WHO Guidelines on Meningitis Diagnosis, Treatment and Care

WHO EPI-WIN Webinar

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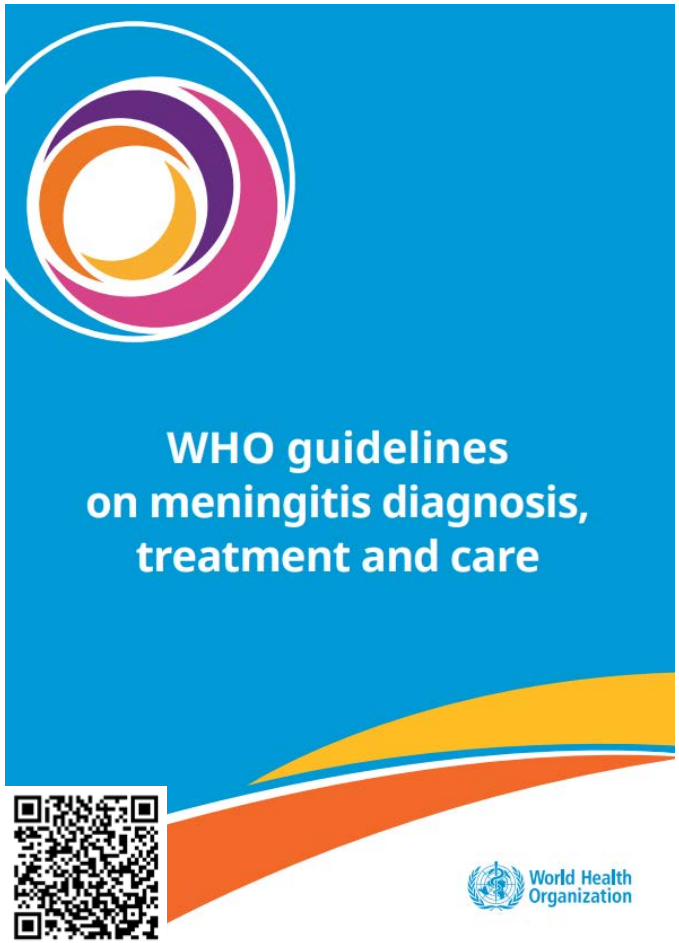
Health Emergencies Programme

World Health Organization

World Health Organization

DEFEATING MENINGITIS BY 2030
A GLOBAL ROAD MAP

Overview



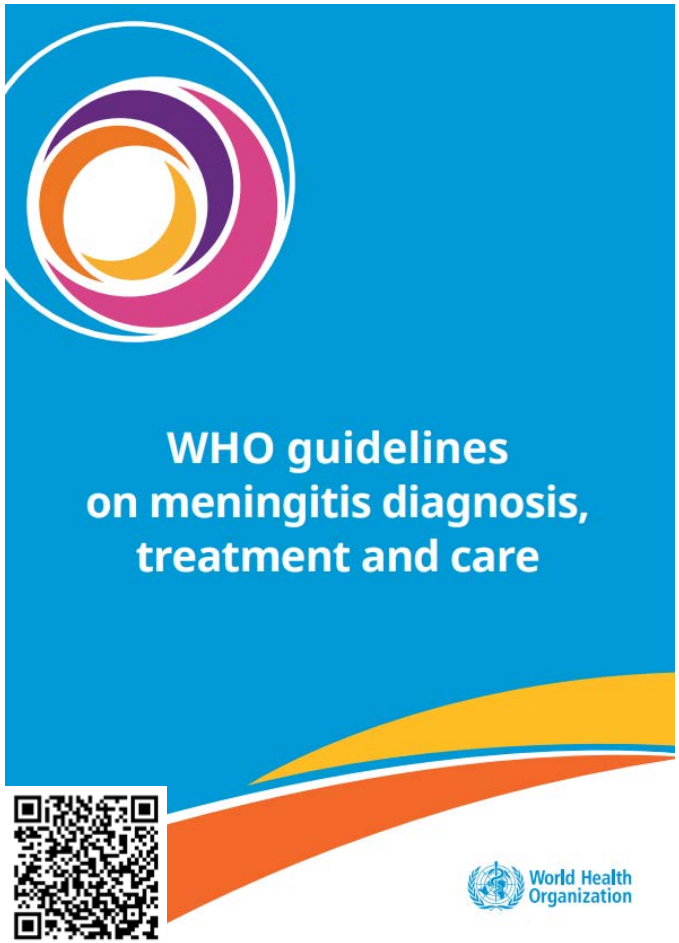
First-ever comprehensive WHO clinical guidelines on meningitis

37 recommendations based on 21 systematic reviews and accompanied by clinical remarks and implementation considerations

- Diagnosis (laboratory investigations and cranial imaging)
- Treatment (antibiotic therapy, adjunctive corticosteroids and supportive care)
- Management of sequelae

Globally applicable, including in resource-limited and emergency settings

Overview



Scope

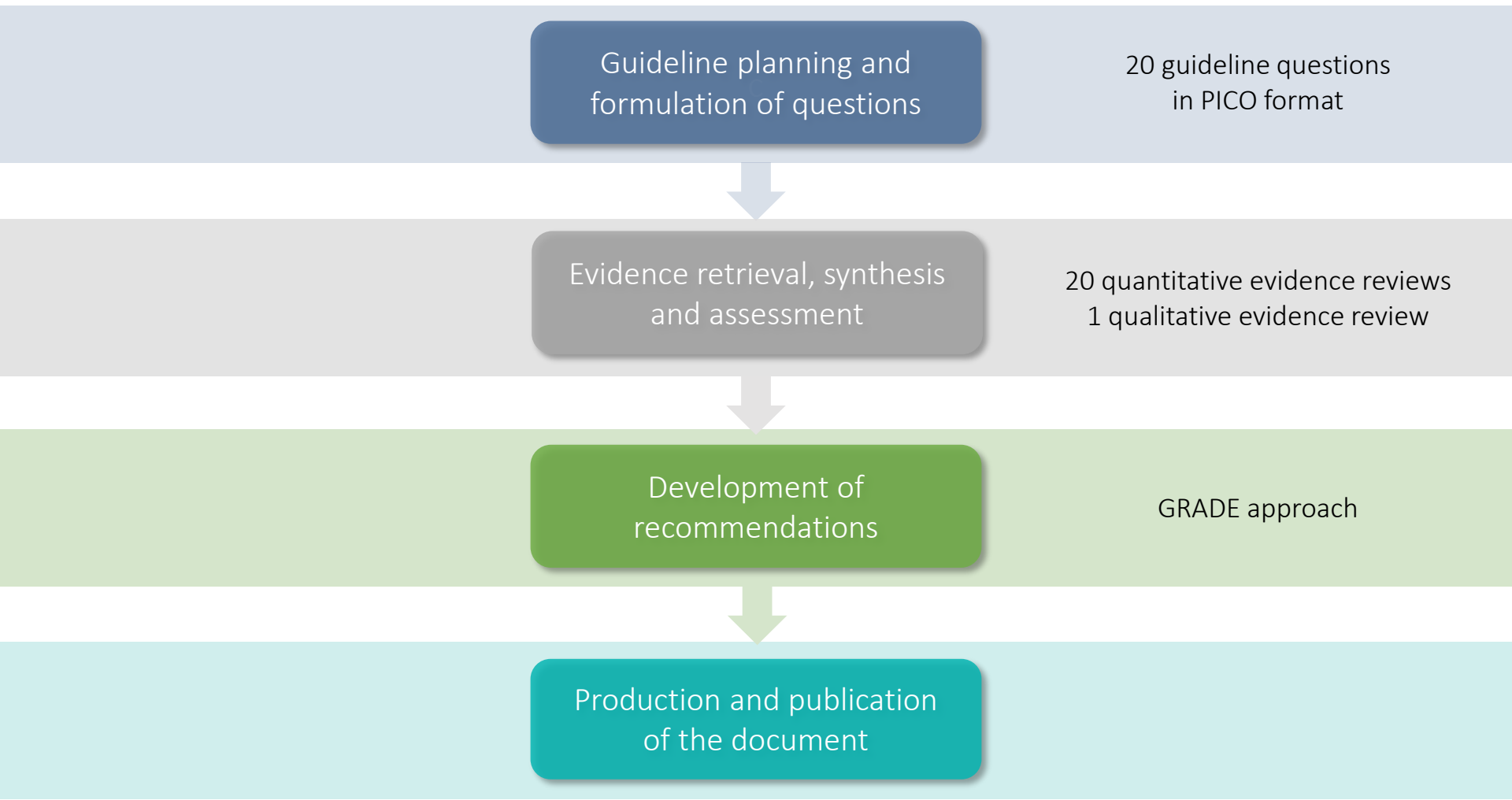
Inclusion criteria: acute-onset, community-acquired meningitis in adults, adolescents, and children > 1 month

Exclusion criteria: meningitis in neonates, hospital-acquired meningitis, subacute-chronic meningitis (e.g. TB and cryptococcal meningitis), non-infectious meningitis.

Target audience

- Healthcare providers working in first- or second-level healthcare facilities, including in resource-limited settings
- Ministries of Health and national public health bodies
- Academic institutions
- Non-governmental and civil society organizations

Methods

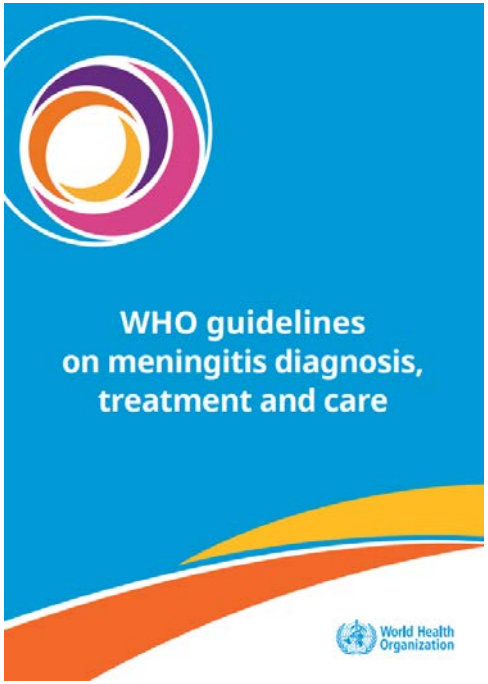

Guideline planning and formulation of questions
20 guideline questions in PICO format
Evidence retrieval, synthesis and assessment
20 quantitative evidence reviews
1 qualitative evidence review
Development of recommendations
GRADE approach
Production and publication of the document

Methods

Guideline Development Group (GDG)

Guideline methodologist

WHO Secretariat
WHO Steering Group



Evidence review teams (ERT)

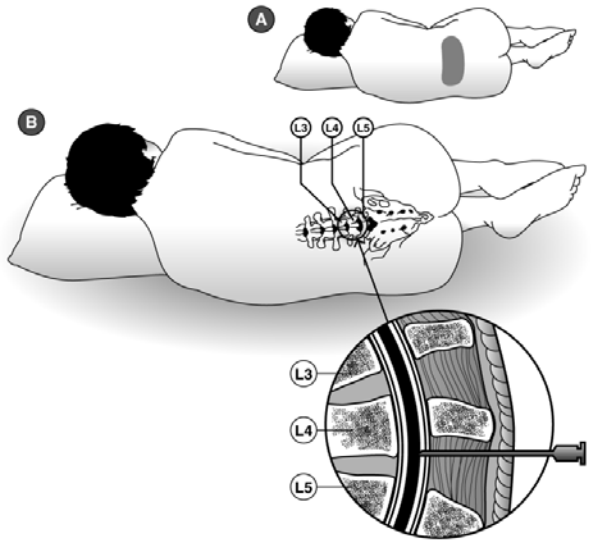
External review group (ERG)

Diagnosis

Lumbar puncture

Good practice statement

In individuals with suspected acute meningitis, lumbar puncture should be performed **as soon as possible**, preferably before the initiation of antimicrobial treatment, unless there are specific contraindications or reasons for deferral.



Lumbar puncture

Absolute contraindications

- Known or suspected bleeding disorder
- Skin or soft tissue infection or spinal epidural abscess overlying or close to to LP site
- Hemodynamic or respiratory compromise that requires clinical stabilization

Reasons for deferral (relative contraindications)

- Glasgow Coma Score < 10
- Focal neurological signs and/or cranial nerve deficits
- Papilledema
- New-onset seizures (in adults)
- Severe immunocompromised state

Strong recommendation

Treatment should not be delayed when lumbar puncture is deferred or for cranial imaging.

CSF initial investigations

CSF test	WHO recommendations
Macroscopic appearance	Indicated
Glucose (CSF-blood ratio)	Strongly recommended
Protein	Strongly recommended
White blood cell total count	Strongly recommended
White blood cell differential count	Strongly recommended
Red blood cell count	Indicated
Gram stain	Strongly recommended
Lactate	Conditionally recommended

CSF initial investigations

A **combined, integrated approach** to the interpretation of CSF findings is required to mitigate and minimize the risks associated with the diagnostic performance of individual tests.

The diagnostic yield of these CSF laboratory investigations may decrease when antimicrobial treatment is initiated prior to lumbar puncture.

In resource-limited settings, CSF laboratory investigations should be widely accessible in peripheral health facilities.

Where not available, CSF samples should be collected and appropriately transported to higher-level laboratories.

CSF initial investigations

Bacterial meningitis	Viral meningitis
Increased opening pressure	Normal or mildly elevated opening pressure
Turbid or cloudy appearance	Clear appearance
Marked leukocyte pleocytosis	Moderate leukocyte pleocytosis
Neutrophilic predominance	Lymphocytic predominance
Low CSF-to-blood glucose	Normal CSF-to-blood glucose
Markedly increased protein	Normal or mildly increased protein
Increased lactate (prior to antibiotics)	Normal lactate

CSF culture

Good practice statement

In individuals with suspected acute meningitis, CSF culture and antimicrobial susceptibility testing remain the **gold standard** for bacterial pathogen identification.

CSF collection should ideally be done as soon as possible because the diagnostic yield of culture decreases if the sample is collected after antimicrobial treatment has begun.

Culture and AST results should always be used to tailor antibiotic therapy based on the identified pathogen and antibiotic resistance patterns.

CSF PCR

Strong recommendation

In individuals with suspected acute meningitis, PCR-based molecular tests for relevant pathogens should be performed on CSF samples.

Results of PCR-based tests on CSF should be interpreted in the context of clinical presentation and additional laboratory findings.

CSF culture and AST should **not** be replaced by PCR and should be routinely performed as the gold standard tests for pathogen identification and characterization of drug-resistance profiles.

Blood culture

Good practice statement

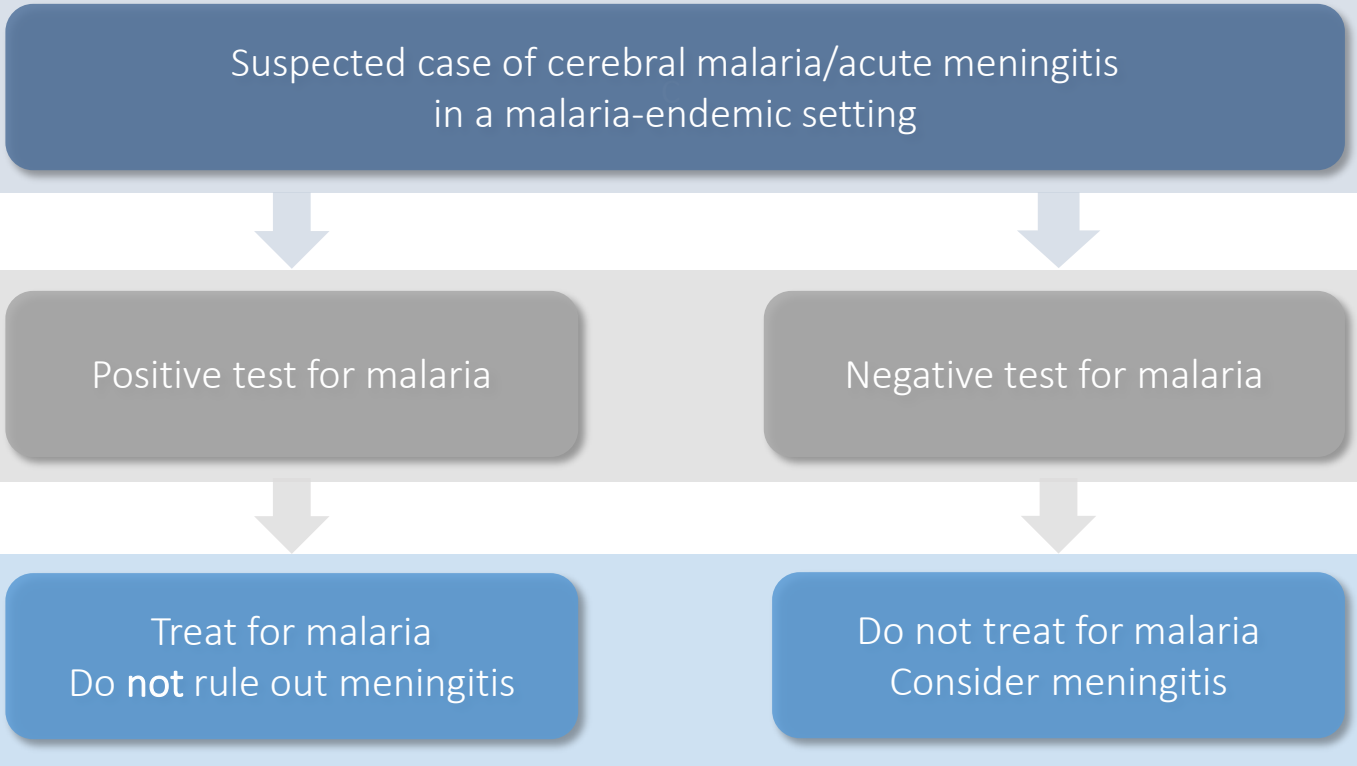
In individuals with suspected acute meningitis, blood cultures should be obtained as soon as possible, preferably before the initiation of antibiotic therapy.

Culture and AST results should always be used to tailor antibiotic therapy based on the identified pathogen and antibiotic resistance patterns.

Blood testing

Blood test	WHO recommendations
White blood cell total count	Conditionally recommended (where resource allow)
White blood cell differential count	Conditionally recommended (where resource allow)
C-reactive protein	Conditionally recommended (where resource allow)
Procalcitonin	Conditionally recommended (where resource allow)
Glucose	To calculate CSF-blood glucose ratio
Serum electrolytes and organ function tests	To initially assess the patient (where resource allow)
Disease-specific serology (e.g. HIV test)	When certain viral or bacterial etiologies are suspected
Malaria test (i.e. microscopy or RDT)	In malaria-endemic areas

Malaria testing



Cranial imaging

Strong recommendation

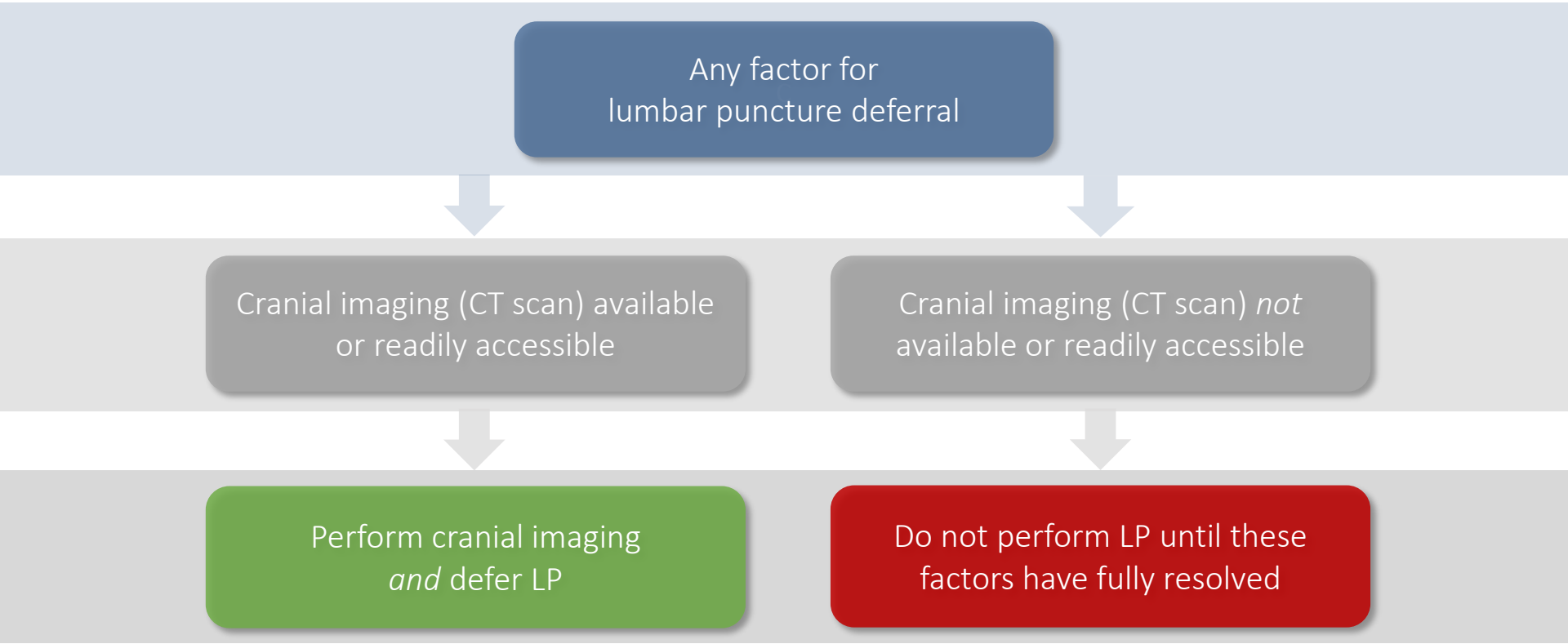
In individuals with suspected acute meningitis, cranial imaging should not be performed routinely.

Strong recommendation

Cranial imaging should be performed prior to lumbar puncture to rule out cerebral space-occupying lesions with midline shift, if any of the following features are identified at time of presentation:

- Glasgow Coma Score below 10
- Focal neurological signs
- Cranial nerve deficits
- Papilledema
- New-onset seizures (in adults)
- Severe immunocompromised state

Cranial imaging



Treatment

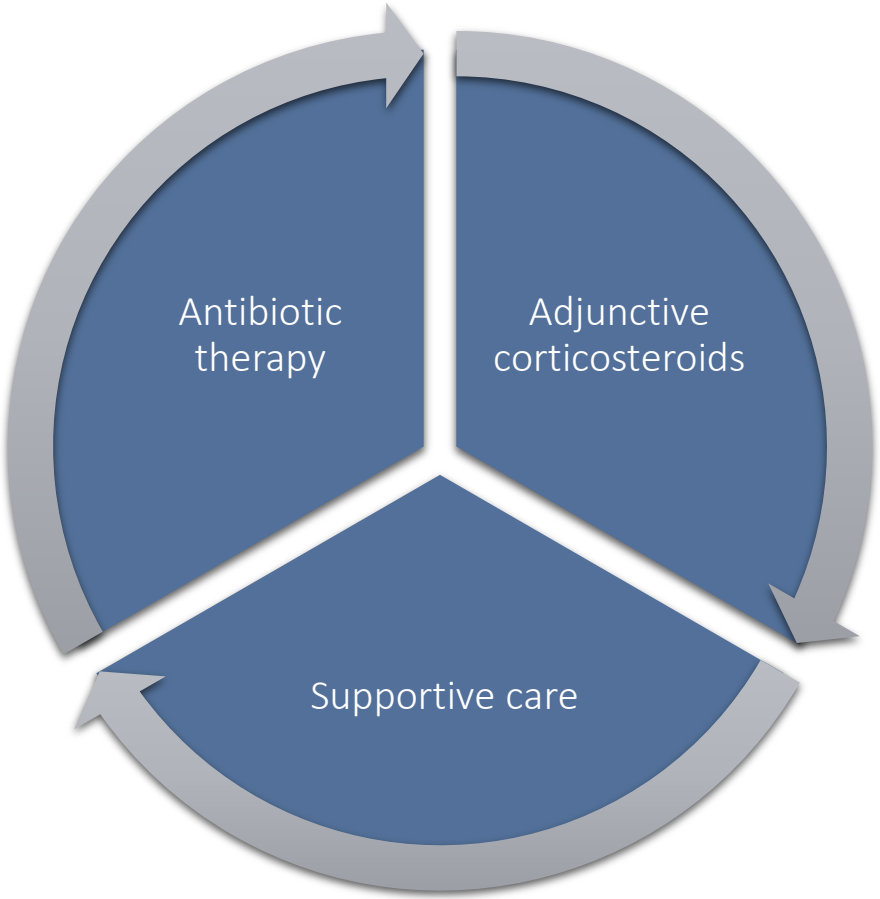
Overview

Good practice statement

Individuals with suspected acute meningitis should be immediately admitted or urgently transferred to an **appropriate health-care facility** for further management.

An appropriate health-care facility is defined as one where lumbar puncture can be performed and adequate monitoring and management of severe illness can be ensured.

Overview


Antibiotic therapy
Adjunctive corticosteroids
Supportive care

Early antibiotic therapy

Strong recommendation

In individuals with suspected acute meningitis *admitted to an appropriate health-care facility,* empiric intravenous antimicrobial treatment should be administered **as early as possible**.

The “1-hour window” is regarded as the golden time period to initiate empiric antibiotic therapy.

Any delay in diagnostic investigations should not delay therapy administration.

Early antibiotic therapy

Suspected case of meningitis in an appropriate healthcare facility

LP can be performed and adequate management of severe illness ensured.

Collect blood samples and perform lumbar puncture

In the absence of absolute contraindications or reasons for deferral

Start empiric antibiotic therapy as soon as possible

Ideally within 1 hour of admission

Pre-referral antibiotic therapy

Meningitis suspected case in a health center

LP cannot be performed or adequate management of severe illness ensured.

Refer the patient to appropriate healthcare facility

Consider pre-referral antibiotic therapy

When a clinically significant delay in transfer is expected

Pre-referral antibiotic therapy

Conditional recommendation

In individuals with suspected acute meningitis, empiric parenteral antimicrobial treatment **before admission or transfer** to an appropriate health-care facility should be considered.

Parenteral antimicrobial treatment may be beneficial where acute bacterial meningitis is strongly suspected and a clinically significant delay in transfer or referral is considered likely.

Antimicrobial treatment should be administered intravenously. If IV administration is not possible and/or an intravenous line is not secured, IM administration should be pursued.

Empiric antibiotic therapy

Strong recommendation

In individuals with suspected or probable acute bacterial meningitis, intravenous **ceftriaxone or cefotaxime** should be administered as empiric treatment.

Strong recommendation

In the presence of one or more risk factors for *Listeria monocytogenes* infection (i.e. age over 60 years, pregnancy, immunocompromised state), intravenous **ampicillin or amoxicillin** should be administered in addition to the initial antimicrobial regimen.

Conditional recommendation

In areas with high prevalence of penicillin or third-generation cephalosporin resistance of *Streptococcus pneumoniae*, intravenous **vancomycin** should be considered in addition to the initial antimicrobial regimen.

Specific antibiotic therapy

As soon as a bacterial pathogen is isolated and AST results are known, antibiotic therapy should be reviewed and optimized accordingly (**antimicrobial stewardship**).

Pathogen	Specific therapy	Overall duration
Streptococcus pneumoniae Penicillin-susceptible Penicillin-resistant Cephalosporin-resistant	Penicillin G / Ampicillin / Amoxicillin Ceftriaxone / Cefotaxime Vancomycin + Rifampicin *or* Vancomycin / Rifampicin + Ceftriaxone / Cefotaxime	10-14 days
Neisseria meningitidis Penicillin-susceptible Penicillin-resistant	Penicillin G / Ampicillin / Amoxicillin Ceftriaxone / Cefotaxime	5-7 days
Haemophilus influenzae Beta-lactamase-negative Beta-lactamase-positive	Ampicillin / Amoxicillin Ceftriaxone / Cefotaxime	7-10 days
Streptococcus agalactiae	Penicillin G / Ampicillin / Amoxicillin	14-21 days
Listeria monocytogenes	Penicillin G / Ampicillin / Amoxicillin	21 days

Antibiotic therapy

Conditional recommendation

In non-epidemic settings, in individuals with suspected or probable acute bacterial meningitis and no pathogen identification, discontinuation of empiric antibiotic therapy may be considered after 7 days if the person has clinically recovered.

Antibiotic therapy during outbreaks

During meningococcal and pneumococcal disease epidemics, intravenous **ceftriaxone** should be used in monotherapy and preferred over cefotaxime (wider availability, longer half life, known efficacy in reducing infection transmission).

Ceftriaxone should be used at maximum dosage and administered every 12 hours in an inpatient setting.

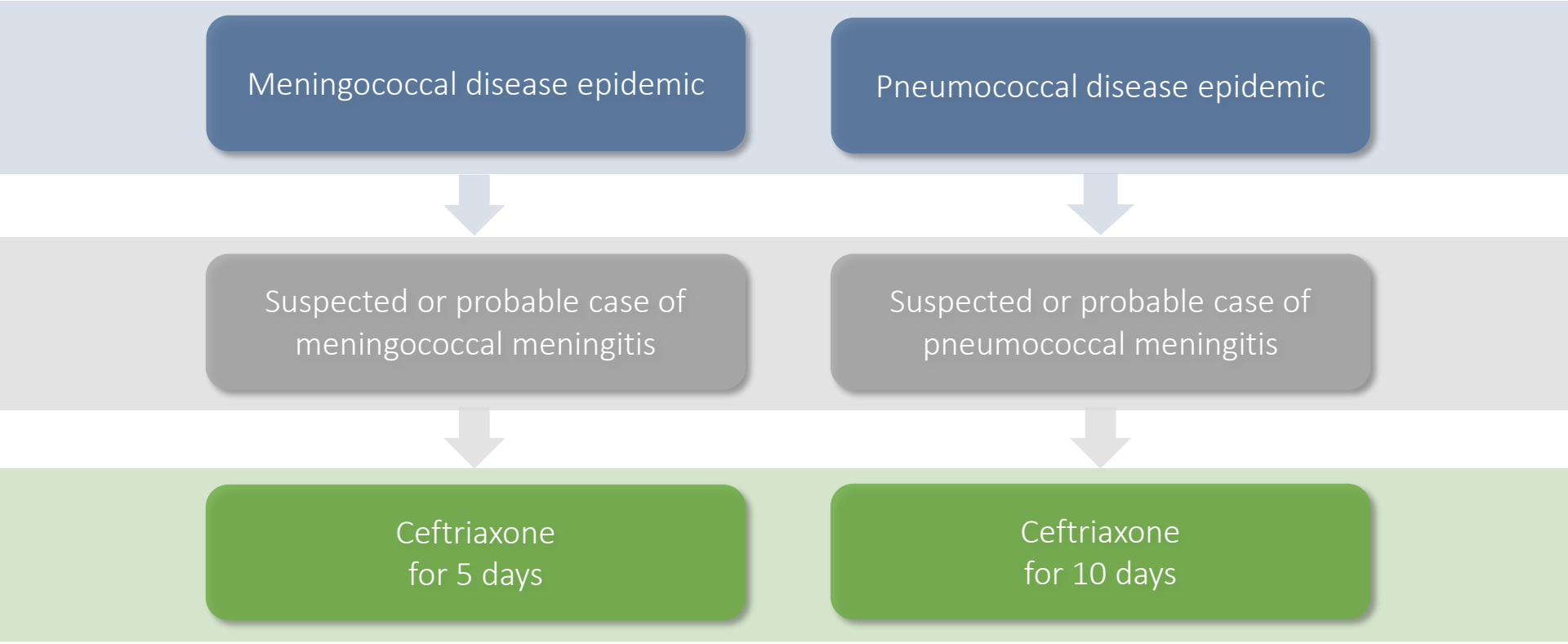
Strong recommendation

During meningococcal disease epidemics, empiric treatment with parenteral ceftriaxone should be administered for **5 days** to individuals with suspected or probable meningococcal meningitis.

Conditional recommendation

During pneumococcal disease epidemics, empiric treatment with parenteral ceftriaxone for **10 days** should be considered for individuals with suspected or probable pneumococcal meningitis.

Antibiotic therapy during outbreaks



Antibiotic therapy during outbreaks

When inpatient completion of antibiotic therapy is not feasible

If the person is clinically stable and can return to the health facility every day, they can be discharged and given parenteral ceftriaxone at full dose once daily to complete treatment in an outpatient setting.

When a 5-day regimen is not feasible during large-scale meningococcal disease epidemics

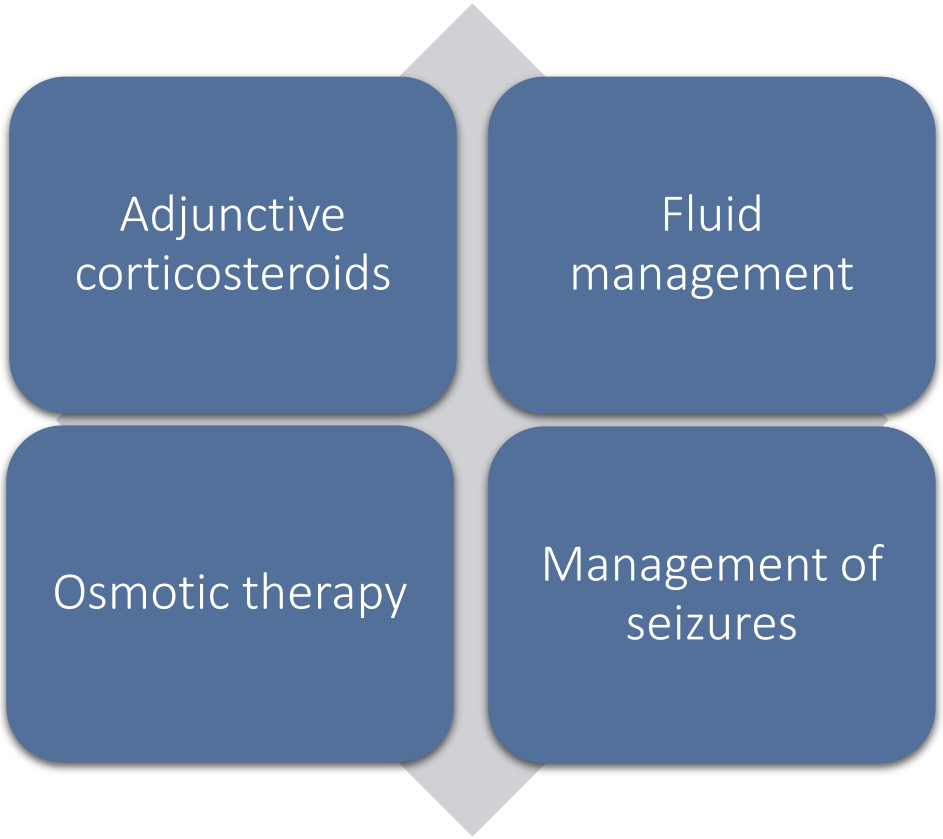
Single-dose treatment protocols may be implemented, provided that:

- There is laboratory confirmation that the epidemic is caused by *N. meningitidis*, and
- The person can be reviewed after 24 and 48 hours.

In the absence of clinical recovery, the person should be hospitalized, and empiric treatment extended.

During meningococcal or pneumococcal disease epidemics, antibiotic treatment should be provided **free of charge** in government health services.

Adjunctive and supportive therapy



Adjunctive corticosteroids

In **selected cases**, adjunctive corticosteroids can be given in addition to antibiotics to reduce the risk of death and neurological complications among individuals with acute bacterial meningitis.

Adjunctive corticosteroids outside outbreaks

Strong recommendation

In non-epidemic settings *where lumbar puncture can be performed*, IV corticosteroids should be initiated with the first dose of antibiotics in individuals with suspected acute bacterial meningitis.

Conditional recommendation

In non-epidemic settings *where lumbar puncture cannot be performed*, IV corticosteroids may be initiated with the first dose of antibiotics when acute bacterial meningitis is strongly suspected and no concurrent condition contraindicates their use.

Dexamethasone should be considered the corticosteroid of choice.

When dexamethasone cannot be administered, hydrocortisone or methylprednisolone may be used at the equivalent dosage.

Adjunctive corticosteroids during outbreaks

Strong recommendation

During meningococcal disease epidemics, intravenous corticosteroids should not be routinely used in individuals with suspected or probable meningococcal meningitis

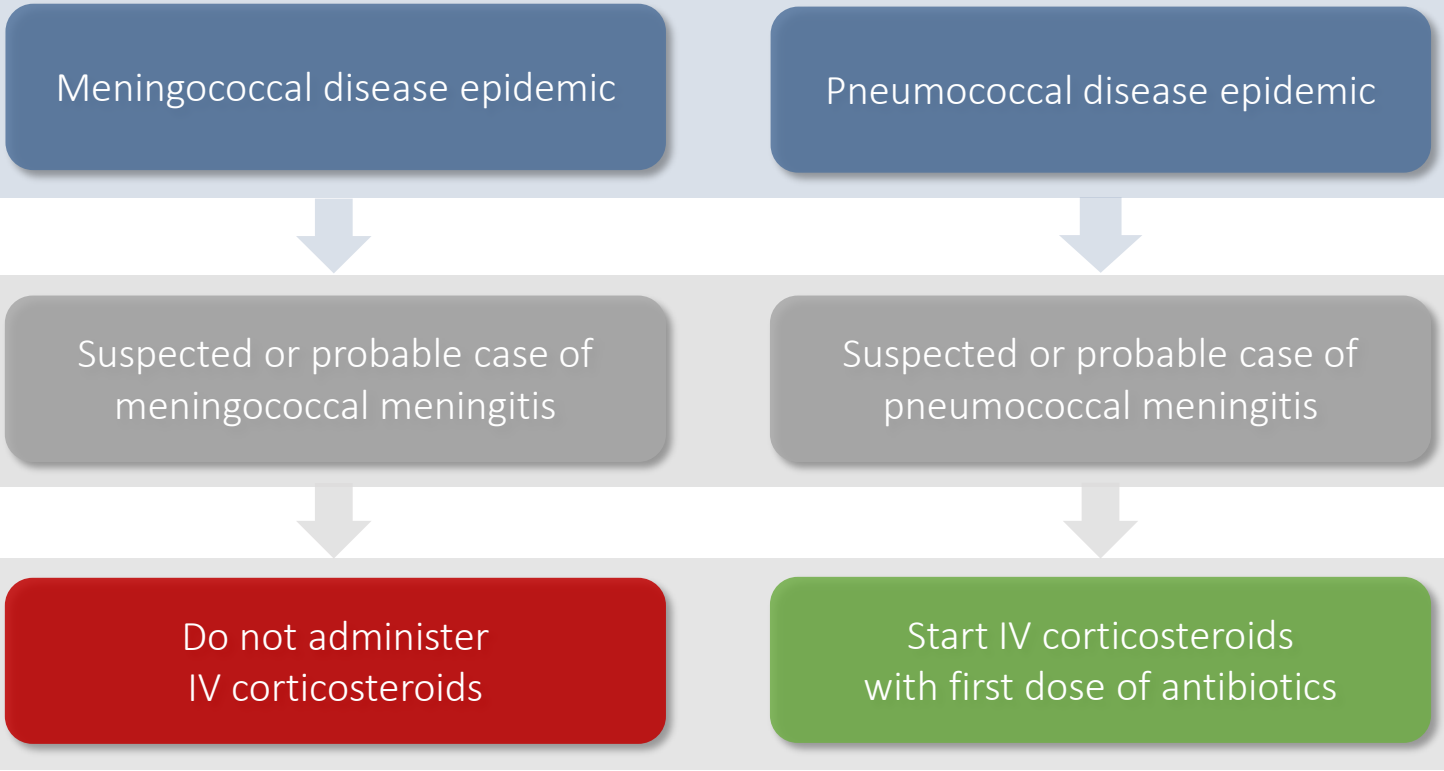
Strong recommendation

During pneumococcal disease epidemics, intravenous corticosteroids should be initiated with the first dose of antibiotics in individuals with suspected or probable pneumococcal meningitis.

Dexamethasone should be considered the corticosteroid of choice.

When dexamethasone cannot be administered, hydrocortisone or methylprednisolone may be used at the equivalent dosage.

Adjunctive corticosteroids during outbreaks



Osmotic therapy

Conditional recommendation

Glycerol should not be used routinely as adjunctive therapy in individuals with suspected, probable or confirmed acute bacterial meningitis.

Hypertonic saline and mannitol may be used as a temporary measure for the management of increased intracranial pressure.

Fluid management

Conditional recommendation

Fluid intake should not be routinely restricted in individuals with suspected, probable or confirmed acute bacterial meningitis.

Maintenance fluids are preferably administered **orally or by enteric tube** (e.g. nasogastric tube). Among infants and young children, breastfeeding is the ideal method of hydration.

When fluids cannot be administered orally or by enteric tube, **isotonic solutions** (Ringer's lactate, normal saline) should be routinely used as maintenance intravenous fluids.

Management of seizures

The decision to start anti-seizure medicines immediately after a first symptomatic seizure among individuals with meningitis depends on multiple factors (e.g. clinical stability and estimated risk of recurrent seizures).

Conditional recommendation

In individuals with acute symptomatic seizures from meningitis, anti-seizure medicines should be continued for no longer than three months, in the absence of any recurring seizures.

Management of sequelae

Management of sequelae

Clinical intervention	WHO recommendation
Assessment for sequelae before discharge and at follow-up	Strongly recommended
Audiological screening before discharge or within 4 weeks	Strongly recommended
Early rehabilitation for individuals with sequelae	Strongly recommended
Early hearing rehabilitation for individuals with hearing loss	Strongly recommended

Post-exposure antibiotic prophylaxis

Post-exposure antibiotic prophylaxis

Antibiotic prophylaxis is given to close contacts of cases of **meningococcal disease** (with or without meningitis) to prevent secondary cases and/or decrease asymptomatic nasopharyngeal carriage of meningococcal infection.

Close contacts should be defined based on context-specific considerations and available resources.

Between 7 days before symptom onset and until 24 hours after initiation of antibiotic therapy in an index case, people at higher risk include:

- Individuals with prolonged exposure while in close proximity (<1 m) to the index case (e.g. household contacts)
- Individuals directly exposed to oral secretions of the index case (e.g. via kissing, mouth-to-mouth resuscitation, endotracheal intubation).

Post-exposure antibiotic prophylaxis

Antibiotic regimens are those proven effective in eradicating nasopharyngeal carriage.

The choice of antibiotic should be guided by **antimicrobial susceptibility patterns** prevalent within the community and potentially adjusted as necessary based on susceptibility testing results from index cases (increasing incidence of ciprofloxacin-resistant strains).

Antibiotic	Route	Duration	WHO recommendations
Ceftriaxone	IM	Single dose	Strongly recommended (based on known AST patterns)
Ciprofloxacin	PO	Single dose	Strongly recommended (based on known AST patterns)
Rifampicin	PO	Two days	Conditionally recommended (i.e. when ceftriaxone or ciprofloxacin cannot be administered)

Post-exposure antibiotic prophylaxis

Epidemiological setting	Target population
Sporadic disease	Close contacts of laboratory-confirmed cases
Small-scale outbreak	Close contacts of laboratory-confirmed or clinically suspected cases (based on available resources)
Large-scale epidemic	Close contacts of clinically suspected cases

Next steps to support outbreak control

Next steps to support outbreak control

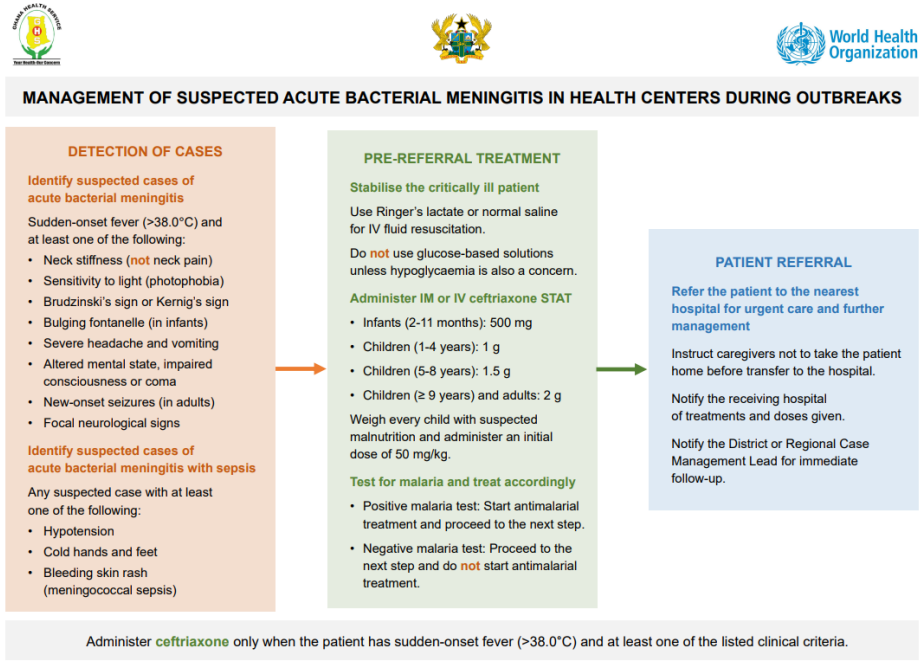
Translation into all UN languages and global dissemination efforts through MoH and national public health bodies

Revision and updating of standard case definitions of bacterial meningitis and meningococcal disease for outbreak investigation and response

Development of job aids and clinical tools for frontline healthcare professionals

Outbreak response in Ghana (early 2025)

Development of context-adapted job aids and clinical capacity strengthening in affected areas



World Health Organization

MANAGEMENT OF SUSPECTED ACUTE BACTERIAL MENINGITIS IN HEALTH CENTERS DURING OUTBREAKS

DETECTION OF CASES

Identify suspected cases of acute bacterial meningitis

Sudden-onset fever (>38.0°C) and at least one of the following:

- Neck stiffness (not neck pain)
- Sensitivity to light (photophobia)
- Brudzinski's sign or Kernig's sign
- Bulging fontanelle (in infants)
- Severe headache and vomiting
- Altered mental state, impaired consciousness or coma
- New-onset seizures (in adults)
- Focal neurological signs

Identify suspected cases of acute bacterial meningitis with sepsis

Any suspected case with at least one of the following:

- Hypotension
- Cold hands and feet
- Bleeding skin rash (meningococcal sepsis)

PRE-REFERRAL TREATMENT

Stabilise the critically ill patient

Use Ringer's lactate or normal saline for IV fluid resuscitation.

Do not use glucose-based solutions unless hypoglycaemia is also a concern.

Administer IM or IV ceftriaxone STAT

- Infants (2-11 months): 500 mg
- Children (1-4 years): 1 g
- Children (5-8 years): 1.5 g
- Children (≥ 9 years) and adults: 2 g

Weigh every child with suspected malnutrition and administer an initial dose of 50 mg/kg.

Test for malaria and treat accordingly

- Positive malaria test: Start antimalarial treatment and proceed to the next step.
- Negative malaria test: Proceed to the next step and do not start antimalarial treatment.

PATIENT REFERRAL

Refer the patient to the nearest hospital for urgent care and further management

Instruct caregivers not to take the patient home before transfer to the hospital.

Notify the receiving hospital of treatments and doses given.

Notify the District or Regional Case Management Lead for immediate follow-up.

Administer ceftriaxone only when the patient has sudden-onset fever (>38.0°C) and at least one of the listed clinical criteria.

Efforts coordinated with national, regional and district health authorities

Thank you