell.

Local laboratory ranges for biochemical tests may vary and should be consulted before interpreting the results.

The diagnostic yield of CSF tests can be reduced by prior initiation of antibiotic therapy.

CSF changes can be attenuated and are less suggestive of specific etiologies in neonates, people living with HIV and older people.

[a] Most of these CSF findings can also be consistent with and/or suggestive of partially treated acute bacterial meningitis or some non-pyogenic bacterial infections, including rickettsioses, leptospirosis, Lyme disease and neurosyphilis.

[b] A traumatic LP can elevate RBC and WBC count.

[c] CSF glucose levels should always be compared to blood glucose levels. When this is not possible, CSF glucose range values are based on presumed blood glucose of 100 mg/dL or 5.6 mmol/L.

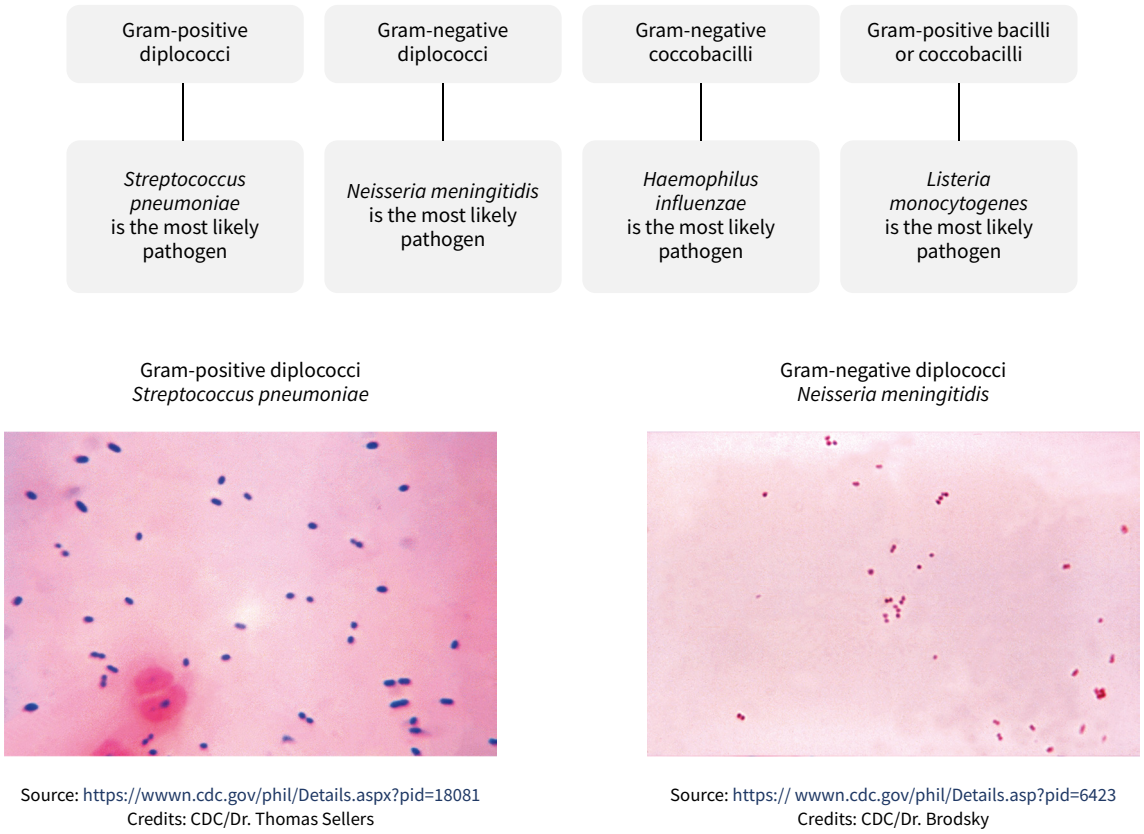
Special considerations for neonates

Interpretation of CSF findings in neonates poses an additional challenge as values may differ from those found in older children and adults and may vary in preterm neonates or by week of age (*82-84*). Findings consistent with bacterial meningitis are CSF white blood cell (WBC) count >15 cells/mm^3, CSF protein levels >100 mg/dL and blood glucose levels <30 mg/dL (*84-89*).

6.3.3 Interpretation of Gram stain

Gram stain should be performed on CSF samples of all suspected cases of acute meningitis, because it has the advantage of suggesting the bacterial etiology before culture results (Fig. 6). However, once antibiotic treatment has been started, the diagnostic yield of CSF Gram stain can be reduced and should be interpreted with caution (e.g. Gram-negative diplococci can appear Gram-positive). Additionally, Gram stain should be interpreted in light of predisposing conditions and risk factors that emerged during collection of medical history (e.g. animal contact or unpasteurized milk).

Fig. 6. Interpretation of CSF Gram staining



Source: https://wwwn.cdc.gov/phil/Details.aspx?pid=18081
Credits: CDC/Dr. Thomas Sellers

Source: https:// wwwn.cdc.gov/phil/Details.asp?pid=6423
Credits: CDC/Dr. Brodsky

CSF: cerebrospinal fluid.

6.4 Blood investigations

Blood tests can serve as a valuable tool to support the diagnosis of acute meningitis in combination with CSF investigations and clinical findings (Fig. 7). Collection of blood samples should be performed just before or in parallel with LP and, preferably, before the initiation of antibiotic treatment.

The following blood investigations should be performed in all patients with suspected acute meningitis, where resources and technical capacity are available:

- cultures (at least one set aerobic/anaerobic);
- complete blood count (including peripheral white blood cell count, total and differential);
- glucose;

- HIV test;
- malaria test (microscopy or rapid diagnostic test) where malaria is a clinical possibility (e.g. people living in malaria-endemic areas or returning travellers); and
- C-reactive protein (CRP) or procalcitonin (PCT), or both.

6.4.1 Blood cultures

At least one set of blood cultures with one aerobic bottle and one anaerobic bottle should be obtained as soon as possible, in parallel with LP and, ideally, before antibiotics are administered, because the diagnostic yield may be substantially reduced once antibiotics have been started (*90*, *91*). However, if blood culture collection is not readily available this should not delay the initiation of antibiotic treatment.

Collecting blood cultures is especially important for people in whom LP and CSF sampling were not performed or were delayed owing to absolute or relative contraindications. In these cases, blood cultures may be the only confirmatory test available to identify the causative bacterial pathogens and determine their antimicrobial susceptibility patterns.

6.4.2 Blood glucose

Blood glucose should be performed as part of the initial assessment to diagnose hypoglycaemia, which can be life-threatening, especially in young children. Additionally, blood glucose should be performed immediately before LP to calculate a reliable CSF-to-blood (or CSF-to-serum) glucose ratio.

6.4.3 HIV test

Relevant WHO resources (please check regularly for updates)
Consolidated guidelines on HIV prevention, testing, treatment, service delivery and monitoring: recommendations for a public health approach, 2021 (*25*)

HIV infection can directly cause acute meningitis, but also serves as a risk factor for invasive pneumococcal and meningococcal disease, leading to a higher prevalence of HIV in people with suspected or confirmed meningitis (*48-50*, *92*). Furthermore, people with advanced HIV disease are at increased risk of developing meningitis from *C. neoformans and M. tuberculosis* (*54*, *55*). Given the substantial implications in terms of diagnostic approach and clinical management, ascertaining HIV status, and HIV testing where unknown, is indicated in individuals presenting with signs and symptoms of acute meningitis, especially in high HIV burden settings.

Although HIV testing should be voluntary, if the person presents with altered mental status or is unconscious, HIV testing should be considered where this is clinically judged to be in the person's best interests for optimal care; the reasoning should be explained to the person when they regain mental capacity.

6.4.4 Markers of bacterial infection

Where resources allow, measuring peripheral white blood cell count (total and differential) and serum levels of inflammatory markers (e.g. CRP, PCT) is suggested. These tests are often used as auxiliary investigations that may contribute to meningitis diagnosis, including differentiating bacterial from non-bacterial disease (*93*). However, these two tests cannot be used to confirm or exclude the diagnosis of bacterial meningitis, and their results should be interpreted in the context of clinical presentation and CSF characteristics.

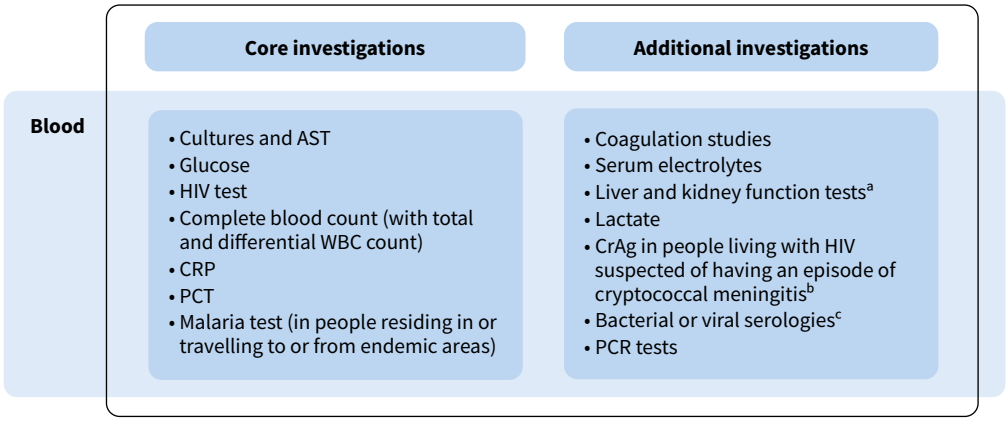
The decision on whether to choose CRP or PCT (or both) should be based on resources and local availability. When CRP is measured, quantitative assays should be preferred over qualitative assays, since serum levels can be monitored and used as a marker of clinical response to treatment.

6.4.5 Additional blood tests to consider

Additional tests to consider are as follows:

- Coagulation studies (i.e. prothrombin time and activated partial thromboplastin time) in the presence of purpuric or petechial lesions should be undertaken to assess for disseminated intravascular coagulation (a life-threatening complication of sepsis or septic shock).
- Electrolytes and biochemical tests – including creatinine, blood urea nitrogen and bilirubin – are useful as part of the initial assessment or when septic shock is suspected.
- Lactate can be used to assess metabolic acidosis, sepsis or shock (*94*).
- Rapid serum, plasma or whole-blood CrAg assays should be performed in people living with HIV suspected of having cryptococcal meningitis when LP is not available or cannot be performed (*24*).
- Disease-specific serologies should be performed based on clinical and epidemiological considerations; such tests include those for arboviral diseases, scrub typhus and other rickettsioses, neurosyphilis, Lyme disease, leptospirosis or brucellosis.
- PCR tests can be used to confirm the diagnosis when a pathogen typically associated with meningitis is identified.

Fig. 7. Core and additional blood investigations



AST: antimicrobial susceptibility test; CrAg: cryptococcal antigen assay; CRP: C-reactive protein; HIV: human immunodeficiency virus; PCT: procalcitonin; PCR: polymerase chain reaction; WBC: white blood cell.

[a] These investigations should include creatinine, blood urea nitrogen and serum bilirubin.

[b] When LP is not available or cannot be performed.

[c] Based on clinical and epidemiological considerations (e.g. neurosyphilis, Lyme disease, leptospirosis, brucellosis, rickettsioses and several arboviral diseases).

6.5 Acute meningitis and cerebral malaria

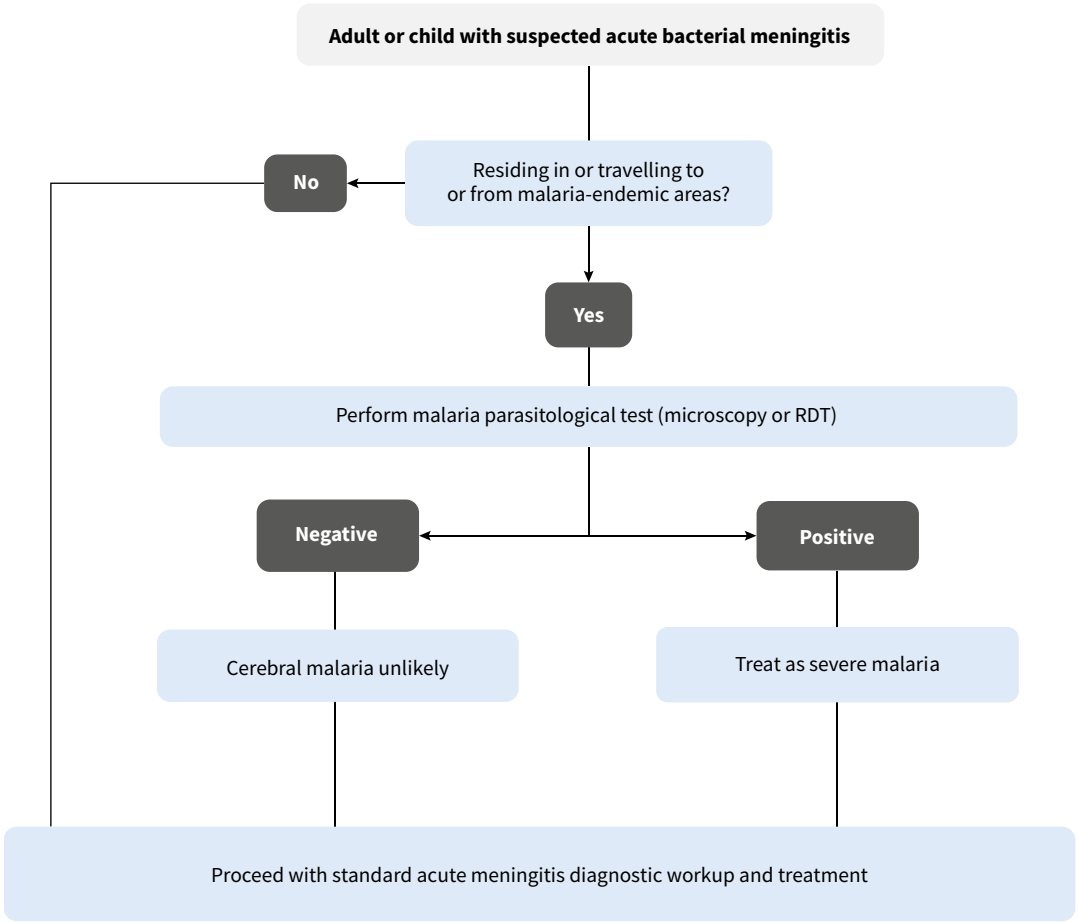
Relevant WHO resources (please check regularly for updates)
WHO guidelines for malaria, 2025 (*20*)

Cerebral malaria, caused by *Plasmodium falciparum* infection, can mimic acute meningitis and should be considered in the differential diagnosis for individuals who live in (or have recently travelled to) areas with an ongoing, measurable incidence of malaria and sustained mosquito-borne transmission over successive years (i.e. malaria-endemic areas) (*95*).

A parasitological test (i.e. light microscopy or a rapid diagnostic test) should be performed on a blood sample in all individuals where both malaria and meningitis are suspected. If the parasitological test confirms malaria infection, parenteral antimalarial treatment should be initiated promptly. Nonetheless, a diagnostic workup with an LP for CSF analysis should be performed to exclude bacterial meningitis (*96*). CSF findings in cerebral malaria are generally normal, except for ICP, which is elevated in most cases (*97*, *98*).

The diagnostic approach with individuals with signs and symptoms of acute meningitis in malaria-endemic areas is described in Fig. 8.

Fig. 8. Decision-making diagnostic algorithm for people with suspected acute meningitis in malaria-endemic areas



RDT: rapid diagnostic test.

6.6 Cryptococcal meningitis in people living with HIV

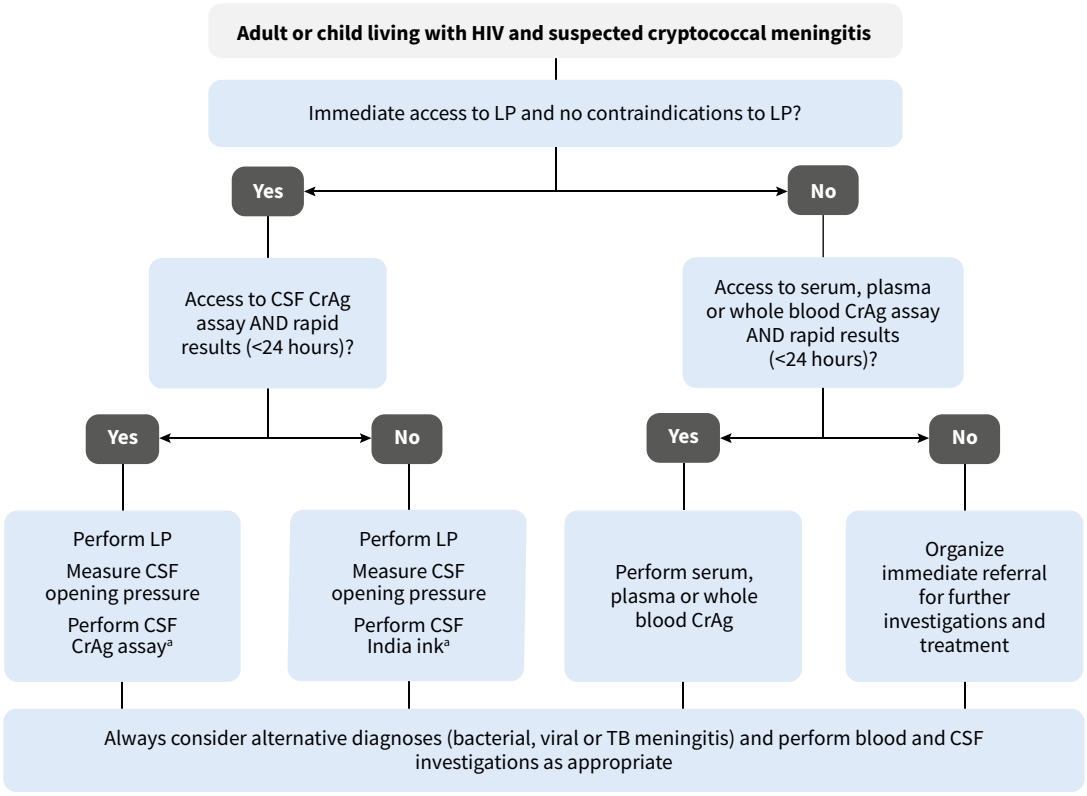
Relevant WHO resources (please check regularly for updates)
Guidelines for diagnosing, preventing and managing cryptococcal disease among adults, adolescents and children living with HIV, 2022 (*24*)
Providing care to people with advanced HIV disease who are seriously ill, 2023 (*99*)
WHO guidelines on the management of advanced HIV disease, 2025 (*100*)

Although cryptococcal meningitis typically presents with subacute or chronic symptoms in advanced HIV, acute presentations can also occur (*55*). Health care professionals should have a low threshold for suspecting cryptococcal meningitis among people with advanced HIV disease who exhibit signs and symptoms of acute meningitis, because prompt diagnosis and initiation of antifungal therapy are critical to reducing mortality (*24*). When LP is available and no contraindications are present, the preferred diagnostic approaches are measurement of CSF opening pressure and rapid CSF CrAg test (or CSF India ink test when CSF CrAg is not available).

In settings where access to LP is limited or contraindicated, a serum, plasma or whole-blood CrAg test is recommended as an initial diagnostic option. When neither LP nor rapid CrAg test is available, prompt referral for further investigation and treatment should be organized. Additionally, CD4 testing should be performed if HIV status has been established, to guide treatment and further diagnostics.

A simplified decision-making clinical algorithm describing the diagnostic approach suggested by the *Guidelines for diagnosing, preventing and managing cryptococcal disease among adults, adolescents and children living with HIV* (*24*) is provided in Fig. 9.

Fig. 9. Decision-making diagnostic algorithm for people living with HIV and suspected acute cryptococcal meningitis



CrAg: cryptococcal antigen assay; CSF: cerebrospinal fluid; LP: lumbar puncture; TB: tuberculosis.

[a] For a first episode, CSF cryptococcal culture is also recommended in parallel with cryptococcal antigen testing if this is feasible.

7. Treatment

Key messages
Given its severity, acute meningitis is always considered to be of bacterial origin until proven otherwise.
The first dose of antibiotics should never be delayed (ideally given within 1 hour of presentation to care).
Lumbar puncture or imaging (or both) should not delay initiation of treatment.

Remember

The content of this chapter covers non-epidemic-prone settings only. While overlap in clinical management exists, specific considerations for epidemic-prone settings, during and outside epidemics, are provided in the publication *Preparedness and response to bacterial meningitis outbreaks: toolkit for frontline healthcare workers (5).*

7.1 General management

Key message
Individuals with suspected acute meningitis should be admitted or urgently transferred to a health care facility where LP can be performed, and adequate monitoring and management can be ensured.

Intensive care management may be required for people with haemodynamic or respiratory compromise, generalized seizures, increased ICP, brain oedema or mass effect, coma or other life-threatening complications (e.g. septic shock, disseminated intravascular coagulation or multiorgan failure).

7.2 Initial emergency management

Relevant WHO resources (please check regularly for updates)
Basic emergency care: approach to the acutely ill and injured, 2018 (*19*)

In people with suspected acute meningitis admitted to any health care facility, the ABCDE approach should be followed. Acute meningitis is associated with a variety of underlying emergency conditions, which must be recognized promptly and treated, as shown in Table 8.

Quick cards summarizing the initial approach to assessment and management of key findings following the ABCDE approach are provided in *Annex 1*, while detailed guidance on the initial management of acutely ill individuals with life-threatening conditions is available in the WHO publication *Basic emergency care: approach to the acutely ill and injured* (*19*).

If IV fluid resuscitation is required, balanced crystalloids (e.g. Ringer's lactate) should be used, whereas glucose-based solutions should be avoided unless hypoglycaemia is also a concern. Management of maintenance fluids is addressed in Section 7.10.

Table 8. Management of underlying emergency conditions

Manifestation or complication	Immediate management[a]
Coma	Maintain the airway, place patient on his or her side, exclude other treatable causes of coma (e.g. hypoglycaemia or cerebral malaria) and intubate if necessary.
Hyperpyrexia	Administer tepid sponging, fanning, a cooling blanket and paracetamol.
Convulsions	Maintain the airway; treat promptly with intravenous or rectal diazepam, lorazepam or midazolam; check blood glucose.
Septic shock	Suspect bacteraemia, take blood for cultures; correct haemodynamic disturbances.

[a] It is assumed that empiric antibiotic treatment has been started in all cases, as considered appropriate.

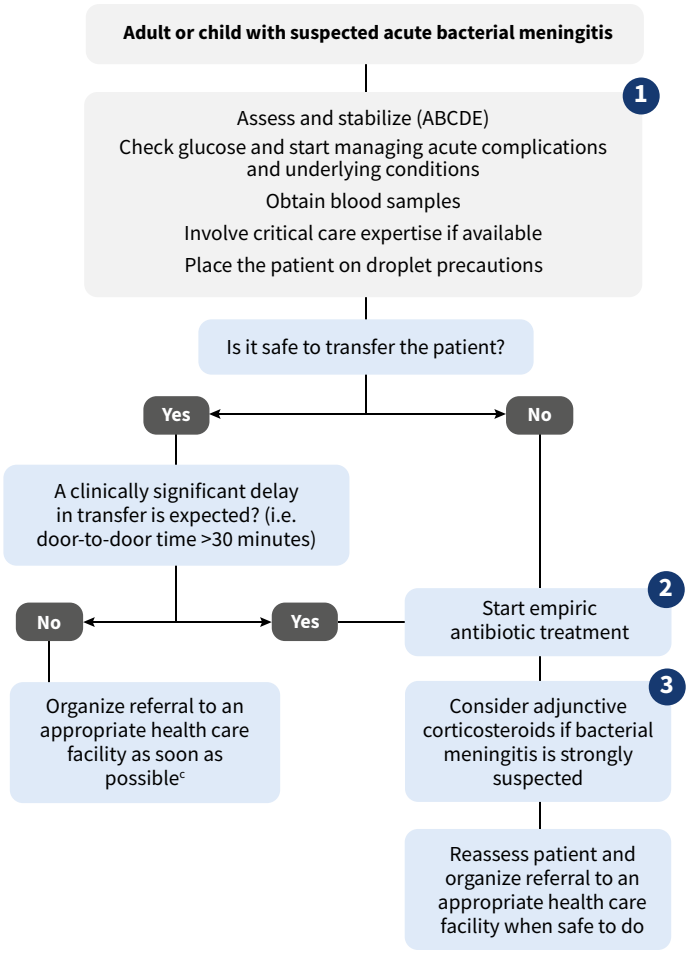
7.3 Pre-referral management (before admission or transfer to an appropriate health care facility)

If a person with signs and symptoms of acute meningitis presents to a health care facility where LP and adequate monitoring and management of severe illness cannot be ensured, rapid transfer to an appropriate health care facility should be arranged. All attempts should be made to stabilize the patient for transfer (see Section 7.2).

Empiric antibiotic treatment (see Section 7.5.1) should be initiated urgently when bacterial meningitis is strongly suspected and a clinically significant delay in transfer or referral is considered likely. This delay should not exceed 30 minutes from time of presentation at the initial health care facility to admission at an adequately equipped facility (door-to-door). In this context, when IV administration is not possible or an IV line has not been secured, for antibiotics that can be administered intramuscularly (IM), this administration route can be used as an alternative. Fig. 10 describes the decision-making clinical algorithm for the management of children or adults with suspected acute meningitis before admission or transfer to an appropriate health care facility. Adjunctive corticosteroids can be initiated, along with empiric antibiotic treatment, when bacterial meningitis is strongly suspected (see Section 7.5.2).

Transfer and handover should be organized as soon as possible. To ensure clear communication with the receiving health facility, a transfer summary should be produced. The SBAR Handover Tool (*Annex 2*) can be used to guide communication with health care professionals of the receiving health care facility. A checklist is available that may be used to help arrange transfer and prepare for any possible needs during transport.

Fig. 10. Management of children or adults with suspected acute meningitis before admission or transfer to an appropriate health care facility



1 Blood investigations:[a]
- cultures (at least one set) and AST
- glucose
- CBC
- HIV test
- CRP
- PCT
- malaria test (microscopy or RDT)[b]

2 Empiric antibiotic treatment (see Fig. 12 for dosing)

Give IV or IM ceftriaxone or cefotaxime

Consider adding IV or IM ampicillin or IV amoxicillin if ≥1 risk factor for *L. monocytogenes* (i.e. age >60 years, pregnancy or immunocompromised state)

Consider adding IV vancomycin if risk of *S. pneumoniae* resistant to penicillin or third-generation cephalosporins

3 Adjunctive corticosteroids

Give IV dexamethasone 10 mg in adults or 0.15 mg/kg in children, every 6 hours, starting with the first dose of antibiotics

Do not administer corticosteroids if:

- Cerebral malaria has not been excluded (where it is a clinical possibility)
- Cryptococcal meningitis is considered likely (e.g. person with advanced HIV disease).

ABCDE: airway, breathing, circulation, disability and exposure; AST: antimicrobial susceptibility test; CBC: complete blood count; CrAg: cryptococcal antigen assay; CRP: C-reactive protein; CSF: cerebrospinal fluid; HIV: human immunodeficiency virus; IM: intramuscular; IV: intravenous; *L. monocytogenes: Listeria monocytogenes*; LC-aNAAT: low-complexity automated nucleic acid amplification test; LP: lumbar puncture; PCR: polymerase chain reaction; PCT: procalcitonin; RBC: red blood cell; RDT: rapid diagnostic test; *S. pneumoniae: Streptococcus pneumoniae*; WBC: white blood cell.

[a] Perform additional blood investigations based on available resources and clinical considerations (e.g. electrolytes, kidney and liver function tests, coagulation studies, serum CrAg in people living with HIV suspected of having an episode of cryptococcal meningitis).

[b] According to clinical and epidemiological considerations.

[c] Appropriate health care facility: LP can be performed where indicated and management of severe illness can be ensured.

7.4 After admission or transfer to an appropriate health care facility

When a patient with suspected acute meningitis is admitted or transferred to an appropriate health care facility, emergency management should be initiated promptly, following the ABCDE approach (see Section 7.2). Initial CSF and blood diagnostic investigations should be performed as soon as possible.

In the absence of absolute or relative contraindications, LP should be performed, preferably before initiation of antibiotic treatment. However, performance of LP or (when indicated and available) cranial imaging should not delay the initiation of antibiotic treatment, which should be administered within 1 hour from admission.

Similarly, people who have already received one or more doses of antibiotics before being admitted to the facility should undergo LP as soon as possible. Fig. 11 describes the decision-making clinical algorithm for the management of children or adults with suspected acute meningitis before admission or transfer to an appropriate health care facility. Further guidance on empiric antibiotic treatment and adjunctive corticosteroids is provided in Section 7.5.1 and 7.5.2, respectively.

Fig. 11. Management of children or adults with suspected acute meningitis after admission or transfer to an appropriate health care facility

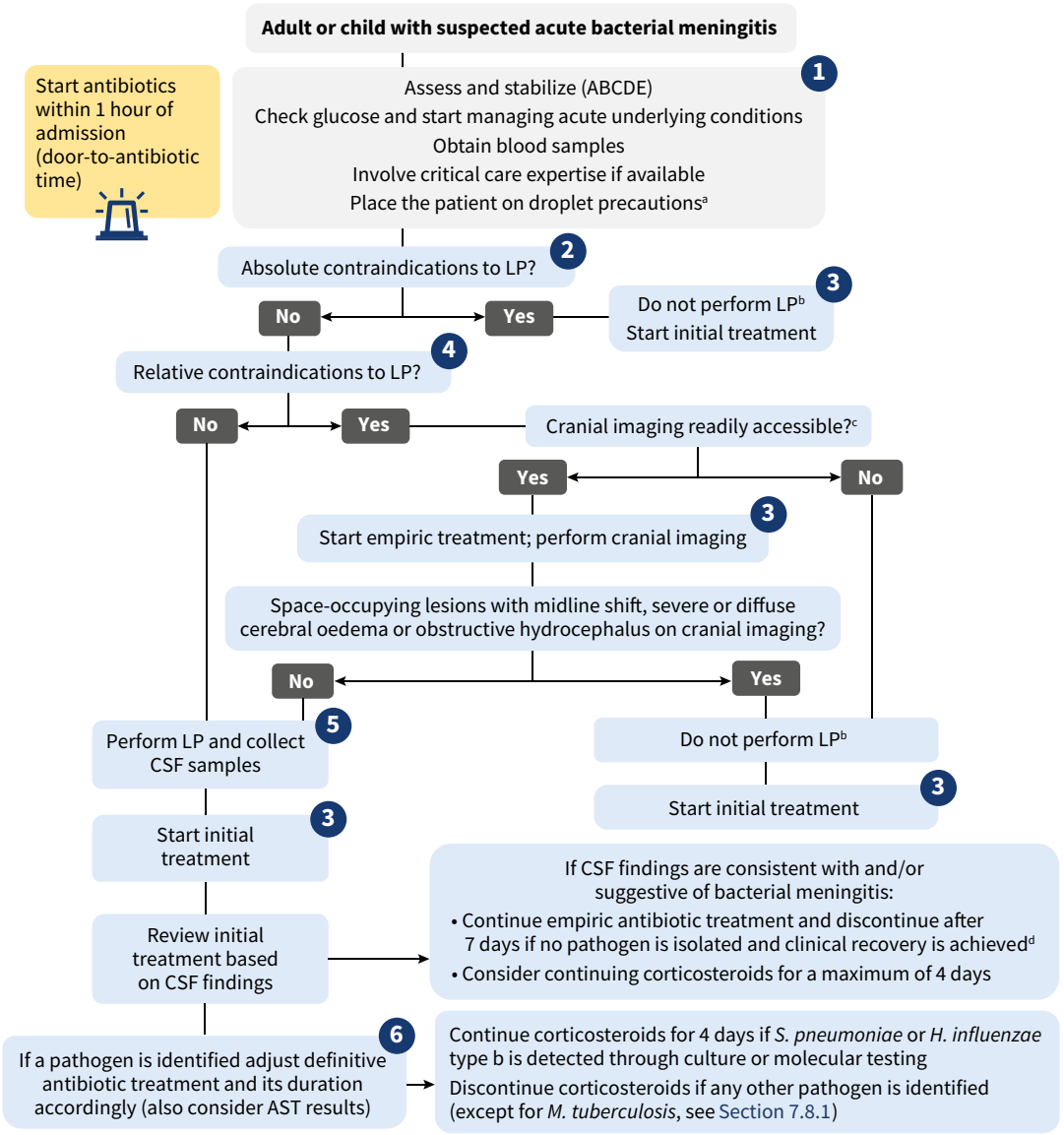


Fig. 11 *continued*

1

Blood investigations:[e]
- cultures (at least one set) and AST
- glucose
- HIV test
- CBC
- CRP
- PCT
- malaria test (microscopy or RDT)[f]

2

Absolute contraindications:
- ongoing haemodynamic instability or respiratory failure (until stabilized)
- severe bleeding disorder
- skin or soft tissue infection overlying or close to puncture site
- epidural abscess close to puncture site

3

Initial treatment:
- empiric antibiotics IV (see Figure 12)
- adjunctive corticosteroids IV if bacterial meningitis is strongly suspected[g]

4

Relative contraindications:
- GCS <10
- focal neurological signs
- cranial nerve deficits
- papilloedema
- new-onset seizures (in adults)
- severe immunocompromised state

5

CSF investigations:[h]
- glucose
- total protein
- WBC count (total and differential)
- RBC count
- Gram staining
- culture and AST
- PCR (singleplex or multiplex) for bacteria and viruses

6

Definitive antibiotic treatment duration (in days):
- *S. pneumoniae*: 10–14
- *N. meningitidis*: 5–7
- *H. influenzae* type b: 7–10
- *S. agalactiae*: 14–21
- *L. monocytogenes*: 21

ABCDE: airway, breathing, circulation, disability and exposure; AST: antimicrobial susceptibility test; CBC: complete blood count; CrAg: cryptococcal antigen assay; CRP: C-reactive protein; CSF: cerebrospinal fluid; CT: computed tomography; GCS: Glasgow Coma Scale; *H. influenzae*: *Haemophilus influenzae*; HIV: human immunodeficiency virus; IV: intravenous; *L. monocytogenes*: *Listeria monocytogenes*; LC-aNAAT: low-complexity automated nucleic acid amplification test; LP: lumbar puncture; *M. tuberculosis*: *Mycobacterium tuberculosis*; MRI: magnetic resonance imaging; *N. meningitidis*: *Neisseria meningitidis*; PCR: polymerase chain reaction; PCT: procalcitonin; RBC: red blood cell; RDT: rapid diagnostic test; *S. agalactiae*: *Streptococcus agalactiae*; *S. pneumoniae*: *Streptococcus pneumoniae*; WBC: white blood cell.

[a] Until meningococcal infection has been excluded or until the person has received at least 24 hours of effective antimicrobial treatment.

[b] The need for LP should be reassessed on a case-by-case basis in the event that contraindications resolve.

[c] Readily accessible cranial imaging refers to the availability of cranial CT or MRI and the clinical expertise to interpret the findings.

[d] Clinical recovery may be indicated by the presence of all of the following for at least 48 hours: 1) resolution of fever; 2) resolution of vital sign abnormalities (blood pressure, heart rate, respiratory rate and oxygen saturation); and 3) resolution of altered consciousness.

[e] Additional blood investigations based on available resources and clinical considerations: coagulation studies, electrolytes, liver and kidney function tests, lactate, CrAg in people living with HIV, bacterial or viral serologies and PCR tests.

[f] According to clinical and epidemiological considerations.

[g] Corticosteroids should be administered with the first dose of antibiotics or as soon as possible (within 12 hours) after the initial antibiotic dose. Do not administer corticosteroids if cerebral malaria has not been excluded (where it is a clinical possibility) and/or cryptococcal meningitis is considered likely (e.g. person with advanced HIV disease).

[h] Additional CSF investigations: lactate when antibiotics are not yet initiated; LC-aNAATs when *Mycobacterium tuberculosis* is suspected; CrAg, or India ink when CrAg is not available, in people living with HIV.

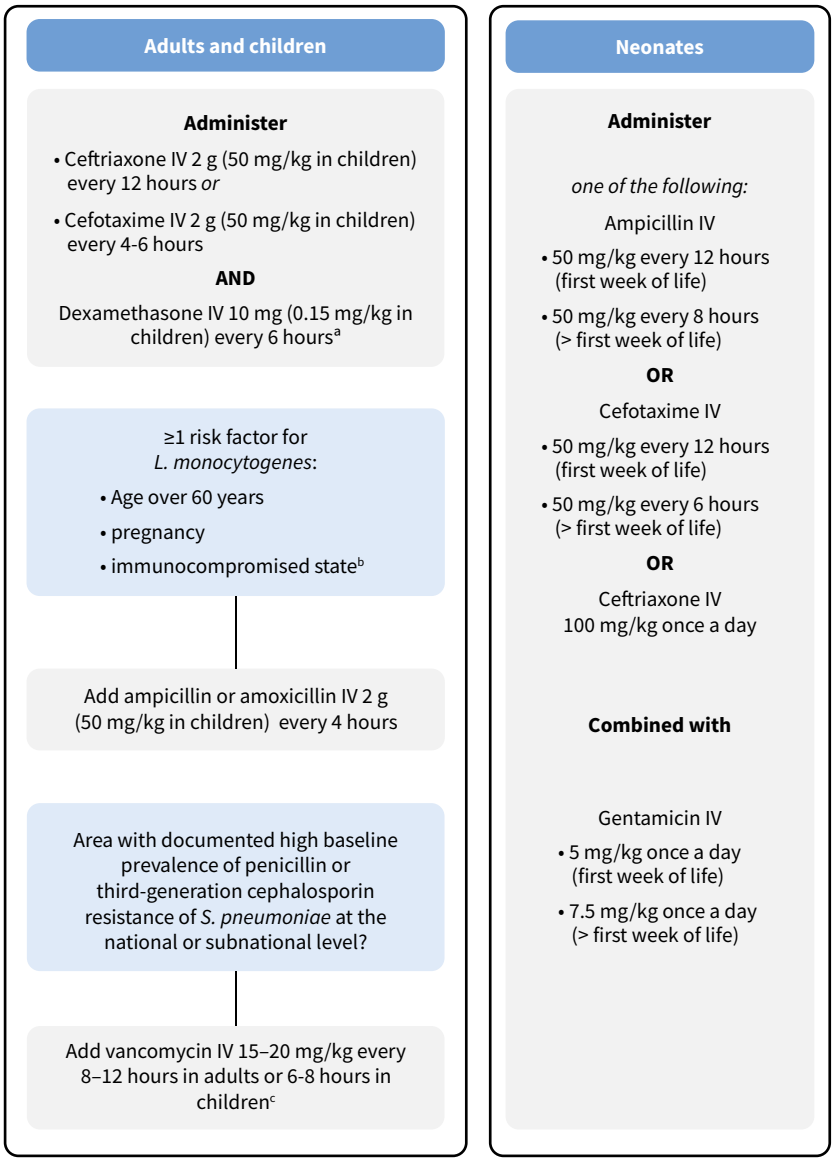
7.5 Initial treatment

Relevant WHO resources (please check regularly for updates)

WHO recommendations for management of serious bacterial infections in infants aged 0–59 days, 2024 (*16*)

Initial treatment for suspected acute meningitis consists of empiric parenteral antibiotics, preferably IV, and IV corticosteroids when appropriate (Fig. 12). Empiric antibiotics are the mainstay of initial treatment for suspected acute meningitis. Corticosteroids can also be started alongside antibiotics when bacterial meningitis is strongly suspected. However, if cerebral malaria and/or HIV-associated cryptococcal meningitis are suspected, these conditions should be ruled out prior to initiating corticosteroid therapy.

Fig. 12. Initial treatment of suspected acute meningitis in adults, children and neonates in an appropriate health care facility



HIV: human immunodeficiency virus; IM, intramuscular; IV, intravenous; TB: tuberculosis.
All dosages are for normal renal function.

[a] When bacterial disease is strongly suspected. Corticosteroids should be administered with the first dose of antibiotics or as soon as possible (within 12 hours) after the initial antibiotic dose. Do not administer corticosteroids if cerebral malaria has not been excluded (where it is a clinical possibility) and/or cryptococcal meningitis is considered likely (e.g. person with advanced HIV disease).

[b] Immunosuppressive therapy, organ transplantation, malignancy, advanced HIV disease, diabetes mellitus, end-stage kidney disease, liver cirrhosis, alcohol use disease.

[c] In settings with low TB burden, rifampicin can be used as an alternative to vancomycin. In settings with high TB burden, rifampicin should be used only when vancomycin is not readily available or is contraindicated.

7.5.1 Empiric antibiotic treatment

Table 9 lists the recommended empiric antimicrobial regimens for acute bacterial meningitis in adults, children and neonates; Table 10 provides dosages for each antibiotic according to the age group.

Table 9. Empiric antibiotic treatment for acute bacterial meningitis in adults, children and neonates

Adults and children >1 month
First choice
Ceftriaxone IV *or* cefotaxime IV
If risk factors for L. monocytogenes[a] add
Ampicillin IV *or* amoxicillin IV
In areas with documented high baseline prevalence of penicillin or third-generation cephalosporin resistance of S. pneumoniae at the national or subnational level add
Vancomycin[b] IV
Second choice
Chloramphenicol IV *plus* amoxicillin IV *or*
Chloramphenicol IV *plus* ampicillin IV *or*
Chloramphenicol IV *plus* benzylpenicillin IV[c]
Neonates
First choice
Ampicillin IM/IV *plus* gentamicin IM/IV *or*
Cefotaxime IM/IV *plus* gentamicin IM/IV *or*
Ceftriaxone IM/IV *plus* gentamicin IM/IV
Second choice
Meropenem IV

IM: intramuscular; IV: intravenous; TB: tuberculosis.

[a] Age over 60 years, pregnancy, immunocompromised state.

[b] In settings with a low TB burden, rifampicin can be used as an alternative to vancomycin. In settings with a high TB burden, rifampicin can be used only when vancomycin is not readily available or is contraindicated.

[c] In settings with low vaccination coverage for *Haemophilus influenzae* type b, IV amoxicillin or ampicillin should be preferred over benzylpenicillin for combined empiric treatment.

Colour coding adapted from *WHO AWaRe* (*access, watch, reserve*) *antibiotic book* (*11*): green: access; yellow: watch.

Duration of empiric treatment

All efforts should be made to identify and characterize the causative pathogen on blood and CSF samples through culture and molecular tests (e.g. PCR). However, when the pathogen remains unknown, empiric antibiotic treatment can be discontinued after 7 days, provided that the person has clinically recovered. Clinical recovery may be indicated by the presence of all of the following for at least 48 hours:

- resolution of fever;
- resolution of vital sign abnormalities (blood pressure, heart rate, respiratory rate and oxygen saturation); and
- resolution of altered consciousness.

In neonates the duration of empiric treatment is 3 weeks, but treatment can be continued for longer if the neonate is not improving (*16*).

7.5.2 Adjunctive corticosteroids

Early IV administration of systemic corticosteroids (e.g. dexamethasone) is generally used as part of the initial management strategy to reduce the risk of death and neurological complications among individuals with acute bacterial meningitis. However, the beneficial effect of corticosteroids has mostly been observed for meningitis due to *S. pneumoniae and H. influenzae* type b. This highlights the importance of performing LP and microbiological CSF investigation to identify the causative pathogen.

The beneficial effects of corticosteroids are likely to decrease as the delay in administration increases. Therefore, corticosteroids should be administered with the first dose of antibiotics or as soon as possible after the initial antibiotic dose, and no later than 12 hours after the first dose of antibiotics.

Dexamethasone is the corticosteroid of choice for children and adults. Suggested dosage of IV dexamethasone is 10 mg in adults and 0.15 mg/kg (maximum dosage 10 mg) in children, every 6 hours. When dexamethasone cannot be administered, IV hydrocortisone or methylprednisolone should be used at equivalent dosages.

Special considerations for neonates

Corticosteroids are not recommended in neonatal meningitis due to lack of evidence showing benefit (*12*, *101*).

Special considerations for people with advanced HIV disease

Corticosteroids are not recommended in children or adults with advanced HIV disease, because they have not been shown to reduce mortality or morbidity in this population (*102*). Additionally, cryptococcal meningitis should be ruled out before administering corticosteroids (*25*, *103*).

Adjunctive corticosteroids can be considered on a case-by-case basis for people with suspected acute bacterial meningitis and living with HIV who are on antiretroviral therapy and have undetectable viral load (less than 50 copies/µL).

Special considerations for malaria-endemic areas

In settings where malaria is a possibility (e.g. endemic areas or returning travellers), empiric corticosteroids should not be started until cerebral malaria has been ruled out because their use has not been proven to be effective in reducing mortality and is associated with an increased risk for gastrointestinal bleeding and seizures, as well as prolonged coma resolution times (*96*).

Duration of corticosteroid treatment

If LP was not performed and corticosteroids were initiated because of a strong clinical suspicion of bacterial meningitis, treatment can be continued for a maximum of 4 days to complete the full course.

If LP was performed and CSF findings are consistent with bacterial meningitis, corticosteroids can be continued for a maximum of 4 days, even in the absence of pathogen identification.

Corticosteroids should be continued for a maximum of 4 days if *S. pneumoniae or H. influenzae* type b have been detected through culture or molecular testing. Corticosteroids should be discontinued if any other bacterial pathogens are identified (except for TB meningitis, see Section 7.8.1).

7.6 Definitive antibiotic treatment

The antibiotic treatment regimen should be reviewed and modified based on the identified pathogen and its antibiotic susceptibility pattern. See Table 10 for the recommended treatment regimens and Table 11 for dosages for each antibiotic according to the age group. This approach prevents or minimizes the inappropriate use of broad-spectrum antibiotics and the emergence of drug-resistant pathogens. Antibiotic treatment can be optimized by selecting the most effective antibiotic that covers the narrowest spectrum of pathogens. Moreover, antibiotic treatment should be optimized when the clinical presentation and results of the CSF Gram stain are unequivocal. As an example, if Gram-negative diplococci are seen, *N. meningitidis* is the likely pathogen and antibiotic treatment should be reviewed accordingly.

Table 10. Specific antibiotic treatment for the most common causes of community-acquired acute bacterial meningitis and overall duration

Pathogen	Specific antibiotic treatment (IV)	Total duration
Streptococcus pneumoniae		10–14 days
Penicillin-susceptible	Penicillin G (benzylpenicillin) / ampicillin / amoxicillin	
Penicillin-resistant and cephalosporin-susceptible	Ceftriaxone / cefotaxime	
Cephalosporin-resistant	Vancomycin + ceftriaxone / cefotaxime or vancomycin + levofloxacin / moxifloxacin[a] or vancomycin + rifampicin[b] or ceftriaxone / cefotaxime + rifampicin[b]	
Neisseria meningitidis		5–7 days
Penicillin-susceptible	Penicillin G (benzylpenicillin) / ampicillin / amoxicillin	
Penicillin-resistant	Ceftriaxone / cefotaxime	
Haemophilus influenzae		7–10 days
Beta-lactamase-negative	Ampicillin / amoxicillin	
Beta-lactamase-positive	Ceftriaxone / cefotaxime	
Streptococcus agalactiae	Penicillin G (benzylpenicillin) / ampicillin / amoxicillin	14–21 days
Listeria monocytogenes	Penicillin G (benzylpenicillin) / ampicillin / amoxicillin	21 days

Table 10 *continued*

Pathogen	Specific antibiotic treatment (IV)	Total duration
Escherichia coli and other Gram-negative bacilli		14–21 days
Penicillin-susceptible	Ampicillin (+ gentamicin in neonates)	
Penicillin-resistant and cephalosporin-susceptible	Ceftriaxone or cefotaxime (+ gentamicin in neonates)	
Viruses	Discontinue empiric antibiotic treatment	
Unknown	Continue empiric antibiotic treatment	7 days[c]

IV: intravenous; TB: tuberculosis.

[a] Fluoroquinolone-containing regimens (i.e. regimens with levofloxacin and moxifloxacin) should be considered as an option for pneumococcal meningitis in adults.

[b] Rifampicin-containing regimens should be avoided when TB is a concurrent concern.

[c] If the person has clinically recovered. Clinical recovery may be indicated by the presence of all of the following for at least 48 hours: 1) resolution of fever; 2) resolution of vital sign abnormalities (blood pressure, heart rate, respiratory rate and oxygen saturation); and 3) resolution of altered consciousness.

Adapted from the *WHO AWaRe* (*access, watch, reserve*) *antibiotic book* (12). Colour coding: green: access; yellow: watch.

Table 11. Antibiotic dosing

Medicine	IV/IM dose in neonates (>1 month)[a]	IV dose in children (>1 month)[a]	IV dose in adults[a]	Maximum dosea (children and adults)	AWaRe group
Amoxicillin	Age <1 week: 50 mg/kg every 12 hours Age 1–4 weeks: 50 mg/kg every 8 hours	50 mg/kg every 4 hours (max. 2 g every 4 hours) *or* 75 mg/kg every 6 hours (max. 3 g every 6 hours)	2 g every 4 hours *or* 3 g every 6 hours	12 g/day	Access
Ampicillin	Age <1 week: 50 mg/kg every 12 hours Age 1–4 weeks: 50 mg/kg every 8 hours	50 mg/kg every 4 hours (max. 2 g every 4 hours) *or* 75 mg/kg every 6 hours (max. 3 g every 6 hours)	2 g every 4 hours *or* 3 g every 6 hours	12 g/day	Access
Penicillin G (benzylpenicillin)	Age <1 week: 150 000 IU/kg or 90 mg/kg per dose every 8 hours Age 1–4 weeks: 125 000 IU/kg or 75 mg/kg per dose every 6 hours	50 000 IU/kg or 30 mg/kg every 4 hours (max. 4 million IU or 2.4 g per dose) *or* 100 000 IU/kg or 60 mg/kg every 6 hours (max. 4 million IU or 2.4 g per dose)	4 million IU *or* 2.4 g every 4–6 hours	24 million IU or 14.4 g/day	Access

Table 11 *continued*

Medicine	IV/IM dose in neonates (>1 month)[a]	IV dose in children (>1 month)[a]	IV dose in adults[a]	Maximum dose[a] (children and adults)	AWaRe group
Cefotaxime	Age <1 week: 50 mg/kg per dose every 12 hours Age 1–4 weeks: 50 mg/kg per dose every 6 hours	50 mg/kg every 4 hours (max. 2 g every 4 hours) *or* 75 mg/kg every 6 hours (max. 3 g every 6 hours)	2 g every 4 hours *or* 3 g every 6 hours	12 g/day	Watch
Ceftriaxone	100 mg/kg once a day	100 mg/kg once a day or divided every 12 hours (max. 2 g every 12 hours)[b]	2 g every 12 hours[b]	4 g/day	Watch
Meropenem	40 mg/kg (IV) every 8 hours	–	–	–	Watch
Vancomycin[c]	–	15–20 mg/kg every 6–8 hours[d]	15–20 mg/kg every 8–12 hours[d]	4 g/day	Watch
Gentamicin	Age <1 week: 5 mg/kg given once a day Age 1–4 weeks: 7.5 mg/kg given once a day	–	–	–	Access
Chloramphenicol[e]	–	25 mg/kg every 6 hours (max. 1 g every 6 hours)	1 g every 6 hours	4 g/day	Access
Rifampicin	–	10 mg/kg every 12 hours (max. 300 mg every 12 hours)	300 mg every 12 hours *or* 600 mg every 24 hours	–	Watch
Levofloxacin	–	–	750 mg every 24 hours	750 mg/day	Watch
Moxifloxacin	–	–	400 mg every 24 hours	400 mg/day	Watch

AWaRe: access, watch and reserve; IM: intramuscular; IU: international units; IV: intravenous.

Antibiotics are ordered by mechanism of action.

[a] The doses recommended in the table apply to individuals with normal renal and hepatic function. In the presence of renal impairment, dosing adjustments are required for amoxicillin, ampicillin, cefotaxime, levofloxacin, penicillin G, rifampicin (end-stage renal failure) and vancomycin.

[b] In selected circumstances where twice daily administration cannot be operationalized, once daily administration is possible: 100 mg/kg (max. 4 g) every 24 hours in children; 4 g every 24 hours in adults.

[c] The risk of toxicity, including acute kidney injury, increases as a function of trough vancomycin concentration, especially when the trough is consistently above 15–20 mg/L. Therefore, where feasible, trough vancomycin concentration should be regularly monitored (target trough concentrations of 15 to 20 mcg/mL) and the dose adjusted accordingly.

Table 11 *continued*

[d] When monitoring of trough vancomycin concentration is not feasible, a 750 mg per dose should not be exceeded in children, while a total of 3 g per day should not be exceeded in adults.

[e] Severe life-threatening blood dyscrasias (aplastic anaemia, thrombocytopenia and granulocytopenia) are known to occur after the administration of chloramphenicol, and their potential occurrence should be carefully monitored. Initial doses may be reduced after clinical improvement.

Adapted from the *WHO AWaRe* (*access, watch, reserve*) *antibiotic book* (*11*).

7.6.1 Monitoring antibiotic treatment

Adverse reactions to antibiotics

Antibiotics are associated with adverse reactions that can range from mild and self-limiting to life-threatening. Hypersensitivity reactions are relatively common adverse effects of antibiotics, especially beta-lactams and vancomycin, and can range from a skin rash to anaphylaxis. Where an individual has a history of previous life-threatening reactions to antibiotics, adequate clinical monitoring within an appropriate health care facility is warranted.

In most cases of non-severe penicillin allergy, cephalosporins and carbapenems can be safely used, owing to cross-reactivity of less than 2% (*12*). However, where an individual has a previous severe penicillin allergy, any use of other beta-lactams should be avoided. In such cases, alternative antibiotics should be selected based on the most probable causative pathogen, local drug availability and drug-resistance patterns in the community. Further information on allergies to antibiotics and their management can be found in Chapter 3 of the *WHO AWaRe (access, watch, reserve) antibiotic book* (*12*).

In neonates, concomitant use of ceftriaxone and calcium containing solutions should be avoided because it has been associated with cardiopulmonary adverse events (*104*). Evidence on the association between use of ceftriaxone in neonates and hyperbilirubinemia and its clinical significance is limited (*16*, *104*).

Repeat LP

Repeat LP is not indicated routinely, owing to limited utility (*105*, *106*). However, in selected cases – for example, in the presence of poor clinical response to treatment, persistence of fever or when drug resistance is suspected – it can be performed to confirm response to therapy. The role of repeat LPs in cryptococcal meningitis is discussed in Section 7.12.

7.7 Antiviral treatment

Acute viral meningitis is a challenging diagnosis presenting with nonspecific clinical findings that often overlap with bacterial meningitis, acute encephalitis or meningoencephalitis. Initial CSF findings may be inconclusive, especially in cases where antibiotic treatment was initiated before LP performance.

The decision to initiate antiviral treatment empirically – alongside empiric antibiotics, corticosteroids and supportive care – is still a subject of debate and warrants expert consultation. Evidence on the effectiveness of IV aciclovir in reducing mortality or the development of sequelae in patients with herpes simplex virus (HSV) and varicella-zoster virus (VZV) meningitis remains limited, although some evidence of clinical benefit has been observed in immunosuppressed patients (*107-111*). However, both HSV and VZV are relatively frequent causes of viral meningitis and the clinical presentation often overlaps with acute encephalitis and meningoencephalitis where early empiric treatment with IV aciclovir has been demonstrated to reduce mortality; hence, it is common clinical practice to start IV aciclovir empirically (*112-117*).

Suggested dosing regimens of IV aciclovir in HSV and VZV meningitis are reported in Table 12; the regimens are derived from HSV and VZV encephalitis or severe clinical episodes of genital or anorectal HSV infection (*118*, *119*). Once a diagnosis of viral meningitis has been made, empiric antibiotics and corticosteroids should be stopped. Conversely, aciclovir should be discontinued if a diagnosis of bacterial meningitis has been made or microbiological investigations (e.g. CSF PCR) rule out HSV or VZV infection. If the causative pathogen remains unknown, the decision whether to continue aciclovir should be made on a case-by-case basis and directed by a specialist.

Table 12. Suggested dosing of aciclovir for HSV meningitis

Age	Dosing
28 days – 3 months	20 mg/kg every 8 hours
3 months – 12 years	10–15 mg/kg every 8 hours
>12 years	10 mg/kg every 8 hours

HSV: herpes simplex virus.

7.8 Treatment for drug-susceptible TB meningitis

Relevant WHO resources (please check regularly for updates)
WHO consolidated guidelines on tuberculosis: module 4: treatment and care, 2025 (*22*)
WHO consolidated operational handbook on tuberculosis: module 4: treatment and care, 2025 (*120*)
WHO consolidated guidelines on tuberculosis: module 5: management of tuberculosis in children and adolescents, 2022 (*23*)
WHO operational handbook on tuberculosis: module 5: management of tuberculosis in children and adolescents, 2022 (*121*)

In cases where TB meningitis is suspected, anti-tuberculous (anti-TB) treatment should be initiated as soon as possible; once the diagnosis has been confirmed, it should be reviewed based on AST results (*22*, *23*).

Adults

Standard treatment for drug-susceptible TB (DS-TB) meningitis in adults is composed of an intensive phase consisting of a four-drug regimen (isoniazid, rifampicin, pyrazinamide and ethambutol) for 2 months, followed by a continuation phase (isoniazid and rifampicin) for 7–10 months, for a total treatment duration of 9–12 months. Recommended doses to be used in this regimen are the same as those for the treatment of pulmonary TB.

The recommended dosages of first-line TB drugs in adults are provided in *Annex 3*.

Children

Infants and young children, especially those aged under 2 years, are at higher risk of developing TB meningitis, which is associated with high morbidity and mortality. Children and adolescents with suspected or confirmed DS-TB meningitis should be treated with isoniazid, rifampicin, pyrazinamide and ethambutol for 2 months, followed by isoniazid and rifampicin for 10 months, for a total duration of treatment of 12 months (Table 13) (*121*). In children with no risk factors for any form of drug-resistant TB (DR-TB) and not living with HIV, a 6-month intensive regimen with isoniazid, rifampicin, pyrazinamide and ethionamide (6HRZEto) may be used as an alternative option (Table 13) (*121*). The recommended dosages for the standard and short regimen are provided in *Annex 3* and *Annex 4*, respectively.

Table 13. Treatment regimens for DS-TB meningitis in children and adolescents aged 0–19 years

	Treatment regimen[a]	
	Intensive	**Continuation**
Standard course (strong recommendation)	2HRZE	10HR
Short course (conditional recommendation)[b]	6HRZEto	

DS-TB: drug-susceptible TB; HIV: human immunodeficiency virus; TB: tuberculosis.

[a] The standard code for TB treatment regimens uses an abbreviation for each medicine: isoniazid (H), rifampicin (R), pyrazinamide (Z), ethambutol (E) and ethionamide (Eto). A regimen consists of two phases – the intensive and continuation phases (except for the 6HRZEto regimen). The number at the front of each phase represents the duration of that phase in months. For example, 2HRZE consists of treatment with isoniazid, rifampicin, pyrazinamide and ethambutol for 2 months.

[b] Not recommended for children and adolescents with any risk factors for DR-TB and for those living with HIV.

For children and adolescents weighing 25 kg or over, adult guidance and dose recommendations should be followed (*Annex 3*).

For children weighing less than 25 kg, it is preferable to use child-friendly dispersible tablet formulations, including the HR (isoniazid and rifampicin) fixed-dose combination (FDC) (*Annex 4*).

For children weighing between 3 kg and 5 kg, a joint age- and weight-based approach should be adopted, accounting for maturation factors. For children weighing between 25 kg and 35 kg, either dispersible tablets or adult formulations of the corresponding medicines (HR 75/150 mg, Z 400 mg or 500 mg, Eto 250 mg) can be used. In older children, using adult formulations reduces the number of pills. For severely ill children (e.g. those with a reduced level of consciousness), child-friendly dispersible formulations can be administered via a nasogastric tube.

Ethionamide can cause hepatotoxicity, gastrointestinal irritability and hypothyroidism. Gastrointestinal irritability can mostly be overcome by dosing ethionamide in the evening, separately from other TB medicines.

7.8.1 Adjuvant corticosteroids for TB meningitis

In individuals with TB meningitis, evidence from randomized controlled trials showed lower rates of mortality, death or severe disability, and disease relapse when patients were treated with corticosteroids in addition to anti-TB treatment (*122-126*).

Both dexamethasone and prednisolone tapered over the first 6–8 weeks can be given to children and adults with suspected or confirmed TB meningitis (*22*). IV administration is preferred to oral administration initially, because a more immediate response is needed. Patients with TB meningitis are often critically ill with impaired consciousness; this makes oral administration less feasible and reliable in ensuring adequate drug levels in serum and CSF (*127*):

- In adults, dexamethasone can be used at a dosage of 0.4 mg/kg per day, reducing the dose each week over 6–8 weeks to eventually stop administration. Alternatively, prednisolone can be used at a dosage of 2.5 mg/kg per day for 4 weeks and then gradually reduced over 2–4 weeks (*128*).
- In children and adolescents, dexamethasone can be used at a dosage of 0.6 mg/kg per day, reducing the dose each week over 6-8 weeks to eventually stop administration (*128*). Alternatively, prednisolone can be used at a dosage of 2 mg/kg per day (increased to 4 mg/kg per day in severely ill children and adolescents), with a maximum dosage of 60 mg per day for 4 weeks. The dose should then be reduced gradually over 2–4 weeks before stopping (*125*, *128*, *129*).

7.8.2 DR-TB meningitis

In people with DR-TB meningitis, a longer treatment duration is suggested (18–20 months). The composition of the treatment regimen is best guided by drug susceptibility testing of the infecting strain and by the ability of TB medicines to cross the blood–brain barrier (*22*).

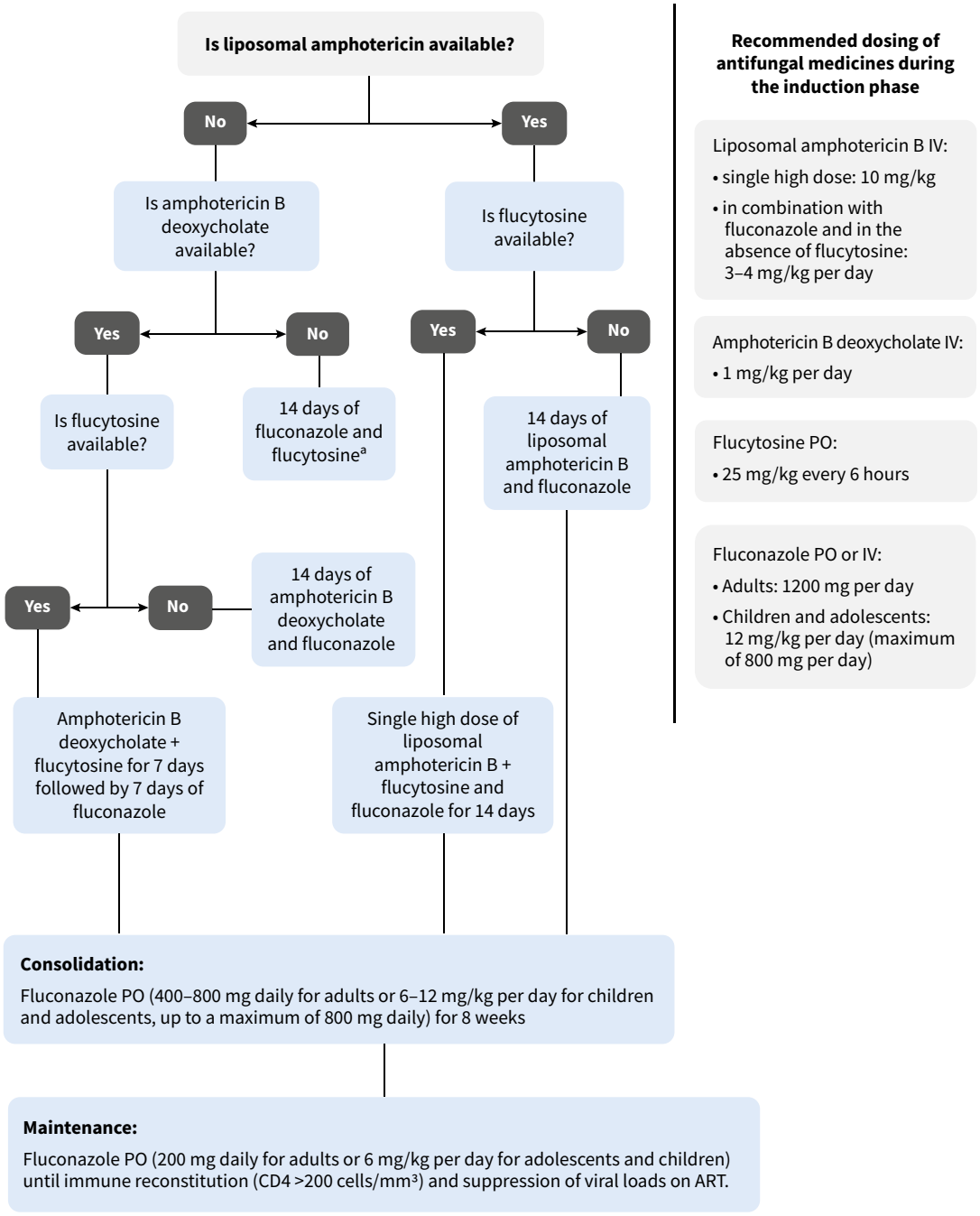
7.9 Antifungal treatment for HIV-associated cryptococcal meningitis

Relevant WHO resources (please check regularly for updates)
Guidelines for diagnosing, preventing and managing cryptococcal disease among adults, adolescents and children living with HIV, 2022 (*24*)
WHO guidelines on the management of advanced HIV disease, 2025 (*100*)

Among people with HIV-associated cryptococcal meningitis, early diagnosis and prompt initiation of optimal antifungal treatment is essential to improving survival and clinical outcomes. However, access to essential antifungal medicines remains inadequate in many settings, and laboratory monitoring of treatment and drug toxicities continue to be important barriers.

A decision-making clinical algorithm to guide antifungal therapy with recommended dosing for the induction phase is shown in Fig. 13.

Fig. 13. Clinical decision-making algorithm to guide treatment for acute cryptococcal meningitis in people with advanced HIV disease



ART: antiretroviral therapy; IM: intramuscular; IV: intravenous; PO: per os (i.e. by mouth).

[a] In the absence of liposomal amphotericin, amphotericin B deoxycholate and flucytosine, monotherapy with fluconazole PO or IV 1200 mg for 14 days can be used as a last resort, but its efficacy is suboptimal and close monitoring for treatment failure is required (*130*, *131*).

Please see the *Guidelines for diagnosing, preventing and managing cryptococcal disease among adults, adolescents and children living with HIV* (*22*) for guidance on drug toxicities and drug–drug interactions.

7.9.1 Adjuvant corticosteroids for HIV-associated cryptococcal meningitis

The use of corticosteroid therapy in the induction phase of treatment is not recommended among individuals with HIV-associated cryptococcal meningitis (*24*, *103*).

7.10 Management of maintenance fluids

Relevant WHO resources (please check regularly for updates)
Basic emergency care: approach to the acutely ill and injured, 2018 (*19*)

Once the patient has been assessed and adequately treated for shock or dehydration if present, maintenance fluids should be initiated, avoiding both restriction of fluid intake and over-hydration. The preferred route of fluid administration among children and adults is oral or by enteric tube (e.g. nasogastric tube); among neonates and young infants, breastfeeding is the ideal method of hydration. When this is not possible, balanced crystalloids (e.g. Ringer's lactate) should be used as maintenance IV fluids; glucose-based solutions should be avoided unless hypoglycaemia is a concurrent concern.

Moderate fluid restriction can be considered in people without hypovolemia and with suspected syndrome of inappropriate antidiuretic hormone secretion (SIADH), supported by suggestive laboratory investigations (e.g. serum sodium levels <130 mEq/L.)

7.11 Management of increased ICP in acute bacterial meningitis

Increased ICP is a potentially life-threatening complication of meningitis and constitutes a medical emergency. ICP is considered increased when ≥20 cm H_2O in adults, but this threshold can be lower in children and infants (*116*, *132*). Increased ICP in people with bacterial meningitis may occur as a result of cerebral oedema, hydrocephalus or space-occupying lesions (e.g. brain abscess or subdural empyema) (*93*). Signs and symptoms of increased ICP include severe headache, vomiting, altered consciousness, cranial nerve deficit and papilloedema. The triad of bradycardia, hypertension and respiratory depression, also known as the Cushing reflex, is generally observed at the later stage of the disease and has very high specificity but low sensitivity (*133-135*).

Prompt recognition and management of increased ICP is essential to reduce meningitis-associated morbidity and mortality. Interventions to reduce ICP depend on the level of care available in the health facility.

Intensive care management may be required for people with increased ICP. However, in patients with signs and symptoms of increased ICP admitted in settings where care at the level of the intensive care unit (ICU) and ICP monitoring are not available, or while transfer is being organized, an initial set of basic emergency interventions can be used for the initial management of increased ICP. These interventions include (*136-140*):

- assessment of airway patency, ventilation and circulation to ensure that the person has nothing in their airway, is breathing well and has a stable pulse;
- avoidance of hypotension because it can lead to reduced cerebral perfusion; if needed, treatment with vasopressors (e.g. norepinephrine) as appropriate;
- avoidance of hypoxia by keeping SpO2 >94% to mitigate secondary brain damage;
- monitoring respiratory rate for irregular respirations and apnoea and the need for ventilation or intubation;
- maintenance of normal body temperature (<37.5°C) by controlling fever with antipyretics or cooling blankets;
- initiation of interventions to promote cerebral venous drainage (e.g. head elevation at 15- 30° and positioning of the head at the midline); and
- hyperventilation if the person is mechanically ventilated (target pCO2: 26–30 mmHg).

Hyperosmolar therapy with mannitol or hypertonic saline can be considered, although most of the evidence comes from studies on traumatic brain injuries, subarachnoid haemorrhage, intracerebral haemorrhage and stroke (*141*).

More advanced guidance on the management of increased ICP – including how to administer hyperosmolar agents or ventilation strategies in mechanically ventilated patients – is beyond the scope of this document.

7.12 Management of increased ICP in cryptococcal meningitis

Raised ICP is a frequent and potentially life-threatening complication that occurs in up to 80% of people with HIV-associated cryptococcal meningitis. Reduction of raised CSF pressure is associated with clinical improvement and survival benefit, regardless of initial opening pressure (*77*, *142*). The following good-practice principles should be applied in individuals with cryptococcal meningitis to monitor and manage increased ICP:

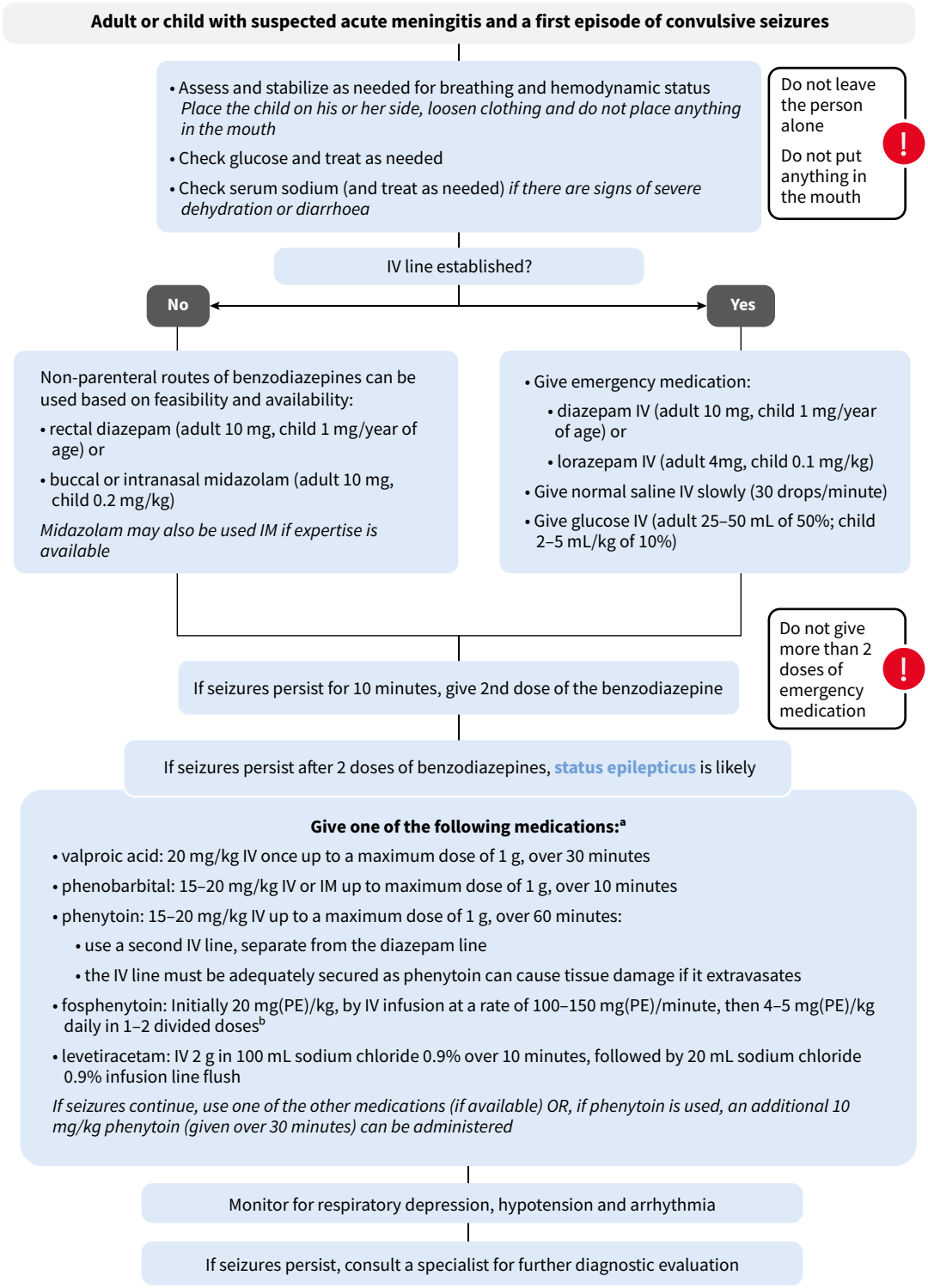
- An initial LP and an early repeat LP with measurement of CSF opening pressure should be performed to assess for raised ICP, regardless of the presence of symptoms or signs of raised ICP.
- Therapeutic LP should be performed to relieve pressure by draining a volume sufficient to reduce the CSF pressure, preferably to <20 cm H_2O or to halve the baseline pressure if extremely high. No data exist on the maximum volume of CSF that can be safely drained at one LP. CSF opening pressure can be rechecked after every 10 mL is removed. Usually 20–30 mL is enough to reduce the opening pressure sufficiently.
- For people with persistent symptoms of raised ICP, two therapeutic LPs (e.g. 12 hours apart) may be necessary.
- Daily therapeutic LP (with measurement of CSF opening pressure) and CSF drainage if required should be repeated until symptoms resolve or the opening pressure has been normal for at least 2 days.
- Lumbar or ventricular shunts should only be placed if the person has received appropriate antifungal therapy, and if therapeutic LPs have failed to control raised ICP.
- The use of medicines such as mannitol, acetazolamide, furosemide or corticosteroids for managing raised ICP in people with cryptococcal meningitis is not recommended because there is no evidence to indicate that using these medicines improves outcomes and there is some evidence indicating that they may be harmful (*103*, *143*, *144*).

7.13 Management of seizures

Relevant WHO resources (please check regularly for updates)
mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings: mental health Gap Action Programme (mhGAP), 2016 (*18*)
Mental Health Gap Action Programme (mhGAP) guideline for mental, neurological and substance use disorders, 2023 (*17*)

Seizures occur in about 20–30% of individuals with acute meningitis (*145-147*). They can present early, before hospital presentation or during hospitalization. Seizures, especially when presenting later during the disease, are associated with poorer outcomes and increased risk of neurological sequelae (*145*, *148*). Acute symptomatic seizures, also known as provoked seizures, occur as a consequence of an acute brain insult (*149*). Examples include toxic, metabolic and traumatic insults, as well as infections and high fever. Acute symptomatic seizures are a medical emergency and require prompt assessment and management. A decision-making algorithm for the initial management of a person with suspected acute meningitis and a first episode of acute symptomatic seizures is described in Fig. 14 (*17*, *18*). Management of seizures in neonates is not covered by this algorithm and is described in the WHO publication *Pocket book of hospital care for children: guidelines for the management of common childhood illnesses* (*15*).

Fig. 14. Clinical decision-making algorithm for the initial management of children and adults with suspected acute meningitis and acute symptomatic seizures



IM: intramuscular; IV: intravenous; PE: phenytoin sodium equivalent.

[a] The choice of medicine is affected by several factors, including availability, cost and side effects.

[b] Doses are expressed as phenytoin sodium equivalent (PE); fosphenytoin sodium 1.5 mg is equivalent to phenytoin sodium 1 mg

Follow-up care

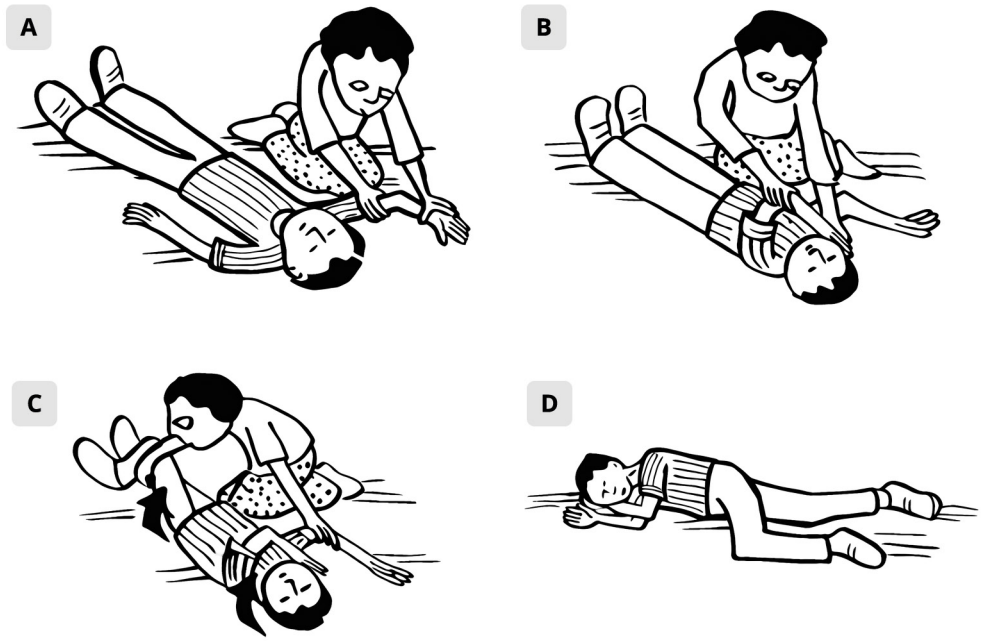
At discharge, patients and caregivers should be informed about the risks of recurrent seizures. Comprehensive counselling should be provided, including guidance on how to recognize, monitor and manage subsequent episodes and first aid measures.

Caregivers and families should be reassured that there are effective treatment options for epilepsy, and it should be underscored that compliance with medication and adherence to developmental support programmes are important for optimizing the child's neurodevelopmental outcome. Also, instructions on how to manage seizures at home should be provided (Fig. 15):

- Lay the child on the side, with the head turned to ease breathing.
- Do not put anything into the mouth or restrain the child.
- Make sure the child is breathing.
- Bring or call the nearest healthcare provider if you are concerned about the child's breathing, the seizure lasts longer than 5 minutes or the child does not wake up after the seizure.

People who had an episode of acute symptomatic seizures should be reviewed at 3 months after discharge regardless of whether they have been started on antiseizure medicines (*18*). For those who were started on antiseizure medicines, and in the absence of recurrent seizures, these medicines can be slowly tapered down and then discontinued, 3 months post discharge.

Fig. 15. The recovery position



A. Kneel on the floor on one side of the person. Place the arm closest to you at a right angle to their body with the person's hand upwards towards the head.

B. Place the other hand under the side of the person's head, so that the back of the hand is touching the cheek.

C. Bend the knee furthest from you to a right angle. Roll the person carefully onto his or her side by pulling on the bent knee.

D. The person's top arm should be supporting the head and the bottom arm will stop the person from rolling too far.

Adapted from *mhGAP humanitarian intervention guide* (*150*)

8. Prevention of secondary cases of meningococcal disease

8.1 Infection prevention and control measures in the health care setting

Health care workers are at risk of acquiring *N. meningitidis* infection when exposed to people with suspected acute meningitis (*151*, *152*). Although nosocomial transmission of *N. meningitidis* is rare, it can lead to severe consequences and warrants the implementation of specific infection prevention and control (IPC) measures (*151*, *153*). In addition to standard precautions, which should be implemented for all patients at all times (*154*), individuals with suspected acute meningitis or invasive meningococcal disease should be placed under droplet precautions (Box 3) until meningococcal infection has been excluded or until the person has received at least 24 hours of effective antimicrobial treatment (*155*).

Box 3. Droplet precautions

Health workers should do the following:

- Put on a medical mask before entering the patient room and remove it upon exit.
- Wear additional personal protective equipment (PPE) if indicated (e.g. eye protection), based on a risk assessment.
- Perform hand hygiene before and after the use of masks.[a]
- Place the patient in a single room.
- Consider the following when single-patient rooms are not available:
  - Prioritize any single-patient rooms for patients with excessive cough and sputum production (if any).
  - Cohort patients with the same symptoms, suspect diagnosis and confirmed diagnosis.
  - Physically separate patients by at least 1 m (3 ft) and draw privacy curtains.
- Use disposable or dedicated patient-care equipment (e.g. stethoscopes), and clean and disinfect equipment before use on other patients.
- Instruct the patient to wear a mask and follow respiratory hygiene and cough etiquette when transport is necessary.

[a] See *Five moments for hand hygiene*, 2021 (*156*).

Adapted from *Transmission-based precautions for the prevention and control of infections: aide-memoire*, 2022 (*157*).

8.2 Antibiotic prophylaxis

8.2.1 Indications

Close contacts of a case of meningococcal disease are at increased risk of developing the disease compared with the general population. This risk is increased 400- to 800-fold in household contacts (*158*, *159*). A standard definition of close contact in the context of meningococcal disease has not been established; however, close contacts are typically people who, during the 7 days before the onset of symptoms in the index case and until 24 hours after initiation of appropriate antibiotic treatment, had prolonged exposure (>8 hours) in close proximity (<1 m) to the case, or were directly exposed to oral secretions (e.g. via kissing, mouth-to-mouth resuscitation or endotracheal intubation). Close

contacts may include household members; roommates; intimate partners; contact persons at childcare centres, schools or dormitories; military recruits in training centres; and at-risk health care providers.

8.2.2 Regimens

Post-exposure antibiotic prophylaxis should be provided to close contacts as soon as possible because administration more than 14 days after exposure probably has limited or no benefit. Antibiotics used for post-exposure prophylaxis are listed in Table 14.

Inappropriate use of antibiotic prophylaxis leads to antimicrobial resistance among nasopharyngeal *N. meningitidis* carriers, and changes in intestinal and genitourinary microbiota. In addition, it may lead to the spread of these resistance patterns to other bacterial pathogens, especially those that share a similar epidemiological distribution (e.g. *Salmonella* Typhi).

Considering the increasing incidence of cases caused by ciprofloxacin-resistant isolates worldwide, the choice of antibiotic should be based on documented susceptibility patterns prevalent within the community, and should then be optimized based on susceptibility testing results from index cases.

Table 14. Antibiotics used for post-exposure prophylaxis

Antibiotic	Route	Duration	Dose		
			Neonates	Children	Adults
Ceftriaxone	IM	Single dose	125 mg	125 mg	250 mg
Ciprofloxacin[a]	PO	Single dose	Not indicated	20 mg/kg[b]	500 mg
If ciprofloxacin or ceftriaxone cannot be used:					
Rifampicin[c]	PO	2 days	5 mg/kg every 12 hours	10 mg/kg every 12 hours[d]	600 mg every 12 hours

IM: intramuscular; IV: intravenous; PO: per os (i.e. by mouth).

[a] During pregnancy, ciprofloxacin should be avoided, and ceftriaxone is the preferred agent.

[b] Maximum dose 500 mg.

[c] Rifampicin is associated with several drug–drug interactions (e.g. oral contraceptives or anticoagulants).

[d] Maximum dose 600 mg every 12 hours.

9. Early identification of sequelae

Acute meningitis may result in the development of long-term sequelae, leading to limitations in functioning and, in some cases, profound disability. In turn, these effects may lead to decreased participation in meaningful life roles and community activities. Examples of major sequelae are hearing loss, focal neurological deficits, neuropsychological impairment (cognitive impairment in adults, intellectual disability or behavioural changes in children), hydrocephalus, epilepsy, meningococcal septicaemia requiring limb or digit amputation, and skin scarring (*160*). Some sequelae may not be immediately apparent (e.g. social and emotional difficulties or learning disabilities in children).

The incidence of sequelae is highly variable and depends on the causative pathogen, geographical region and presence of comorbidities (*161*). Bacterial meningitis is more frequently associated with sequelae, with pneumococcal infection posing the highest risk (*162*). Additionally, the risk of sequelae is nearly three times higher in Africa and Asia than in Europe (*163*).

Along with inequities in health outcomes, people with sequelae may experience gaps in formal social support mechanisms and are frequently reliant on support from family members, often female, to access health services and engage in community activities. The *Global report on health equity for persons with disabilities* calls on Member States to take action to advance health equity for individuals with disability, including those that result from meningitis (*164*).

9.1 Early identification of neurological sequelae

People who have had acute meningitis should be thoroughly assessed to identify potential physical, cognitive, emotional, sensory and social complications. Some emotional, cognitive and sensory sequelae (e.g. vision or hearing loss) may be more subtle and easily overlooked compared with physical sequelae or those affecting the skin.

Early recognition of sequelae while the person is still in hospital is a crucial first step in assessing, addressing and commencing care, including rehabilitation, as soon as possible. Prior to discharge, all individuals who experienced acute meningitis should undergo a complete neurological examination. Table 15 lists the domains that should carefully be assessed following acute meningitis.

Table 15. Neurological assessment following acute meningitis

Functioning domain	Features to assess	Potential findings	Referral to specialized diagnostics or rehabilitation
Seizure activity	History or signs of recent seizures	Epilepsy or post-meningitis seizures	EEG, neurology follow-up
Mental health	Mood, anxiety, behaviour, sleep	Depression, PTSD, irritability, sleep disorders	Psychotherapy and psychological support, rehabilitation for mental functions and behaviours
Cognitive functions	Memory, concentration, executive function	Cognitive impairment, confusion	Neuropsychological testing, rehabilitation for cognitive functions including assistive products for cognition
Speech, language and communication	Fluency of speech, language (comprehension, naming), communication difficulties	Dysphasia, dysarthria, difficulties with communication	Rehabilitation for speech, language and communication including assistive products for communication
Sensory functions	Hearing, vision	Bilateral or unilateral sensorineural hearing loss	Hearing rehabilitation including assistive products (hearing aids)
		Decreased visual acuity, visual disturbances, diplopia, nystagmus	Vision rehabilitation, low vision services including assistive products (vision aids)
Motor functions and mobility	Muscle tone, muscle strength, joint mobility, balance and coordination, facial movement, swallowing, gait	Impairments in muscle tone (spasticity, isolated hypotonia), muscle strength (including facial paresis), joint contractures, balance and coordination (including ataxia), related difficulties with swallowing, coordination or gait	Rehabilitation for swallowing, rehabilitation for motor functions and mobility (including related assistive products)
Sensory functions (other)	Light touch, temperature, proprioception, pain	Numbness, neuropathic pain	Rehabilitation for pain management

EEG: electroencephalography; PTSD: post-traumatic stress disorder.

9.2 Audiological screening for hearing loss

Relevant WHO resources (please check regularly for updates)
Hearing screening: considerations for implementation, 2021 (*165*)

Hearing loss is one of the most common sequelae of acute bacterial meningitis, and occurs in a significant proportion of children and adults (*160*). It is more frequently associated with pneumococcal meningitis than any other form of bacterial meningitis, and it may occur at admission or during the course of the disease (*161*, *162*). Transient hearing loss is generally caused by a conductive disorder, whereas permanent hearing loss is associated with the involvement of the eighth cranial nerve, cochlea or labyrinth.

Formal audiological screening at the appropriate time allows for early diagnosis, reduces the time to access hearing rehabilitation services and mitigates the impact of long-term complications. Audiological screening should be conducted in all neonates, children and adults before discharge. When this is not possible, it should be conducted within 4 weeks of discharge.

Screening for hearing loss at discharge can be performed by ear and hearing care clinicians (e.g. ear, nose and throat specialists, audiologists, or speech and language pathologists), non-hearing care clinicians (e.g. school doctor, general physician or paediatrician) or trained health workers and nurses (e.g. clinical officers, nurses, medical assistants or technicians). Where ear and hearing checks are to be performed by non-clinicians, training must be provided, followed by supervised practice and ongoing quality control and support.

If screening tests identify any hearing loss, the patient should be referred to an ear and hearing service where more advanced testing can be performed and rehabilitation initiated. If the screening test is negative for hearing loss, a second formal audiological screening test should be organized at follow-up, because some people may develop hearing loss at a later stage.

The following sections are adapted from the *Hearing screening: considerations for implementation* (*165*). That document provides specific guidance and considerations on audiological screening strategies across different age groups.

9.2.1 Audiological screening in neonates and young children

In neonates and young children following acute meningitis, a single positive test result should lead to referral for diagnostic testing.

As far as possible, physiological screening measures should be applied in preference to behavioural screening. Sensitive screening tests that are commonly used include automated auditory brainstem response (AABR) or otoacoustic emission (OAE) screening.

9.2.2 Audiological screening in children and adolescents

Following acute meningitis, children and adolescents with hearing loss of any grade (i.e. 20 dBHL or higher) should be identified, because even mild hearing loss is known to affect educational attainment (*166*, *167*). Such identification should be the aim, especially in places where testing of environmental noise levels can be kept under a strict control (e.g. <40 dBA).

When assessing hearing in children, several hearing tests can be used. Table 16 describes the various types of tests, tools and methods used.

Ear examination, including otoscopy, can also be performed as part of the examination to assess for concomitant disorders of the outer and middle ear.

Table 16. Hearing screening tests in children and adolescents

Type of test	Tools used	Testing method	Criteria for referral
Sweep audiometry	Conventional (non-automated) screening audiometer	Both ears tested separately at 3 frequencies (1 kHz, 2 kHz, and 4 kHz), at a fixed dB level of 20/25/30/35 dBHL A differential approach can be adopted that raises the dB level at 1 kHz to avoid a false positive result due to background noise (e.g. if the target hearing threshold is 25 dBHL, the screening will be conducted at 25 dBHL for 2 kHz and 4 kHz, but at 30 dBHL for 1 kHz)	Child does not respond: • at the criterion threshold level; • at 1 or more frequencies; or • at least 2 out of 3 times Failure to respond in either ear should be an indication for referral
	Automated digital screeners (*166*, *167*)		

Adapted from *Hearing screening: considerations for implementation*, 2021 (*165*).

9.2.3 Audiological screening in adults

Screening tests

Table 17 describes the following tests, which are used to check for hearing loss in adults following acute meningitis:

- detection of pure tones in both ears at a fixed decibel level;
- determination of air conduction thresholds through pure-tone threshold screening.

If both tests are not available, the whispered voice test can be used. Further information on this test is available at Hearing screening: considerations for implementation (*165*).

When undertaking any of these tests, it is important to ensure that levels of background noise are below 40 dBA (*168*). This can be ensured by testing with a sound level meter or with use of a validated smartphone app.[1]

[1] Some examples of validated apps that can be downloaded for use are NIOSH Sound Level Meter, Sound Meter Pro, and Sound Meter and Noise Detector.

Table 17. Tests for screening in adults

Screening test	Setting	Testing method	Referral criteria
Detection of pure tones in both ears at a fixed dB level	Most suitable when screening is undertaken in a community setting or in clinical settings other than an audiology clinic	Both ears should be tested separately, at 3 frequencies (1 kHz, 2 kHz and 4 kHz), at a fixed dB level of 35 dBHL	Failure to respond at 20/25 dBHL at one or more frequencies in either ear[a]
Determination of air conduction thresholds through pure tone screening	Audiology clinic	Both ears should be tested separately for air conduction thresholds at 4 frequencies (0.5 kHz, 1 kHz, 2 kHz and 4 kHz), and the hearing threshold calculated as an average of the 4 frequencies	An average hearing threshold of <35 dBHL

[a] Where the capacity of the health system permits, and it is considered more suitable, mild hearing loss can also be identified (i.e. a hearing level above 20 dB may be set as the criterion).

Adapted from *Hearing screening: considerations for implementation*, 2021 (*165*).

10. Rehabilitation for meningitis sequelae

Relevant WHO resources (please check regularly for updates)
Package of interventions for rehabilitation: module 1: introduction, 2023 (*26*)
Package of interventions for rehabilitation: module 2: musculoskeletal conditions, 2023 (*169*)
Package of interventions for rehabilitation: module 3: neurological conditions, 2023 (*170*)
Package of interventions for rehabilitation: module 5: neurodevelopmental disorders, 2023 (*171*)
Package of interventions for rehabilitation: module 6: sensory conditions, 2023 (*172*)

People who have suffered from acute brain infections often require extended post-acute inpatient rehabilitation and continued outpatient rehabilitation care to regain functional abilities or prevent further functional decline (*173*). Acute brain infection is a public health priority because of its wide extent of symptoms, the consequences for performing activities of daily living, and the burden of sequelae for both patients and their caregivers (*174*).

Rehabilitation plays a vital role in the management of meningitis sequelae. Rehabilitation provides evidence-based interventions targeted to an individual's needs based on a comprehensive assessment of functioning. The various modules in the WHO *Package of interventions for rehabilitation* (PIR) provide a list of evidence-based interventions for 20 health conditions, including neurological and musculoskeletal conditions, and hearing and vision loss (*175*). In addition, to enhance access to high-quality, affordable assistive products, in 2016 WHO launched the *Priority assistive products list* (APL), which includes 50 priority assistive products (*176*). Many of the interventions for rehabilitation available with the PIR and APL are relevant to the rehabilitation of people experiencing meningitis sequelae. Interventions for rehabilitation include exercises and training to optimize the functions affected by the sequelae. They also include, if necessary, training in compensatory strategies such as the provision of assistive products (e.g. hearing aids, spectacles, communication aids, wheelchairs and prostheses) and modifying the environment to better suit the person's needs so that tasks can be performed more safely and independently. Table 18 provides examples of interventions for rehabilitation in the management of meningitis sequelae.

Table 18. Examples of rehabilitation interventions for selected meningitis sequelae

Rehabilitation targeting impairments in body functions		
Target of the intervention	**Sequelae (example)**	**Specific intervention (example)**
Cognitive functions	Cognitive impairment	Cognitive training
Mental functions and behaviours	Behavioural problems	Behavioural interventions
Vision functions	Visual disturbances	Vision skills training
Hearing functions	Hearing loss	Provision of assistive products (e.g. hearing aids)
Speech, language and communication	Speech apraxia	Language therapy
Pain management	Neuropathic pain	Range of motion exercises
Swallowing	Dysphagia	Swallowing therapy

Table 18 *continued*

Rehabilitation targeting impairments in body functions		
Target of the intervention	**Sequelae (example)**	**Specific intervention (example)**
Motor functions and mobility	Joint contractures	Provision of assistive products (e.g. orthoses)
Rehabilitation targeting limitations in performing meaningful life roles related to the sequelae		
Target of the intervention	**Limitation (example)**	**Specific intervention (example)**
Activities of daily living	Limitations in washing due to motor problems	Activities of daily living training
Interpersonal relationships	Difficulties in interacting with others due to behavioural problems	Social skills training
Work and employment	Difficulties accessing the workplace due to limitations in mobility	Modification of the workplace environment
Self-management	Difficulties with self-managing the condition due to lack of understanding of the condition	Education, advice and support for the self-management of the health condition
Rehabilitation for the prevention of secondary conditions		
Target of the intervention	**Problem (example)**	**Specific intervention (example)**
Prevention of pressure ulcers	Increased risk due to limited mobility	Positioning for pressure relief
Prevention of mental health problems	Increased risk due to stress with the experience of the condition and related limitations in functioning	Stress management training

Rehabilitation involves taking a person-centred approach based on working with the person and their family. This includes education for strengthening self-management, so that individuals with meningitis sequelae can overcome difficulties with independence in daily activities and perform meaningful life roles. Rehabilitation, including the provision of assistive products, should be initiated as soon as possible following the assessment of sequelae and should continue without disruption until optimal functioning has been achieved. It can be provided as an integrated service within other health services, including in outpatient hospital settings; or as outpatient prosthetics and orthotics, physiotherapy, occupational and speech and language therapy practices, and community environments, such as home, school or workplace.

Hearing loss is the most frequent sequelae; thus, it presents the highest burden in people with meningitis, especially children. Section 10.1 provides specific information related to hearing rehabilitation. A more extensive overview of interventions for rehabilitation relevant to people experiencing meningitis sequelae is available in *Annex 5*.

10.1 Hearing rehabilitation

Relevant WHO resources (please check regularly for updates)
Hearing screening: considerations for implementation, 2021 (*165*)

Following the identification of hearing loss, it is essential that affected people are referred to rehabilitation without delay, to mitigate any adverse impact. Hearing rehabilitation should address the impairments in hearing functions – if necessary with the provision of hearing aids, speech reading and communication strategy training – but also the individual's social and physical environments, including the provision of and guidance on the use of hearing assistive technologies (e.g. frequency modulation [FM] systems and hearing induction loops) and captioning. Some people (and their families or caregivers) may benefit from counselling to help them accept and adjust to the hearing loss, including learning to overcome the stigmatizing attitudes of others towards hearing loss. Table 19 provides an overview of interventions for hearing rehabilitation recommended with the PIR for hearing loss (*172*).

Table 19. Interventions for rehabilitation for hearing loss

Target of the intervention	Specific intervention
Hearing functions	Referral to specialist assessment
	Referral to cochlear implant
	Provision and training in the use of assistive products for hearing
Speech, language and communication	Auditory training
	Speech and language therapy
	Verbal and/or sign language training
	Communication skills training
	Provision and training in the use of assistive products for hearing
Education and vocation	Educational and/or vocational counselling, training and support
Community and social life	Participation-focused interventions
Self-management	Education, advice and support for self-management of the condition
Carer and family support	Carer and family training and support

In neonates and children, decisions regarding management should be made through a consultative family-based approach. Options for interventions include rehabilitative therapy to support the development of language skills, along with hearing technology use (hearing aids or cochlear implantation), sign language learning, or a combination of both. In addition, parents should be directed to enrol their child in a suitable early education programme.

When a diagnosis of hearing loss has been made in adolescents and adults, the interventions must include basic education and counselling on hearing loss for both the person with hearing loss and their caregiver and family, to facilitate psychological acceptance and adjustment. This should also include communication training and adaptations in social and physical environments and peer mentoring.

Additionally, the need for, and type of, hearing technology should be assessed. Whichever technology is required (e.g. hearing aids, cochlear implants or hearing assistive technologies) should be provided and fitted by a trained professional who is authorized to do so (in line with local rules and regulations). Also, further or more advanced testing may be recommended where this has been indicated by the nature of the hearing loss or associated symptoms.

11. Follow-up after discharge

People who had sequelae detected at discharge and those who did not have such sequelae detected should be followed up after discharge, because even those who appear not to have suffered from any neurological deficits could later develop cognitive or neurodevelopmental disorders (*177*). Conversely, people who had neurological sequelae detected at discharge may show clinical improvement in the following months.

Owing to the complex needs and high levels of dependency and morbidity of people with sequelae from infections, a range of coordinated health and social support is essential; in particular, this includes the involvement of parents as partners in the dialogue with clinicians. Assisting parents and families in the coordination and planning of follow-up care is particularly important for the parents of a child with physical or intellectual disabilities and should be accompanied by mental health support to both the caregiver and the person affected. Equally important is to provide support in accessing education or employment opportunities.

Due to the wide range of needs of people with meningitis sequelae, follow-up care requires a multidisciplinary approach and coordination of providers and services within and outside the health system. To achieve this, district health services for people with meningitis sequelae should be mapped and care pathways established (Fig. 16). This chapter was created adapting the framework for integrating health services provided by the WHO publication *mhGAP operations manual: mental health Gap Action Programme (mhGAP)* (*178*).

11.1 Mapping of health and social services

People with sequelae following acute meningitis often have complex needs which require broad knowledge and skills that cannot be provided by only one person. Care providers involved in supporting this population include community workers, social workers, counsellors, and both non-specialist and specialist health care providers.

Mapping of these services for people with sequelae and relevant stakeholders constitutes an essential first step to ensure continuity of care (see *Annex 6* for a sample form that can be used to map health and social services). Furthermore, strategies to engage in scaling up services for people with sequelae should be identified. In this context, the role of each care provider in the workforce and in district facilities that provide care for individual cases should be defined.

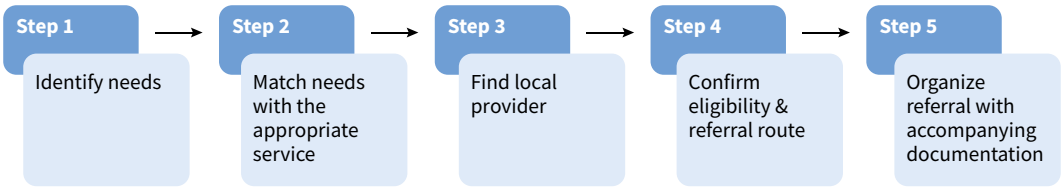
11.2 Coordinating care pathways (linking to services)

Once available health services have been mapped, care pathways should be established. These are the collaborative routes by which people with sequelae access necessary treatment and care, involving several public and private service providers at multiple levels.

An effective referral system ensures close relations at all levels of the health system and mechanisms for referral to and from service points outside the health sector. A good referral system helps to ensure that people with sequelae receive the best possible care closest to their homes. It also contributes to cost–effective use of bidirectional care pathways, in which referrals are made between hospitals, non-specialized health settings and the community. See *Annex 7* for sample follow up and referral forms.

Continuity of care can often be optimized using digital health solutions (e.g., telemedicine) that foster greater information-sharing between providers and people with neurological disorders and their carers, and allow for remote consultation through telehealth (*179*).

Fig. 16. Decision pathway for follow-up care



12. Conclusion and next steps

This practical manual was developed as a critical step towards strengthening clinical care for people with acute meningitis worldwide by improving recognition, initial investigations, management and rehabilitation interventions.

As a derivative product of several WHO guidelines, the development of this document was grounded in an evidence-based process. Furthermore, an external review process ensured alignment with current needs and refined the content to support health workers providing care for people with acute meningitis.

The primary goal of the manual is to operationalize the recommendations outlined in the *WHO guidelines on meningitis diagnosis*, *treatment and care*, thereby facilitating their implementation globally. To achieve this, publication should be accompanied by targeted training activities, and integration into national guidelines and protocols should be actively supported.

Countries are encouraged to adapt the guidance in this manual to their specific contexts. WHO will assist Member States in translating these recommendations into practice and will collaborate with national public health authorities and partners to promote implementation, monitor application and inform future updates.

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Annex 1. ABCDE approach "Quick cards"

	ASSESSMENT FINDINGS	IMMEDIATE MANAGEMENT
Airway 	Unconscious with limited or no air movement	If **NO TRAUMA**: head-tilt and chin-lift, use OPA or NPA to keep airway open, place in recovery position or position of comfort. If possible **TRAUMA**: use jaw thrust with c-spine protection and place OPA to keep the airway open (no NPA if facial trauma).
	Foreign body in airway	Remove visible foreign body. Encourage coughing. • If **unable** to cough: chest/abdominal thrusts/back blows as indicated • If patient becomes unconscious: CPR
	Gurgling	Open airway as above, suction (avoid gagging).
	Stridor	Keep patient calm and allow position of comfort. • For signs of anaphylaxis: give IM adrenaline • For hypoxia: give oxygen
Breathing 	Signs of abnormal breathing or hypoxia	Give oxygen. Assist ventilation with BVM if breathing NOT adequate.
	Wheeze	Give salbutamol. For signs of anaphylaxis: give IM adrenaline.
	Signs of tension pneumothorax (absent sounds / hyperresonance on one side WITH hypotension, distended neck veins)	Perform needle decompression, give oxygen and IV fluids. Will need chest tube
	Signs of opiate overdose (AMS and slow breathing with small pupils)	Give naloxone.
Circulation 	Signs of poor perfusion/shock	If **no pulse**, follow relevant CPR protocols. Give oxygen and IV fluids.
	Signs of internal or external bleeding	Control external bleeding. Give IV fluids.
	Signs of pericardial tamponade (poor perfusion with distended neck veins and muffled heart sounds)	Give IV fluids, oxygen. Will need rapid pericardial drainage
Disability 	Altered mental status (AMS)	If NO TRAUMA, place in recovery position.
	Seizure	Give benzodiazepine.
	Seizure in pregnancy (or after recent delivery)	Give magnesium sulphate.
	Hypoglycaemia	Give glucose if <3.5 mmol/L or unknown.
	Signs of opiate overdose (AMS with slow breathing with small pupils)	Give naloxone.
	Signs of life-threatening brain mass or bleed (AMS with unequal pupils)	Raise head of bed, monitor airway. Will need rapid transfer for neurosurgical services
Exposure 	Remove wet clothing and dry skin thoroughly.	
	Remove jewelry, watches and constrictive clothing	
	Prevent hypothermia and protect modesty.	
	Snake bite	Immobilize extremity. Send picture of snake with patient. Call for anti-venom if relevant.

If cause unknown, remember trauma: Examine the entire body and always consider hidden injuries [see also TRAUMA card]

REMEMBER: PATIENTS WITH ABNORMAL ABCDE FINDINGS MAY NEED RAPID HANDOVER/TRANSFER. PLAN EARLY.

NORMAL ADULT VITAL SIGNS

Pulse rate: 60–100 beats per minute
Respiratory rate: 10–20 breaths per minute
Systolic blood pressure >90 mmHg

Estimating systolic blood pressure
(not reliable in children and the elderly):
Carotid (neck) pulse → SBP ≥ 60 mmHg
Femoral (groin) pulse → SBP ≥ 70 mmHg
Radial (wrist) pulse → SBP ≥80 mmHg

SAMPLE History

Signs & Symptoms
Allergies
Medications
PMH
Last oral intake
Events

SPECIAL CONSIDERATIONS IN THE ASSESSMENT OF CHILDREN

A

- Children have bigger heads and tongues, and shorter, softer necks than adults. Position airway as appropriate for age.
- Always consider foreign bodies.

B

- Look for signs of increased work of breathing (e.g. chest indrawing, retractions, nasal flaring).
- Listen for abnormal breath sounds (e.g. grunting, stridor, or silent chest).

AGE	RESPIRATORY RATE (breaths per minute)
<2 months	40–60
2–12 months	25–50
1–5 years	20–40

C

- Signs of poor perfusion in children include: slow capillary refill, decreased urine output, lethargy, sunken fontanelle, poor skin pinch
- Look for signs of anaemia and malnourishment (adjust fluids).
- Remember that children may not always report trauma and may have serious internal injury with few external signs.

AGE (in years)	NORMAL HEART RATE (beats per minute)
<1	100–160
1–3	90–150
4–5	80–140

D

- Always check AVPU
- Hypoglycaemia is common in ill children.
- Check for tone and response to stimulus.
- Look for lethargy or irritability.

E

INFANTS AND CHILDREN HAVE DIFFICULTY MAINTAINING TEMPERATURE

- Remove wet clothing and dry skin thoroughly. Place infants skin-to-skin when possible.
- For hypothermia, cover the head (but be sure mouth and nose are clear).
- For hyperthermia, unbundle tightly wrapped babies.

DANGER SIGNS IN CHILDREN

- Signs of airway obstruction (unable to swallow saliva/ drooling or stridor)
- Increased breathing effort (fast breathing, nasal flaring , grunting, chest indrawing or retractions)
- Cyanosis (blue colour of the skin, especially at the lips and fingertips)
- Altered mental status (including lethargy or unusual sleepiness, confusion, disorientation)
- Moves only when stimulated or no movement at all (AVPU other than "A")
- Not feeding well, cannot drink or breastfeed or vomiting everything
- Seizures/convulsions
- Low body temperature (hypothermia)

ESTIMATED WEIGHT in KILOGRAMS for CHILDREN 1–10 YEARS OLD:

[age in years + 4] x 2

ABCDE: airway, breathing, circulation, disability and exposure; AMS: altered mental status; AVPU: alert, voice, pain, unresponsive; BVM: bag-valve-mask; CPR: cardiopulmonary resuscitation; IM: intramuscular; IV: intravenous; NPA: nasopharyngeal airway; OPA: oropharyngeal airway; PMH: past medical history; SBP: systolic blood pressure.

Source: WHO/IFRC/IFEM Basic emergency care (BEC): approach to the acutely ill and injured, quick cards (2018).

Annex 2. SBAR Handover Tool

World Health Organization

SBAR Handover Tool

Use this tool to help facilitate efficient and safe communications about patients, including facility transfers and handover of care between providers.

S — Situation

- **Identify yourself & location** ☐
- **Identify patient** (name, age, sex) ☐
- **State diagnosis** (suspected or definitive) ☐
- **State reason for transfer or handover** ☐
  (e.g. unavailable diagnostics or therapeutics)

B — Background

- **Admission date** ☐
- **Relevant past medical & surgical history** ☐
- **Recent changes in status** (ABCDE findings/interventions) ☐
- **Relevant labs & imaging** ☐
- **Recent vital signs** ☐
- **Management or interventions provided** ☐
  (e.g. O2, infusions, antibiotics, procedures)
- **Relevant psychosocial factors** ☐

A — Assessment

- **State the diagnoses or conditions** (if diagnostic uncertainty) ☐
- **State severity of illness** (stable or critical) ☐
- **State patient trajectory** (worsening or improving) ☐
- **Report response to interventions provided** ☐

R — Recommendation

- **State your recommendations & concerns** ☐
  (e.g. transfer for specialist consult or frequent monitoring)
- **State timeline for recommendations** ☐
  (e.g. transfer or intervention needed in next 1 hour)
- **State contingency plans** ☐
  (e.g. If patient transfer is delayed, then I will...)

Confirmation: Ask receiver to repeat back key information and clarify any questions

ABCDE: airway, breathing, circulation, disability and exposure; SBAR: situation, background, assessment and recommendation.

Source: https://cdn.who.int/media/docs/default-source/integrated-health-services-%28ihs%29/csy/bec-slides/bec/sbar.pdf

Annex 3. Dosages of anti-TB medicines by weight band for treatment of drug-susceptible tuberculosis

Medicine	Weight-based dose	Formulation (mg)	Formulation type	25 to <30 kg	30 to <35 kg	35 to <50 kg	50 to <65 kg	65 kg +
				Tablets	Tablets	Tablets	Tablets	Tablets
FDC (HR)		75/150	FDC	2	3	4	4	5
FDC (HRE)		75/150/275	FDC	2	3	4	4	5
FDC (HRZE)		75/150/ 400/275	FDC	2	3	4	4	5
Isoniazid (H)	4–6 mg/kg	300	Loose	0.5	1	1	1	1.25
Rifampicin (R)	8–12 mg/kg	300	Loose	1	1.5	2	2	2.5
Ethambutol (E)	15–25 mg/kg	400	Loose	1.5	2	3	3	4
Pyrazinamide (Z)	20–30 mg/kg	400	Loose	2	3	4	4	5
Pyrazinamide (Z)	20–30 mg/kg	500	Loose	1.5	2.5	3	3	4
Rifapentine (P)	Fixed	150	Loose	–	–	8	8	8
Rifapentine (P)	Fixed	300	Loose	–	–	4	4	4
Moxifloxacin (M)	Fixed	400	Loose	–	–	1	1	1
Adult FDC (mg)	**H**	**R**	**Z**	**E**				
FDC (HRZE)	75	150	400	275				
FDC (HRE)	75	150	–	275				
FDC (HR)	75	150	–	275				
FDC (HRZE)	75	150	400	275				

FDC: fixed-dose combination; TB: tuberculosis.

Adapted from *WHO consolidated operational handbook on tuberculosis: module 4: treatment and care* (*1*).

References for Annex 3

1. WHO consolidated operational handbook on tuberculosis: module 4: treatment and care. Geneva: World Health Organization; 2025 (https://iris.who.int/handle/10665/381095). Licence: CC BY-NC-SA 3.0 IGO.

Annex 4. Recommended dosing for the 6-month intensive regimen (6HRZEto) to treat drug-susceptible TB meningitis in children and adolescents

Weight band (kg)	Weight 3–<35 kg using child-friendly formulationsa					Weight 25–<35 kg using adult formulations (with Z 400 mg tablet)[a]			Weight 25–<35 kg using adult formulations (with Z 500 mg tablet)[a]		
	HR 50/75 mg dispersible tablet[b]		Z 150 mg dispersible tablet[b]		Eto 125 mg dispersible tablet[b]	HR 75/ 150 mg tablet	Z 400 mg tablet	Eto 250 mg tablet	HR 75/ 150 mg tablet	Z 500 mg tablet	Eto 250 mg tablet
3–<4[c]	<3 months 1.5[b]	≥3 months 1.5[b]	<3 months 0.5[b]	≥3 months 1[b]	0.5[b]						
4–<5[c]	<3 months 1.5[b]	≥3 months 2[b]	<3 months 0.5[b]	≥3 months 1[b]	0.5[b]						
5–<6	2.5		1.5 [b]		1						
6–<8	3		2		1						
8–<10	3.5[b]		2.5[b]		1.5[b]						
10–<13	4		3		2						
13–<16	5		3.5[b]		2						
16–<20	6		4		2.5[b]						
20–<25	7		5		3						
25–<30	9		6		4	4	2	2	4	2	2
30–<32	10		6		4	5	2	2	5	2	2
32–<35	10		6		4	5	3	2	5	2	2

Eto: ethionamide; HR: isoniazid and rifampicin; TB: tuberculosis; Z: pyrazinamide.

[a] For children weighing 25–<35 kg, adult formulations can be used to reduce the pill burden.

[b] If the formulation has a scoring line, tablets can be split and administered whole or dispersed in water. If the formulation does not have a scoring line, tablets should be dispersed in a specific amount of water and the exact dose administered using an aliquot with a syringe. To give 0.5 tablet, dissolve 1 tablet in 10 mL water and administer 5 mL.

[c] For children weighing 3–<5 kg, a joint age- and weight-based approach is used. The dosing of HR and Z for children weighing 3–<5 kg depends on whether the child is aged under or over 3 months. For example, an infant weighing 4.5 kg would receive 1.5 tablets of HR 50/75 mg and 0.5 tablet of Z 150 mg if aged under 3 months, but 2 tablets of HR and 1 tablet of Z if aged 3 months or over.

Adapted from *WHO consolidated operational handbook on tuberculosis: module 5: management of tuberculosis in children and adolescents* (*1*).

References for Annex 4

1. WHO operational handbook on tuberculosis: module 5: management of tuberculosis in children and adolescents. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/352523). Licence: CC BY-NC-SA 3.0 IGO.

Annex 5. Interventions for rehabilitation

Access to rehabilitation is essential for people who experienced acute meningitis and developed sequelae in the acute, post-acute and long-term phases following the onset of the illness. Rehabilitation helps a person to become as independent as possible in everyday activities and enables them to return to participation in education, work, recreation and meaningful life roles (e.g. taking care of family). It involves working with the person and their family to address the sequelae of meningitis, modifying the environment to better suit the person's needs, using assistive products, educating the person to strengthen self-management, and amending tasks so that they can be performed more safely and independently. Together, these strategies can help people experiencing sequelae following meningitis to overcome the difficulties related to these sequelae.

5.1 Interventions for rehabilitation in people experiencing sequelae following meningitis

Rehabilitation interventions should be based on a comprehensive assessment of functioning and target the individual's specific needs.

To select the interventions for rehabilitation that target the specific needs of an individual, a comprehensive assessment of functioning must be conducted; the assessment should include the patient's needs, preferences, abilities and medical status. Based on the results of the assessment, goals should be defined, in collaboration with the patient and family, and the rehabilitation plan developed. Some interventions may be contraindicated in the acute phase of the illness or in patients with specific comorbidities (e.g. uncontrolled seizures, severe hypertension, deep vein thrombosis). This approach is called "person-centred goal setting" in rehabilitation.

Interventions for rehabilitation are organized according to "functioning domains"; here, these domains cover the areas that are mostly affected by the sequelae that follow meningitis and are amenable to rehabilitation. Table A5.1 lists the body functions that are most commonly affected by the sequelae of meningitis. Interventions are derived from the World Health Organization (WHO) *Package of interventions for rehabilitation* (*1*).

Table A5.1 Body functions most commonly affected following acute meningitis

Functioning domain	Sequelae of meningitis (examples)
Cognitive functions	Cognitive impairments (problems with memory, concentration)
Mental functions and behaviours	Sleep problems, irritability
Vision functions	Vision loss
Hearing functions	Hearing loss
Speech, language and communication	Problems with fluency of speech, communication difficulties
Pain	Neuropathic pain
Swallowing	Dysphagia
Motor functions and mobility	Spasticity, paresis, joint contractures, ataxia

The experience of impairments in body functions often limits a person's capacity to perform activities and to participate in meaningful life roles. These limitations and restrictions can be relevant to people with any kind of sequelae; thus, they should always be carefully assessed in all people experiencing sequelae. Table A5.2 lists the functioning domains that are most commonly affected with respect to activity limitations and participation restrictions.

Table A5.2 Functioning domains most commonly affected with respect to activity limitations and participation restrictions following meningitis

Functioning domains
Activities of daily living
Interpersonal interactions and relationships
Education, work and employment
Community and social life
Self-management

Survivors of acute meningitis are also at risk of experiencing secondary conditions related to the condition or its sequelae. Interventions for rehabilitation can effectively help to prevent or limit these secondary conditions. Table A5.3 lists the secondary conditions that are relevant to people following acute meningitis and are amenable to rehabilitation.

Table A5.3 Most common secondary conditions following meningitis

Secondary conditions
Pressure ulcers
Malnutrition
Mental health problems (in particular, depression, anxiety and emotional distress)

5.2 Interventions for rehabilitation to address problems in body functions, activities and participation following acute brain infections

Tables A5.4-A5.6 provide lists of interventions for rehabilitation, derived from the World Health Organization (WHO) *Package of interventions for rehabilitation* (*1*). These rehabilitation interventions are effective in improving functioning in people following meningitis.

Interventions marked as essential (in bold) constitute a minimum set of interventions that can be provided in primary health care facilities by general practitioners, nurses and community health workers who have been trained in the delivery of these interventions. Expanded interventions (not in bold) require the skills of trained rehabilitation workers (e.g. rehabilitation doctors, physiotherapists, prosthetists and orthotists, occupational therapists, speech and language therapists or psychosocial counsellors); these interventions can be included when more resources, including more specialized personnel, are available.

Table A5.4 Rehabilitation interventions to address problems in body functions

Domain	Intervention
Cognitive functions	
Cognitive functions	**Cognitive training**
	Physical exercise training
	Provision and training in the use of assistive products for cognition
	Cognitive stimulation
	Cognitive remediation therapy
Consciousness functions	**Sensory stimulation**
Perceptual functions	**Sensory integration interventions**
	Provision and training in the use of assistive products for perceptual functions
Mental functions and behaviours	
Energy and drive functions (fatigue)	**Psychological therapies**
	Physical exercise training
	Cognitive behavioural therapy
	Energy conservation techniques
Sleep functions	Cognitive behavioural therapy
	Relaxation training
Problems with behaviour	**Behavioural interventions**
	Physical exercise training
	Person-tailored activities
	Relaxation training
	Cognitive behavioural therapy
Impulse control	Cognitive behavioural therapy
Vision functions	
Functions of structures adjoining the eye	**Vision skills training**
Watching	**Vision skills training**
	Provision and training in the use of assistive products for vision
Hearing functions	
Hearing functions	**Provision and training in the use of assistive products for hearing**
Auditory perception	**Auditory training**

Table A5.4 *continued*

Speech, language and communication	
Speech functions	**Speech therapy**
Mental functions of language (aphasia) Mental functions of sequencing complex movements (speech apraxia)	**Language therapy**
Communication	**Communication skills training**
	Provision and training in the use of assistive products for communication
	Verbal and/or sign language training
Reading and writing	**Provision and training in the use of assistive products for reading and writing**
Pain	
Sensation of pain	**Physical exercise training**
	Pain-relieving positioning
	Range of motion exercises
	Soft tissue techniques
	Massage
	Joint mobilization
	Manual therapy
	Thermotherapy
	Provision and training in the use of orthoses
	Relaxation training
	Cognitive behavioural therapy
Swallowing	
Swallowing	**Swallowing therapy**
Motor functions and mobility	
Mobility of joint functions	**Range of motion exercises**
	Positioning for the prevention of contractures
	Provision and training in the use of orthoses
	Soft tissue techniques
	Joint mobilization
	Manual therapy

Table A5.4 *continued*

Motor functions and mobility	
Muscle power functions	**Muscle-strengthening exercises**
Muscle stiffness	**Stretching**
Muscle tone functions	Range of motion exercises
	Stretching
	Antispastic pattern positioning
	Provision and training in the use of orthoses
Vestibular functions	**Vestibular training**
Control of voluntary movement functions (motor control)	**Movement strategy training**
	Dual task training
	Mirror therapy
Involuntary movement reaction functions (balance)	Balance training
	Provision and training in the use of assistive products for mobility
Maintaining a body position	**Functional positioning**
	Provision and training in the use of adapted seating equipment
Movement functions	**Environmental enrichment**
Hand and arm use	**Functional training**
	Bimanual therapy
	Provision and training in the use of orthoses
	Provision and training in the use of upper limb prosthesis
Gait pattern functions and walking	**Gait training**
	Provision and training in the use of assistive products for mobility
	Provision and training in the use of lower limb prosthesis
Mobility	**Graded sitting and standing training**
	Mobility training
	Orientation and mobility training
	Provision and training in the use of assistive products for mobility
	Modification of the home environment
	Physical exercise training
Exercise tolerance functions	Fitness training

Table A5.5. Rehabilitation interventions to address limitations in activities and restrictions in participation

Domain	Intervention
Activities of daily living	
Activities of daily living	**Activities of daily living training**
	Cognitive rehabilitation
	Provision and training in the use of assistive products for self-care
	Modification of the home environment
	Supported housing
Interpersonal interactions and relationships	
Interpersonal interactions and relationships	**Social skills training**
	Psychosocial interventions
	Psychological support
	Peer support
	Cognitive behavioural therapy
	Structured group activities
	Family interventions
Sexual functions and intimate relationships	**Psychological support**
Education, work and employment	
Education	**Educational counselling, training and support**
	Provision and training in the use of assistive products for education
	Modification of the school environment
	Supported education
Work and employment	**Vocational counselling, training and support**
	Provision and training in the use of assistive products for work and employment
	Modification of the workplace environment
	Supported employment
Community and social life	
Community and social life	**Participation-focused interventions**
	Peer support
	Provision and training in the use of assistive products for recreation and leisure
	Supported housing

Table A5.5 *continued*

Self-management	
Self-management	**Education, advice and support for the self-management of the health condition**
	Education, advice and support for healthy lifestyle
	Education and advice on self-directed exercises
Carer and family support	**Carer and family training and support**

Table A5.6 Rehabilitation interventions for the prevention and management of secondary conditions

Secondary condition	Intervention
Malnutrition and pressure ulcers	Nutritional management
Pressure ulcers	**Positioning for pressure relief**
	Skin/wound care
	Provision and training in the use of assistive products for pressure relief
Mental health problems (in particular, depression, anxiety and emotional distress)	Stress management training
	Psychological therapies
	Physical exercise training

5.3 Descriptions of interventions for rehabilitation

Table A5.7 provides short descriptions for each intervention for rehabilitation relevant to people experiencing sequelae following meningitis. The "essential" interventions are highlighted in bold. Interventions are derived from the World Health Organization (WHO) *Package of interventions for rehabilitation* (*1*).

Table A5.7 Descriptions of rehabilitation interventions[a]

Intervention	Description
Antispastic pattern positioning	Antispastic pattern positioning aims to modulate spasticity and to prevent contractures and limitations in joint mobility by placing the body or body parts in defined positions for as long as possible. Such positioning is applied by a trained health worker, or may be done by the patient or their caregiver after receiving education and training in the appropriate technique.
Auditory training	Auditory training uses techniques to enhance listening skills and improve speech understanding, which is a pre-condition to successful communication. During auditory training, participants are provided with auditory stimuli and are involved in (focused) listening activities. Such training aims to train the cognitive processes that play a role in listening; it is important for individuals with hearing loss who have been equipped with hearing aids or cochlear implants.

Table A5.7 *continued*

Intervention	Description
Balance training	For balance or postural control, sensory (vestibular, somatosensory and visual) information is processed to inform muscular responses that allow maintenance of a body position. Balance training aims to improve balance, motor control and coordination, to improve movement-related activities (e.g. sitting or walking) and to reduce the risk of falling. Balance exercises use different strategies (e.g. dual tasking or cueing) and are performed repetitively, with a specific level of difficulty (e.g. one-leg standing), for a specific period of time (e.g. 60 seconds). Balance training is guided or assisted by a health worker; where feasible, performance is self-directed by the patient following education and advice on the appropriate exercises.
Behavioural interventions	Problems with behaviour ("challenging", "problematic" or "inappropriate" behaviours, or "behavioural and psychological symptoms") include, for example, agitation, aggression, inattention or over-activity. Such problems can be caused or triggered by factors that are biological (e.g. pain), social (e.g. boredom, insensitivity of others), environmental (e.g. noise and lighting) or psychological (e.g. emotional problems); they may endanger the physical safety of the person or others, or may limit interpersonal interactions or prevent access to community facilities. Behavioural interventions are tailored to an individual's needs and aim to reduce the intensity, frequency and duration of a problematic behaviour or replace that behaviour with appropriate behaviours through providing skills training, using positive or negative reinforcement strategies, or modifying the social or physical environment to reduce external triggers. Behavioural interventions may involve caregivers and family members.
Bimanual therapy	Bimanual therapy uses planned, repeated practice of two-handed activities, tasks or games to improve a person's ability to use their hands together. Different functional tasks that require using both hands are practised repetitively under the guidance and with the assistance of a health worker; where feasible, performance is self-directed by the patient following education and advice on the appropriate techniques.
Cognitive behavioural therapy	Cognitive behavioural therapy (CBT) is a psychological therapy that combines cognitive components (aimed at thinking differently; e.g. through identifying and challenging unrealistic negative thoughts) and behavioural components (aimed at doing things differently; e.g. by helping the person to do more rewarding activities). During CBT sessions, exercises help the person to develop appropriate coping skills. CBT includes exercises, education and advice to help the person develop appropriate coping skills that can be applied in challenging situations.
Cognitive remediation therapy	Cognitive remediation therapy is based on behavioural training and aims to improve cognitive processes and psychosocial functioning. In individual or group sessions, participants perform a series of tasks (e.g. memory exercises, motor dexterity tasks or visual reading exercises), from basic to difficult levels, based on the principles of errorless learning and targeted reinforcement. For individuals, the repetitive tasks promote the capacity to solve problems and be aware of their own difficulties.

Table A5.7 *continued*

Intervention	Description
Cognitive stimulation	Cognitive stimulation aims to improve cognition and psychosocial functioning in people with difficulties in cognitive functions (e.g. memory, thinking, attention and perception deficits). Cognitive stimulation may include both the enrichment of the environment to stimulate cognition and therapeutic sessions. During cognitive stimulation therapy sessions, participants are exposed to and tasked with mentally challenging exercises to improve their ability to think and interact effectively with their environment and with other people.
Cognitive training	Cognitive functions include orientation, attention, memory, abstraction, organization, planning, calculation and problem-solving. Cognitive training includes exercises and tasks designed to restore, retrain or compensate for impaired cognition. It consists of education, advice and training techniques in the context of functional tasks. Under the guidance or assistance of a health worker, techniques are practised repetitively; where feasible, performance can be self-directed by the patient following education and advice on the appropriate exercises.
Communication skills training	Difficulties in communication can relate to problems with understanding and expressing language; to impairments in hearing, speech or vocal functions; and to psychological issues. Communication skills training aims to enable a person to communicate via spoken, written or other forms of language with others through, for example, communication partner training. Such training includes advice on appropriate communication strategies and is practised one-to-one or in a group format.
Dual task training	Everyday life involves situations in which a person needs to do two or more things simultaneously. Problems with the simultaneous execution of motor or cognitive tasks, called dual tasking, can reduce performance in either one or both tasks. Dual task training uses exercises in which people practise two tasks (e.g. one cognitive and one motor) simultaneously. Such training is guided or assisted by a health worker and, where feasible, performance can be self-directed following education and advice on the appropriate exercises.
Energy conservation techniques	Energy conservation techniques aim to reduce energy consumption during physical exertion, to prevent dyspnoea and physical exhaustion. Such techniques comprise the planning and prioritization of day-to-day activities, adjusting the activities according to physical capacity or using equipment when necessary, and applying techniques (e.g. breathing control) during performance of activities. The energy conservation techniques are taught and guided so that they can be performed self-directed following education and advice on the appropriate techniques.
Environmental enrichment	Environmental enrichment involves enhancing the physical environment of the individual to stimulate the person's cognitive, motor and sensory functions and social interactions. Specific approaches include, for example, interactions between a therapist and a parent or infant, or auditory, tactile or visual stimulations. The environmental enrichment is guided by a health worker and, where feasible, provided by family and caregivers following education and advice.

Table A5.7 *continued*

Intervention	Description
Functional positioning	Functional positioning aims to place the body in a position that supports distinct functions and activities (e.g. swallowing, breathing, and hand and arm use) or that prevents long-term damage of body structures due to bad posture whenever the person is not able to make and maintain the position independently. Functional positioning is applied by a trained health worker, or by the patient, caregiver or family member after receiving education and training in the appropriate positioning.
Functional training	Functional training for hand and arm use attempts to train muscles in coordinated, multiplanar movement patterns; it incorporates multiple joints, dynamic tasks and consistent alterations in the base of support. The goal is to make it easier for patients to perform their everyday activities. The training is practised repetitively under the guidance or with the assistance of a health worker and, where feasible, can be self-directed by the person following education and advice.
Gait training	Gait patterns are characterized by the specific sequences of limb and joint movements during a gait cycle. Gait training aims to normalize gait patterns but also to improve safe walking, walking speed and distance. It is based on task repetition, includes different strategies (e.g. cueing, dual tasking and attentional strategies) and is performed on varying surfaces or treadmills. Gait training is guided or assisted by a health worker and, where feasible, can be performed self-directed following education and advice on the appropriate exercises.
Joint mobilization	Joint mobilization is a manual therapy intervention that uses passive arthrokinematic motion (gliding) to improve joint mobility and reduce pain.
Language therapy	Problems with using language comprise difficulties in understanding and expressing spoken, written or other forms of language; for example, in people with limited language development (e.g. in those with hearing loss), or people with different types of impairments following, for example, brain damage (e.g. aphasia). Language therapy aims to promote and restore understanding and expression of language through structured conversational practice and language stimulation (including early and family interventions); if full restoration is not possible, it aims to develop compensatory strategies (e.g. using language cues) to allow a person to understand language and to express themselves. These techniques are practised repetitively and, where feasible, can be performed self-directed by the patient following education and advice on the appropriate techniques.
Manual therapy	Manual therapy is an approach that uses “hands-on” techniques (e.g. joint mobilization and manipulation, soft tissue techniques, passive movements and stretching) to improve tissue extensibility, increase joint mobility, optimize muscle function, modulate pain, and reduce soft tissue swelling and inflammation.
Massage	Massage comprises a variety of different techniques applied with the aim, for example, of releasing tension and restrictions in muscles, fascia, tendons or ligaments and thereby reducing pain, but also increasing blood and lymphatic fluid flow and, as a result, the transport of metabolic products.

Table A5.7 *continued*

Intervention	Description
Mirror therapy	Mirror therapy is used for the management of pain and the improvement of movement functions when the impairment affects one limb more than the other. A mirror or mirror box is used to produce visual feedback of movement of the limb that is unaffected or less affected, to give the illusion to the brain of normal and painless movement in the affected limb. This helps to increase cortical and spinal motor excitability. Under the guidance or assistance of a health worker, mirror therapy is practised repetitively and, where feasible, can be performed self-directed by the patient following education and advice on the appropriate exercises.
Modification of the home environment	The structure, layout, furniture and lighting of a home can facilitate or hinder functioning. Modification of the home environment may involve varying degrees of intervention that address environmental barriers and maximize safety, independence and performance of activities of daily living. Interventions may involve: ▪ providing general advice and guidance on home modifications (including without seeing the home); ▪ assessment of the home environment (i.e. visiting the home); ▪ documenting or reporting structural and non-structural changes that are recommended (including drafting construction plans when relevant); ▪ making environmental changes in the home, such as removing fall hazards, inserting visual cues or moving items to make them more readily accessible; and ▪ referring to appropriate service providers to conduct work that is beyond the scope of the health workers.
Modification of the school environment	The structure, layout, furniture and lighting of a school environment can facilitate or hinder functioning. Modification of the school environment may involve varying degrees of intervention that address environmental barriers and maximize safety, independence and participation in learning and play. Interventions may involve: ▪ providing advice and guidance on modifications to the school environment (including without seeing the school or classroom); ▪ assessment of the school environment (i.e. visiting the school); ▪ documenting or reporting structural and non-structural changes that are recommended (including drafting construction plans when relevant); and ▪ referring to appropriate service providers to conduct work beyond the scope of the health worker.

Table A5.7 *continued*

Intervention	Description
Modification of the workplace environment	The structure, layout, furniture and lighting of a workplace can facilitate or hinder functioning. Modification of the workplace environment may involve varying degrees of intervention that address environmental barriers and maximize safety, independence and performance of work-related tasks. Interventions may involve: ▪ providing advice and guidance on workplace modifications (including without seeing the workplace); ▪ assessment of the workplace environment (i.e. visiting the workplace); ▪ documenting or reporting structural and non-structural changes that are recommended (including drafting construction plans when relevant); and ▪ referring to appropriate service providers to conduct work beyond the scope of the health worker.
Movement strategy training	Impairments in voluntary movements can be caused by deficits in the automatic generation of movements. Movement strategy training uses visual, auditory, cognitive or proprioceptive cues and attentional strategies to initiate and improve simple and complex voluntary movements. Such training is guided or assisted by a health worker and, where feasible, can be performed self-directed following education and advice on the appropriate exercises.
Muscle-strengthening exercises	Muscle-strengthening exercises aim to improve maximal muscle strength, muscle endurance and muscle mass. The exercises are performed regularly (e.g. 3 × per week), at a certain dosage (e.g. with up to 80% of maximal power, 3 × 12 repetitions). The exercises (isometric or dynamic) are performed against gravity or resistance (e.g. body weight, weights or resistance bands), guided or assisted by a health worker and, where feasible, can be performed self-directed following education and advice on the appropriate exercises.
Pain-relieving positioning	Pain-relieving positioning aims to reduce pain by placing the body or body parts in positions that help to relieve specific body structures that may cause pain; it can be used, for example, to reduce tension or pressure on muscles, tissues or organs. Such positioning is performed by a trained health worker or, where feasible, can be performed by the patient or caregiver after receiving training in the appropriate technique.
Person-tailored activities	Person-tailored activities are meaningful and joyful to an individual. They are used to encourage and help a person to, for example, train for specific tasks, maintain a daily routine or be engaged in joyful (social) activities; the overall goal is to achieve and maintain optimal functioning and well-being. Under guidance or assistance, different types of person-tailored activities are offered and tried out, where feasible, with the participation of family members or friends.
Physical exercise training	A variety of physical exercises (e.g. aerobic or strengthening exercises, balance or coordination exercises, or mind-body exercises), with or without weight bearing, can be used to improve exercise capacity, muscle strength, joint mobility, voluntary movement, balance, gait and walking, while also helping to reduce pain and fatigue. Regular physical exercise training (including education and advice on exercises) is planned according to an individual's need, guided or assisted and, where feasible, can be performed self-directed following education and advice on the appropriate exercises.

Table A5.7 *continued*

Intervention	Description
Positioning for the prevention of contractures	Positioning for the prevention of contractures involves placing body parts or joints in positions that reduce the risk for contractures that may occur owing to lack of active movement. Such positioning may use othoses, splints, castings or standing frames to apply prolonged stretching through a standing position. The positioning is applied by a trained health worker and, where feasible, can be performed by the patient or caregiver following education and advice on the appropriate techniques.
Provision and training in the use of adapted seating equipment	Provision of adapted seating equipment supports people to maintain an appropriate sitting position whenever a person can both achieve and maintain this independently. The provision includes identification of a person's specific needs, followed by the selection, manufacturing or modification and adjustment of the appropriate device. Following the provision, the patient will be trained in the use and care of the equipment.
Provision and training in the use of assistive products for cognition	Various assistive products (e.g. pill organizers, time management products, global positioning system locators, simplified mobile phones and personal emergency alarm systems) are available to support people's cognitive functions. The provision includes identification of a person's specific needs, followed by the selection, manufacturing or modification and adjustment of the appropriate product. Following the provision, the patient will be trained in the use and care of the products.
Provision and training in the use of assistive products for communication	Various assistive products (e.g. communication boards, books or cards; electronic devices and communication software; and augmentative and alternative communication devices) are available to support people's communication. The provision includes identification of a person's specific needs, followed by the selection, manufacturing or modification and adjustment of the appropriate product. Following the provision, the patient will be trained in the use and care of the products.
Provision and training in the use of assistive products for hearing	Various assistive products (hearing aids or assistive listening devices) are available to improve hearing functions. The provision includes identification of a person's specific needs, followed by the selection, manufacturing or modification and adjustment of the appropriate product. Following the provision, the patient will be trained in the use and care of the products.
Provision and training in the use of assistive products for mobility	Various assistive mobility devices (e.g. walking aids, transfer aids, and manual or electric wheelchairs with pressure cushions) support people to mobilize in different environments. The provision includes identification of a person's specific needs, followed by the selection, manufacturing or modification and adjustment of the appropriate device. Following the provision, the patient will be trained in the use and care of the products.
Provision and training in the use of assistive products for perceptual functions	Various assistive products (e.g. spectacles with filters and protection) support adequate perceptual arousal and response, and prevent over-arousal. The provision includes identification of a person's specific needs, followed by selection of the appropriate product. Following the provision, the patient will be trained in the use and care of the products.

Table A5.7 *continued*

Intervention	Description
Provision and training in the use of assistive products for reading and writing	Various assistive products (non-optical or electronic devices) are available to improve a person's performance in reading and writing. The provision includes identification of a person's specific needs, followed by selection (considering a person's capacity to use the assistive product), manufacturing or modification and adjustment of the appropriate product and follow-up visits. Following the provision, the patient will be trained in the use and care of the products.
Provision and training in the use of assistive products for vision	Various assistive products (optical devices, including filters) are available to improve vision. The provision includes identification of a person's specific needs, followed by selection (considering a person's capacity to use the assistive product), manufacturing or modification and adjustment of the appropriate product and follow-up visits. Following the provision, the patient will be trained in the use and care of the products.
Provision and training in the use of lower limb prosthesis	The provision of a lower limb prosthesis contributes to the improvement of functioning related to walking; it may also address cosmetic aspects. The provision includes identification of the specific needs of the individual, followed by the selection, manufacturing or modification and adjustment of the prosthesis. Following provision, the person will be trained in the use and care of the prosthesis.
Provision and training in the use of orthoses	Orthoses comprise assistive products such as orthotics, braces or splints. Orthoses support the stability of joints or bones by providing external stability to the relevant body region. They may also help to reduce pain caused by movement of a body part and prevent contractures. The provision and training in the use of orthoses includes identification of a person's specific needs, followed by the selection, manufacturing or modification and adjustment of the orthoses. Following the provision, the person will be trained in the use and care of the orthoses.
Provision and training in the use of upper limb prosthesis	The provision of an upper limb prosthesis contributes to the improvement of functioning and may also address cosmetic aspects. The provision includes identification of the specific needs of the individual, followed by the selection, manufacturing or modification and adjustment of the prosthesis. Following provision, the person will be trained in the use and care of the prosthesis.
Psychological therapies	Psychological therapies use various psychological approaches (e.g. psychoanalytical or psychodynamic therapies, behavioural or cognitive therapies, and integrative or holistic approaches) that help the client to eliminate or control symptoms. They are used to improve psychosocial functioning in people with mental health problems (e.g. depression, anxiety and emotional distress) or emotional difficulties (e.g. difficulties in coping with daily life). Psychological therapies are conducted in an individual, family, couple or group setting, and are applied through conversation between health worker and client(s).
Range of motion exercises	Range of motion exercises are active, assisted or passive movements that are applied to a joint or limb to reduce muscle stiffness, pain, swelling or risk for deep venous thromboembolism through activating the muscle pump; they also improve joint mobility by reducing the shortening of capsules and ligaments. These exercises are guided or assisted by a health worker and, where feasible, can be performed self-directed by the person following education and advice on the appropriate exercises.

Table A5.7 *continued*

Intervention	Description
Relaxation training	Relaxation training targets the subjective experiences of pain, stress and anxiety, but also body functions such as muscle tension or heart functions (i.e. blood pressure or heart rate). The training comprises approaches such as progressive muscle relaxation, guided imagery, biofeedback or deep breathing exercises. Relaxation training is guided by a health worker and, where feasible, can be performed self-directed following education and advice on the appropriate exercises.
Sensory integration interventions	Sensory integration interventions address sensory dysfunctions, specifically problems with the perception and processing of a sensory input, such as touch, sound, sight or smell, that impact the person's behavioural response. The interventions aim to improve how sensory inputs are integrated by using different stimuli (e.g. deep pressure or specific movements) in a structured and repetitive way. The interventions are play-oriented and may use equipment such as swings or a trampoline. Sensory integration is practised under the guidance or assistance of a health worker and, where feasible, performed self-directed under the guidance of parents or other carers following education and advice on the appropriate activities.
Sensory stimulation	Sensory stimulation is the use of external environmental stimuli to promote arousal and adequate behavioural responsiveness by gradually providing the nervous system with sensory information to enable the patient to perform adequate action (depending on their level of responsiveness). Sensory stimulation programmes use different smells and flavours of moderate-to-high intensity, verbal and non-verbal sounds (e.g. white noise or music), visual stimuli (e.g. objects, photographs) and tactile stimuli (e.g. physical contact, feeling one's body, feeling objects of different textures, moving objects) to promote arousal and adequate behavioural responsiveness. The stimulation is guided by a health worker and, where feasible, can also be provided by carers following education and advice on the appropriate exercises.
Soft tissue techniques	Soft tissue techniques comprise a variety of specific techniques (e.g. massage, muscle energy or trigger point technique, or myofascial release) that aim to improve the tone and flexibility of muscles and soft tissue, and can help to increase joint mobility or reduce pain.
Speech therapy	Problems with speech functions include impairments with fluency and rhythm of speech, articulation and coordination of speech owing to impairments related to brain damage (e.g. stuttering, dysarthria or speech apraxia) and also owing to impairments related to hearing loss or developmental disorders. Speech therapy aims to improve the fluency and rhythm, articulation and coordination of speech (e.g. through phonological exercises); if full restoration is not possible, the aim is to develop compensatory strategies (e.g. cued speech) to increase speech intelligibility and allow a person to express themselves well through speech. These techniques are practised repetitively and, where feasible, can be performed self-directed by the patient following education and advice on the appropriate exercises.
Stretching	Stretching can help to improve flexibility of muscles by reducing muscle stiffness or muscle tone. Consequently, it may help to reduce pain related to muscle stiffness and increase the range of motion in joints. Different types of stretching (static or dynamic) are guided or assisted by a health worker and, where feasible, can be performed self-directed following education and advice on the appropriate exercises.

Table A5.7 *continued*

Intervention	Description
Swallowing therapy	Swallowing therapy comprises instruction and training in different techniques and exercises (e.g. postural techniques, supraglottic swallowing, oral sensory–motor exercises and expiratory muscle-strengthening exercises) to improve food sucking, chewing and biting, manipulating food in the mouth, salivating and swallowing, to ensure appropriate food and liquid intake, and reduce the risk of aspiration. It can also include the provision of advice on compensatory strategies (e.g. functional positioning and modification of food consistency). Therapy also covers exercises and peripheral stimulations that focus on improving the strength of muscles relevant to swallowing (oral motor exercises). These techniques are practised repetitively and, where feasible, can be performed self-directed by the patient following the instruction.
Thermotherapy	Thermotherapy (heat or cold) is applied to reduce pain, increase blood flow or reduce inflammation or oedema. Heat or cold is administered, for example, by hot or cold packs, towels, cold air or sprays by a health worker or, where feasible, can be performed by the person after education and advice on appropriate application and potential associated risks.
Verbal and/or sign language training	The capacity to use a language (verbal or sign) is the prerequisite to understanding and sharing information, and communicating with others. Verbal or sign language training aims to enable a person to apply specific verbal or sign language. Such training is practised one-to-one or in a group format.
Vestibular training	Vestibular functions are specific sensory functions of the inner ear related to position, balance and movement. Vestibular therapy includes exercises and techniques designed to address symptoms of vestibular dysfunction (e.g. dizziness, visual or gaze disturbances and balance disorders). These exercises and techniques are practised repetitively and, where feasible, can be performed self-directed by the patient following education and advice on the appropriate exercises.
Vision skills training	Central visual impairments include visual field loss (hemianopia) or eye movement disorders (e.g. strabismus, gaze deficits and nystagmus). Vision skills training aims to improve and strengthen visual skills and abilities through aligning the visual axes and improving the ability to focus and track objects. Vision therapy comprises restitutive techniques (e.g. convergence, pursuit and saccade [rapid movement of the eye between fixed points] exercises) and compensatory techniques (training of eye movements for reading and compensatory head posture). These techniques are practised repetitively under the guidance and assistance of a health worker and, where feasible, can be performed self-directed by the patient following education and advice on the appropriate exercises.

[a] Essential interventions are highlighted in bold.

Reference for Annex 5

1. Package of interventions for rehabilitation [website]. World Health Organization; 2025 (https://www.who.int/teams/noncommunicable-diseases/sensory-functions-disability-and-rehabilitation/rehabilitation/service-delivery/package-of-interventions-for-rehabilitation, accessed 17 April 2026).

Annex 6. Health services mapping template

Give the total number of health facilities and whether public, private or NGO. Include both inpatient and outpatient facilities.

Number of facilities or services that provide care for people following acute meningitis

Public (primary, secondary, tertiary)	Private	NGO

Facilities or services

Name of facility/service	Type of facility/service	Location

Key stakeholders in the district (individuals and organizations)

Name	Position	Contact	Comments

NGO: Non-Governmental Organization.
Adapted from *mhGAP operations manual: mental health Gap Action Programme (mhGAP)* (1)

References for Annex 6

1. mhGAP operations manual: mental health Gap Action Programme (mhGAP). Geneva: World Health Organization; 2018 (https://iris.who.int/handle/10665/275386). Licence: CC BY-NC-SA 3.0 IGO.

Annex 7. Templates for follow-up care

7.1 Follow-up form

This form is designed to assist health care providers in recording important information about people with sequelae following acute meningitis they see in their facilities during follow-up. The form should be adapted to the specific context where it will be used to better suit the needs of the population.

Facility name:	Facility location:	Name of provider:	Date of follow up:
Personal details			
Full name:	Date of birth: Age:	Occupation:	Sex: ☐ M ☐ F
Address:		Telephone:	
Carer's details			
Carer's name:	Address:	Telephone:	Relationship to patient:
Follow-up from first visit			
Date of first assessment:	Name of provider:	Referrals:	
Condition (provide details of diagnosis):			
Medications:			
Rehabilitation interventions:			
Links to other sectors/services:			
Assess for improvement			
Is the person improving?	Yes / No		
Which symptoms are persisting and how do they affect daily functioning?			
Monitor treatment			
Is the person taking any medication?	Yes / No		
Any adverse effects of medication (provide details)?			
Revise treatment as appropriate			
For how long has the person been symptom free?			
Recommendations			
Frequency of contact:			

Adapted from mhGAP operations manual: mental health Gap Action Programme (mhGAP) (1)

7.2 Referral form

This form is designed to assist health care providers in recording important information when referring a person with sequelae following acute meningitis. The form should be adapted to the specific context where it will be used to better suit the needs of the population.

			Original / copy
Referred by	Name:	Position:	
Initiating facility (name and address):			
Date of referral:	Facility Tel No.		
Referred to facility or service (name and address):			
Service user name:			
Identity number:		Age:	Sex: ☐ M ☐ F
Address:			
Health history:			
Assessment findings:			
Current treatment (medications or rehabilitation interventions):			
Reason for referral:			
Documents accompanying referral:			
Name:	Signature:	Date:	

Adapted from mhGAP operations manual: mental health Gap Action Programme (mhGAP) (1)

7.3 Back-referral form

This form is designed to assist health care providers in recording important information when referring back a person with sequelae following acute meningitis to the primary health care service. The form should be adapted to the specific context where it will be used to better suit the needs of the population.

				Original / copy
Back-referral from facility (name):			Tel. No.	
Reply from (person completing the form)				
Name:			Date:	
Position:			Specialty:	
To initiating facility:	Name:		Address:	
Service user name:				
Identity number:		Age:	Sex: ☐ M ☐ F	
Address:				
This person was seen by: (name and position)			On date:	
Health history:				
Assessment findings:				
Diagnosis:				
Treatment plan and follow-up:				
Medication prescribed:				
Rehabilitation interventions recommended:				
Please continue with: *(medications, prescriptions, rehabilitation care, follow-up)*:				
Refer back to:			On date:	
Print name, sign and date	Name:	Signature:	Date:	

Adapted from mhGAP operations manual: mental health Gap Action Programme (mhGAP) (1)

References for Annex 7

1. mhGAP operations manual: mental health Gap Action Programme (mhGAP). Geneva: World Health Organization; 2018 (https://iris.who.int/handle/10665/275386). Licence: CC BY-NC-SA 3.0 IGO.

For more information please contact:

Neurological, Sensory and Oral Conditions Unit
Department of Noncommunicable Diseases and Mental Health

World Health Organization
Avenue Appia 20
CH-1211 Geneva 27
Switzerland

Email: brainhealth@who.int
Website: https://www.who.int/health-topics/brain-health