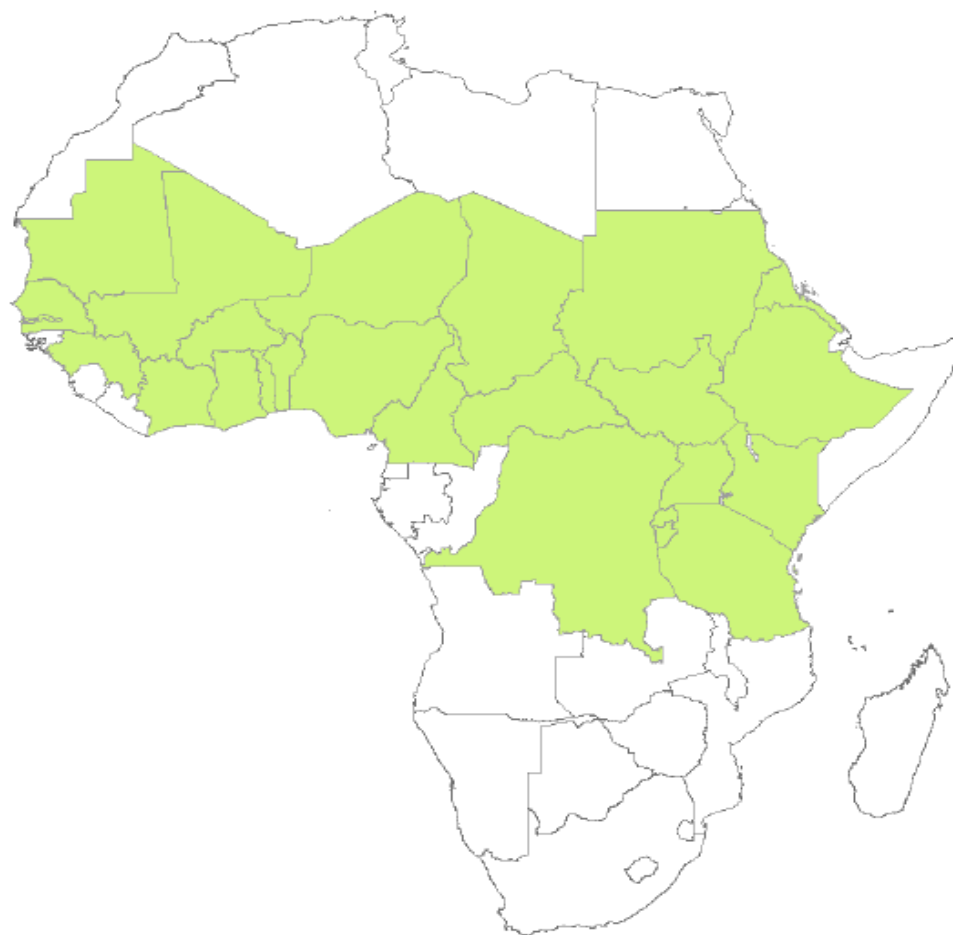




**World Health  
Organization**

REGIONAL OFFICE FOR **Africa**

**Standard operating procedures for surveillance  
of meningitis preparedness and response to  
epidemics in Africa**



October 2018

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**WORLD HEALTH ORGANIZATION  
REGIONAL OFFICE FOR AFRICA  
BRAZZAVILLE • 2019**

## Standard operating procedures for surveillance of meningitis preparedness and response to epidemics in Africa

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Designed by TIP Unit, Brazzaville, Republic of Congo

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## FOREWORD

This second edition of the WHO-AFRO Standard Operating Procedures (SOPs) for Surveillance of Meningitis, Preparedness and Response to Meningitis Epidemics in Africa has incorporated the SOPs for Enhanced and Case-based Surveillance (both versions dated January 2017).

All countries in the African meningitis belt undertake enhanced surveillance (ES) for meningitis. Following the introduction in 2010 of MenAfriVac<sup>®</sup>, a serogroup A meningococcal conjugate vaccine, some countries or parts of countries (for example Burkina Faso, Mali, Niger, Togo, Chad) have also introduced Case-based surveillance (CBS). The principal aim of ES is to strengthen outbreak detection across the meningitis belt to initiate a rapid response to meningitis epidemics. The principal aim of CBS is to evaluate the effectiveness and impact of new vaccines against bacterial meningitis. Both monitor the epidemiology of meningitis due to meningococcal serogroups and other bacterial pathogens.

Separate SOPs were developed for the two surveillance strategies. However, since those countries and parts of countries implementing CBS must also continue ES, a request from countries was that the two SOPs should be merged into one document to facilitate implementation and training.

CBS was introduced in selected countries of the Belt to evaluate MenAfriVac<sup>®</sup> vaccine and should be continued where possible in countries with high surveillance performance if resources permit. This will also allow to evaluate future new vaccines. The main distinguishing feature of CBS is that epidemiological and microbiological data are collected and linked for each case of meningitis, with reporting and analysis at individual case level, whereas ES relies on timely reporting and analysis of aggregate data by week to prepare for and respond promptly to epidemics. CBS does not necessarily cover all districts in all countries and is not designed for timely detection of an epidemic or for launching a rapid response; therefore, it does not replace the need for universal ES. It is not intended that all countries should adopt CBS but that they should consider introduction into all or selected districts as and when resources allow this to happen.

The aim of these SOPs in Africa is to guide health personnel from various levels of the health system in the implementation of enhanced, and where relevant, case-based surveillance of meningitis.

Finally, we invite healthcare stakeholders at all levels to adopt this document for effective conduct of meningitis surveillance, epidemic preparedness and response activities.

## ACRONYMS

AFP	Acute flaccid paralysis
ATB	Antibiogram
CBS	Case-based surveillance
CC	Collaborating Centre
CMYP	Comprehensive multi-year plans
CSF	Cerebrospinal Fluid
DH	District Hospital
DHMT	District Health Management Team
DMO	District Medical Officer
DNA	Deoxyribonucleic acid
DPC	Disease Prevention and Control
EPI	Expanded Program on Immunization
EPR	Epidemic Preparedness and Response
ES	Enhanced Surveillance
GND	Gram negative diplococcus
GPB	Gram-Positive Bacillus
GPD	Gram positive diplococcus
HF	Health Facility
Hib	<i>Haemophilus influenzae</i> type b
ICG	International Coordinating Group
IDSR	Integrated Disease Surveillance and Response
IM	Intra-muscular
IST	Intercountry Support Team for West Africa, WHO
IV	Intravenous
LP	Lumbar Puncture
MenAfriVac <sup>®</sup>	Serogroup A meningococcal conjugate vaccine
MGG	May-Grümwald Giemsa
Nm	<i>Neisseria meningitidis</i>
NmA, NmC	<i>Neisseria meningitidis</i> serogroups A, C, ...
NRL	National Reference Laboratory
PCR	Polymerase Chain Reaction
PHMEC	Public Health Management Emergency Committee
QA/QC	Quality Assurance / Quality Control
QC	Quality Control
RDH	Regional Directorate for Health
RDT	Rapid Diagnostic Test



RRT	Rapid Response Team
SOP	Standard Operating Procedure
TI	Trans-Isolate
WHO-AFRO	World Health Organization Regional Office for Africa



## 1. BACKGROUND

Epidemic meningitis is a major public health challenge in the African 'meningitis belt', an area that extends from Senegal to Ethiopia with an estimated total population of 500 million. Since 2002, the World Health Organization (WHO), in collaboration with its collaborating centres for meningitis, has progressively supported countries in implementing a strategy of ES for meningitis. The strategy is the recommended standard for all countries of the Belt and it is now actively being implemented at different levels in all countries.

Timely containment and adequate case management of epidemics depend on accurate diagnosis of the disease and laboratory confirmation of the causal organism. Enhanced epidemiologic and laboratory surveillance enable early detection of epidemics, identification of the serogroup responsible and the use of the appropriate vaccine to protect the population, thus preventing further spread of the disease, deaths or disabilities. Lessons learned from the implementation of enhanced surveillance highlight that putting in place adequate laboratory reagents, equipment and materials, training of health personnel as well as clear operating procedures are critical for the containment of meningitis epidemics.

### *Updated Vaccine Preventable Disease (VPD) surveillance standards<sup>1</sup>*

In 2018 WHO updated the VPD global surveillance standards. For *Neisseria meningitidis*, the standards now recommend the surveillance of Invasive Meningococcal Disease (IMD), which is a change from the 2003 surveillance standards that described syndromic bacterial meningitis surveillance. IMD includes meningitis and septicaemia, but *N. meningitidis* can also rarely cause arthritis, myocarditis, pericarditis, invasive pneumonia, necrotizing fasciitis and endophthalmitis. The change reflects increasing global laboratory capacity and changing meningococcal epidemiology. It is recommended that all countries in the world should aim to undertake IMD surveillance, which focuses on cases of IMD based on laboratory confirmation or strict clinical grounds (characteristic haemorrhagic rash). However, meningitis surveillance should still be implemented in countries with a historically significant burden of bacterial meningitis or limited confirmation capacity. Hence meningitis is still the focus of the current revised SOPs for the countries of African the meningitis belt. It is recommended however that countries progressively start detecting and reporting IMD to adhere to the new VPD standards.

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<sup>1</sup> [http://www.who.int/immunization/monitoring\\_surveillance/burden/vpd/standards/en/](http://www.who.int/immunization/monitoring_surveillance/burden/vpd/standards/en/)

## 2. OBJECTIVES OF MENINGITIS SURVEILLANCE

### 2.1 General objective

To contribute to the reduction of morbidity and mortality of meningitis through the strengthening of detection systems, confirmation and rapid response to meningitis epidemics in Africa.

### 2.2 Specific objectives

- To detect outbreaks in a timely fashion.
- To guide and assess response strategies.
- To identify population and areas at risk.
- To monitor the epidemiology of meningitis including serogroup shifts.
- To assess impact of meningitis vaccination programmes.
- To monitor the antibiotic susceptibility of identified bacteria.
- Better understanding of disease burden.
- Detection of new and emerging strains.

## 3. ENHANCED AND CASE-BASED SURVEILLANCE OF MENINGITIS

### 3.1 Enhanced Surveillance and its objectives

Enhanced surveillance is the cornerstone of meningitis surveillance, as meningitis epidemics persist. The primary objective of enhanced meningitis surveillance is the detection of outbreaks to initiate a rapid and adequate response. ES occupies a unique position within the more general framework of the Integrated Disease Surveillance and Response (IDSR) strategy and is the basic strategy for meningitis surveillance in this area. It is a population-based approach that uses aggregated data to calculate weekly incidence rates in the districts; epidemiological surveys and containment measures are then conducted accordingly. Data is collected using a standard reporting form for each individual suspect case, which is entered in a line list. The essential data for epidemic detection is then transmitted in an aggregated form to ensure timeliness of response. Reliable laboratory confirmation is required to identify the pathogen responsible for the outbreak. Confirmation throughout the outbreak is also important to find out if the distribution of the responsible serogroups has changed. It is recommended to collect the CSF of at least 50% of suspected cases. Countries send their aggregated (epidemiological and laboratory) data every week to the West Africa Intercountry Support Team.

### Specific ES objectives

- To detect outbreaks in a timely fashion.
- To guide and assess response strategies.
- To identify populations and areas at risk.
- To monitor the antibiotic susceptibility of identified bacteria.
- To monitor the epidemiology of meningitis including serogroup shifts.
- Estimation of disease burden of different pathogens.
- To detect new and emerging strains.

## 4. CASE-BASED SURVEILLANCE AND ITS OBJECTIVES

In 2010, the conjugate vaccine against serogroup A *Neisseria meningitidis* was widely introduced in the African meningitis belt. Such an immunization program substantially changes the epidemiology of the disease and requires more detailed monitoring of cases in some countries that have introduced the conjugate vaccine, allowing to assess the impact of the introduction. In addition, multivalent conjugate vaccines are being considered for introduction in the region in the coming years. This necessitates a precise monitoring of the evolving epidemiology, including the circulating strains. The objectives of Case-Based Surveillance (CBS) include:

- Contribute to the assessment of the effectiveness of the conjugate vaccine, and its long-term monitoring;
- Assess the impact of immunization on the disease;
- Monitor its impact on the circulation of the various serogroups and on the epidemic characteristics, to be able to study a possible replacement of serogroup A;
- Allow assessment of vaccine safety.

CBS allows obtaining epidemiological and microbiological information on each suspected case of meningitis; at the individual level, both types of information are linked for each case. The "case"-based terminology implies a focus on information at the case level rather than "population"-based". Individual data include for example the person's immunization in the relation to the MenA conjugate vaccine. It should be noted that CBS is established on a given geographical scale (country or district), it provides information that is applicable for the population of the area under surveillance (for example, incidence rate of meningitis in the district) allowing to determine its epidemiological and bacteriological profile.

## 5. CHOICE OF TYPE OF SURVEILLANCE

Countries must adapt the surveillance of meningitis to their own context, while maintaining the production of high quality systematic data in a practical, standardized and timely manner. In the context of continuing meningitis epidemics, the most important objective of meningitis surveillance

is to rapidly respond to these outbreaks. As this is the main objective of ES, it remains essential in all districts and areas of the meningitis belt. CBS is complementary to ES, it may also be implemented country-wide or in selected districts, to the extent that resources and capacities permit. In other words, all districts in the meningitis belt should implement ES, and some may implement both ES & CBS.

## 6. DEFINITIONS

### 6.1 Case definitions for bacterial meningitis

#### **Suspected meningitis case:**

Any person with sudden onset of fever (>38.5 °C rectal or 38.0 °C axillary), and neck stiffness or other meningeal signs, including bulging fontanelle in infants.

#### **Probable meningitis case:**

Any suspected case with macroscopic aspect of cerebrospinal fluid (CSF) turbid, cloudy or purulent; or with a CSF leukocyte count >10 cells/mm<sup>3</sup> or with bacteria identified by Gram stain in CSF; or positive antigen detection (for example, by latex agglutination testing) in CSF

**In infants:** CSF leucocyte count >100 cells/mm<sup>3</sup>; or CSF leucocyte count 10–100 cells/mm<sup>3</sup> and either an elevated protein (>100 mg/dl) or decreased glucose (<40 mg/dl) level.

#### **Confirmed meningitis case**

Any suspected or probable case that is laboratory confirmed by culturing or identifying (i.e. polymerase chain reaction) a bacterial pathogen (*Neisseria meningitidis*, *Streptococcus pneumoniae*, *Haemophilus influenzae type b*) in the CSF or blood

## 7. EPIDEMIOLOGICAL THRESHOLDS

Improving timeliness of response and lowering the alert threshold were recommended in the 2014 revised WHO guidance for meningitis outbreak response.<sup>2</sup>

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<sup>2</sup> World Health Organization. (2014) Weekly epidemiological record. Revised guidance on meningitis outbreak response in sub-Saharan Africa. No.51/52, 2014, vol.89, pp 580-586. [http://www.who.int/wer/2014/wer8951\\_52/en/](http://www.who.int/wer/2014/wer8951_52/en/)

Population		
Intervention	30 000–100 000*	Under 30 000
<b>Alert threshold</b> <ul style="list-style-type: none"> <li>• Inform authorities</li> <li>• Strengthen surveillance</li> <li>• Investigate</li> <li>• Confirm (including laboratory)</li> <li>• Prepare for eventual response</li> </ul>	<ul style="list-style-type: none"> <li>• 3 suspected cases/100 000 inhabitants / week</li> </ul> (Minimum of 2 cases in one week)	<ul style="list-style-type: none"> <li>• 2 suspected cases in one week</li> </ul> <p style="text-align: center;"><b>Or</b></p> <ul style="list-style-type: none"> <li>• An increased incidence compared to previous non-epidemic years</li> </ul>
<b>Epidemic threshold</b> <ul style="list-style-type: none"> <li>• Mass vaccination within 4 weeks of crossing the epidemic threshold***</li> <li>• Distribute treatment to health centres</li> <li>• Treat according to epidemic protocol</li> <li>• Inform the public</li> </ul>	<ul style="list-style-type: none"> <li>• 10 suspected cases/100 000 inhabitants / week</li> </ul>	<ul style="list-style-type: none"> <li>• 5 suspected cases in one week**</li> </ul> <p style="text-align: center;"><b>Or</b></p> <ul style="list-style-type: none"> <li>• Doubling of the number of cases in a three-week period e.g. Week 1: 1 case, Week 2: 2 cases, Week 3: 4 cases</li> </ul>
<p><i>*For district populations with more than 100 000 inhabitants, it is recommended to calculate attack rates by sub-districts containing 30 000 to 100 000 inhabitants.</i></p>		
<p><i>**In special situations such as mass gathering refugees displaced persons or closed institutions, two confirmed cases in a week should prompt mass vaccination.</i></p>		
<p><i>***If a neighbouring area to a population targeted for vaccination is considered to be at risk (cases early in the dry season, no recent relevant vaccination campaign, high population density), it should be included in a vaccination programme.</i></p>		

## 8. SURVEILLANCE, PREPAREDNESS AND RESPONSE

Early detection of meningitis outbreaks and prompt laboratory confirmation of circulating pathogens depend on effective implementation of surveillance activities at all levels. The level of preparedness and the public health measures for epidemic meningitis control vary throughout the year and should be intensified as the epidemic season approaches.

During the epidemic season different procedures need to be established for districts that have crossed the alert and epidemic thresholds and those that have not. These procedures also vary depending on hyper-endemic countries (within the meningitis belt) and other countries (outside the meningitis belt).

Therefore, for the purposes of meningitis surveillance, preparedness and response, four different epidemiological phases are discussed: pre-epidemic, epidemic, post-epidemic and inter-

epidemic. Specific procedures for data collection and specimen collection for laboratory confirmation will be indicated for each of these phases.

## 8.1 Pre-epidemic phase

This phase can be sub-divided into two phases: pre-alert and alert.

**A district is in pre-alert phase** when the weekly attack rate is below the alert threshold. For any suspected case, a case reporting form should be completed (Annex 1). The CSF sent to the nearest reference laboratory for bacteriological tests. Every meningitis case should be treated with recommended antibiotics according to the national treatment protocols. Presumptive antibiotic treatment should be started without delay as soon as the CSF is collected, and before the laboratory returns the results.

For each **district in alert phase**, detailed data on the suspected cases should be recorded on a line list. CSF sample collection should be strengthened, and samples sent to the nearest reference laboratory for bacteriological tests accompanied by the case reporting form (**Box 1**). It is recommended to get as many confirmations as possible including the identification of the bacterial pathogen, and the serogroup if a meningococcus is identified (see Performance Indicators Annex 2A). This will help in making a rapid decision as to the need for vaccination and the type of vaccine to be used in case the district reaches the epidemic threshold, as well as orienting the clinicians so they can provide effective case management. Hence, it is important to strengthen laboratory capacity and particularly the use of Gram stain, rapid diagnostic tests and culturing specimens. For every district in alert phase, follow the steps in box 1 below.

### **Box 1: Checklist of what should be done during the alert phase**

1. Immediately alert the health officers in the next higher level.
2. Record cases on a line listing form with: residence, age, sex, vaccination status, outcome, laboratory results, etc.
3. Make use of rapid diagnostic tests to give an early indication of the pathogen(s) and serogroup responsible.
4. Collect and send specimens immediately to the nearest reference laboratory for bacteriological analysis and determination of causal pathogen. Be sure that samples are labelled with patient ID and have a case report form completed (Annex 1).
5. Test as many samples as possible for bacterial pathogens. Ideally 10 positive confirmed cases are needed per surveillance unit (district or sub-district) for decision-making about the appropriate vaccine to be used.
6. Samples should be sent using adequate media: TI bottles (for culture) and cryotubes for PCR.
7. Continue data analysis, graphing and mapping.
8. Treat all suspected cases with antibiotics as recommended by the national treatment protocol.
9. Prepare to initiate request for vaccines (Annex 3).



## 8.2 Epidemic phase

A district or sub-district is in epidemic phase when the attack rate reaches the epidemic threshold. For districts with large populations (above 100 000 inhabitants), it is recommended to calculate the weekly attack rates by sub-districts (surveillance zones or health facility catchment's area) of 30 000 to 100 000 inhabitants to detect localized epidemics.

As soon as the epidemic threshold is reached in a district or sub-district, and if the epidemic is due to a vaccine preventable Nm (NmA, NmC, NmW or NmY), a mass immunization campaign should be conducted in the population of that district or sub-district using multivalent polysaccharide or conjugate vaccines depending on availability (Annex 4). Depending on the age groups affected, the campaign may be targeted for example at those aged 2–29 years old. It is also recommended to include any contiguous district or sub-district that is considered to be at risk (i.e. in the absence of a relevant vaccination programme, if cases occur early in the dry season, in crowded populations).

The speed of response is critical. For mass vaccination to be effective in preventing a substantial number of cases before the epidemic is over, vaccination should commence as soon as possible and within four weeks of crossing the threshold.

A micro-plan and budget for each area targeted for mass vaccination should be quickly finalized. Sufficient vaccine must be immediately requested from either the ministry of health, which maintains the national stocks, or from the International Coordinating Group (ICG) on Meningitis Vaccine Provision which manages the international emergency stockpile (Annex 3). Once vaccine supplies have been confirmed, a public information campaign must be launched to inform all the communities in the target areas of the coming campaign.

CSF samples should continue to be collected and sent to the reference laboratory to monitor the characteristics of the causal pathogens (serogroups, antibiotic sensitivity). Box 2 summarizes the specific actions recommended during the epidemic phase.

### Box 2: What should be done during the epidemic phase

1. If the epidemic is due to NmA, NmC, NmW or NmY, make immediate preparations for mass vaccination in the epidemic district, as well as any contiguous district if the population is considered to be at risk.
2. Vaccinate using vaccines from national contingency stocks. If not available, prepare a request to the ICG for meningococcal vaccine supplies as soon as new districts or sub-districts cross the epidemic threshold. For the ICG to evaluate a country's request, attack rates by district and subdistrict, by week and by age group, and identification of causal pathogens are needed (Annex 3).
3. Continue data collection, transmission and analysis.
4. Maintain regular collection of CSF specimens throughout the epidemic season in the epidemic districts to detect any shifts in the serogroup.
5. Treat all cases with the appropriate antibiotic as recommended by the national protocols.

For longitudinal surveillance purposes, regular collection of CSF samples should be maintained in all epidemic districts for monitoring the circulating serogroups, antibiotic susceptibility testing, as well as any shifts in the serogroup during the epidemic period. Note that before sending a specimen to the reference laboratory, it should be adequately labelled using the case reporting form (Annex 1).

A rapid response team (RRT) from central or regional/provincial level should be sent to the affected areas to support surveillance and laboratory activities. In the event of NmA cases or NmA outbreak in a population vaccinated with MenAfriVac® the RRT should conduct a thorough investigation (Annex 5). The team should evaluate vaccine coverage, the collection, analysis and transmission of data, as well as lumbar puncture practices, the use of trans-isolate medium and all laboratory results and procedures (e.g. Gram stain, cytology, latex agglutination tests, etc.). It is particularly important to verify laboratory results and procedures to ensure the identification of the Nm serogroup is reliable. Vaccination status of the cases should also be verified and a copy of the vaccination card, if available, should be collected.

### 8.3 Post-epidemic phase

The post-epidemic phase corresponds to the first four weeks after the end of an epidemic. The end of a meningitis epidemic is declared when the attack rate in the epidemic district descends below the alert threshold for two consecutive weeks. During this phase it is recommended to:

- evaluate the detection and response/management of the epidemic to outline the gaps, strengths, lessons learned in while implementing the action plan, and make recommendations for their improvement.
- conduct a vaccine coverage survey if a vaccination campaign was implemented.
- mobilize adequate resources to conduct these evaluations, which are essential to improve control and response measures during future epidemics.

To enable these evaluations, good documentation is essential. At the end of the response, the district health management team should:

- Collect all the documents including minutes of the meeting, activity, process, epidemic report, evaluation report and other relevant documents.
- Prepare a coversheet listing of all the above documents.

This will become an essential source of data for evaluating the response.

**Nota bene:** For the evaluation to be successful, it is important to set up a system for the collection and archiving of information/data during the pre-epidemic, epidemic and post-epidemic phases.

## 8.4 Inter-epidemic phase

The inter-epidemic phase extends from the end of an epidemic season to the beginning of the next season. In this phase the epidemiological profile of the causal pathogens may be different from the epidemic phase. Therefore, the identification of prevailing germs is important to better understand and guide future control of meningitis epidemics in Africa. During this phase it is recommended to:

- Facilitate strong collaboration among the surveillance officers, clinicians and the national reference laboratory officers to ensure a comprehensive sample collection and confirmation mechanism.
- Continue surveillance and laboratory confirmation of suspected meningitis cases in all national, regional and district hospitals.
- Ensure new staff are trained in relevant meningitis surveillance protocols and procedures such as lumbar puncture.

## 9. DATA MANAGEMENT

### 9.1 Aim and function

The aim of data management for meningitis surveillance is to provide comprehensive and timely data for action. Key functions for achieving this objective include entry, cleaning, transmission, merging, analysis, feedback, and sharing of data.

The performance of these key functions depends primarily on the organization of the surveillance system, but usually it is the responsibility of data managers at the district and/or regional level, or at the level of the national reference laboratory and the national epidemiological surveillance Directorate. Annex 11 describes the standard data transmission circuit, while Annex 12 describes the key functions of the data manager (national surveillance unit and laboratory) in the form of a checklist.

The data will be captured from reporting forms submitted by health facilities. For each suspected meningitis case with CSF specimen, fill a case investigation form (Annex 1). Provide a unique identifier (Epid Number) to link the laboratory results with the patient clinical/epidemiological records. Keep a copy of the case reporting form at the district level and send the other copy together with the CSF specimen to the national reference laboratory. This Epid Number is assigned at district level.

The District epidemiological surveillance officer provides a unique identifier (EPID number) according to the following model: CCC-RRR-DDD-YY-NNNN (Country-Region-District-Year-Case number). This unique identifier will be later recorded on the case investigation form.

The epidemiological surveillance officer will be responsible for forwarding the laboratory test results to the heads of peripheral health facilities (by post, Radio, phone, etc.).

In case where data are missing or inconsistent, contact the health worker for further information.

Suspected cases and deaths should be recorded and transmitted weekly to the district surveillance officer. Data should be immediately compiled and transmitted by the quickest means available (e.g. radio, telephone/SMS, fax, email) to provincial and national levels. Weekly notification should be done throughout the season/year. Districts should report weekly, even when no cases are recorded (i.e. 'zero reporting') (See Annex 2A for Performance Indicators). Moreover, in case of epidemics, the reporting of cases and deaths should be done daily.

## 9.2 Data entry

### *(a) At district level*

District surveillance officers will enter into a computer programme (e.g. Excel) the case forms (line list and aggregated data) received from peripheral health facilities. They will also enter the laboratory data and tests results in the same software, completing the database. The aggregated data will be sent to the regional/national level on a weekly basis. The line list should be sent on a monthly basis, but on a daily basis in case of outbreak.

### *(b) At regional/provincial level*

A database like that used at district level will be made available to the regional laboratory. The aggregated data received from the districts will be merged by the regional surveillance officer into a single database (e.g. using Epi-Info or Excel or online tool) and sent to national level on a weekly basis. When patients are seen directly at the regional hospital without being referred by a district, the epidemiologist at the regional hospital will also enter the laboratory results produced by the regional hospital by assigning an Epid Number in accordance with the reporting district. The epidemiologist should inform his or her counterpart at the district level about these cases, including the Epid Number of each patient, so they can be recorded at district level. This interaction is crucial to avoid double entries.

### *(c) At central/national level*

The central level monitoring team should develop a standardized data entry form (Excel or Epi Info) and share it with all regions and ensure that it is understood by all users. The aggregated data received from the regions or districts will be merged into a single national database (e.g. using Epi-Info or Excel, Annex 7), before they are sent to WHO and partners on a weekly basis.

#### *(d) At the national reference laboratory*

The data from the national reference laboratories will be computerized using Excel or Epi Info, then sent to the national surveillance/epidemiology unit, where they will be linked to the clinical data using the Epid Number. The results will then be sent to the regions and districts where the specimen originated. The data manager at the national surveillance unit should check for data entry flaws and resolve any anomalies in the database on a weekly basis. S/He should make sure that clinical and laboratory data of each patient are linked before any detailed data analysis.

#### *(e) Data management linked with patients seen in one facility but coming from another district*

To get a correct analysis of the epidemiological situation and allow an adequate decision taking, all cases admitted in one health service (district, regional, national hospital, etc) should be reported:

- In the weekly aggregated data, as cases from their district of residence.
- In the line list, always indicate the district of residence and the district of notification.

Some basic patient information is required for all suspected meningitis cases using the generic IDSR line list form (Annex 6). The line list should be completed at the health facility level, compiled at district level and a copy sent to the regional and national levels, on a weekly basis.

Regular data entry using data management software should be done at different levels (at least the district and the central level). At the district and regional level, all data (surveillance and laboratory) will be entered by the district or regional surveillance officer. The results of the national reference laboratory will be entered by the NRL's data manager.

After the data entry, the data manager will need to clean the data to ensure completeness of the various variables and their validity before any analysis.

- A copy of the database (in electronic form) updated by the District epidemiological surveillance officer (EPI and laboratory data), will be sent to the Regional level on a weekly basis.
- The District epidemiological surveillance officer under the supervision of DMO will compile every week databases from all health facilities.
- The District laboratory's specific results (cytology, Gram, Latex) will be sent to health facilities concerned, by the District epidemiological surveillance officer as soon as possible to guide proper case management.
- He/she will also send on a weekly basis to the regional/central level a copy of the updated database.

### **9.3 Data transmission**

A schedule for the transmission of data should be drawn up (weekly, or monthly). Based on this schedule, each district will need to share its base to complete the national base. The transmission circuit will need to comply with what has been developed in the country; for example, in some

countries, these computerized data will be transmitted to the regional level for a regional summary. This same goes from the region to the central level. In other countries, the data will be transmitted to the regional and national level at the same time. Data from the national reference laboratory will be exchanged according to a schedule established with the national surveillance officer to connect the laboratory results to each patient's clinical information.

After harmonization of epidemiological and laboratory data at the national level, these data will be sent to the district and regional levels to update their databases, thus constituting, at each level, full and comprehensive surveillance database with laboratory results.

#### 9.4 Data storage and protection

The data must be stored and secured to prevent a breach in data confidentiality, or loss of data. The manager must keep the computer in a secure location and protect it with a password. He/she must back up the database on an external drive every week and make sure the anti-virus software is updated.

#### 9.5 Data analysis

It provides key information to identify trends and take timely and appropriate action. Each case should undergo final classification according to the clinical signs (case definitions), the epidemiological context and the laboratory results: confirmed, probable, suspected. The disease surveillance officers at each level should analyse their data. The supervisors at regional and national levels should ensure that all districts keep an up-to-date weekly epidemic trend (curve) of meningitis cases with the alert and epidemic thresholds shown. Every week, the data manager of the national surveillance unit should make a standard map showing the alert and epidemic districts, as well as the laboratory results by district, and for the country. Central teams are also advised to integrate the meningitis data into the integrated epidemiological bulletins they regularly publish.

The weekly processing and analysis of data is expected to provide at least:

- The curve of epidemiological trends to assess the situation compared to previous years.
- The indications of the alert and epidemic thresholds at the district level.
- The description of the situation in terms of person, place, time, and according to key variables such as the vaccination status, the pathogen, the disease outcome.
- The cross-frequency of pathogens by age and vaccination status.
- The mapping of case and pathogen distribution.

The analysis will also generate performance indicators (see monitoring).

## 10. SPECIMEN COLLECTION AND PROCESSING

### 10.1 Preparedness

Before the beginning of the epidemic season, each country should:

- procure an adequate stock of lumbar puncture kits, colour gram kits, rapid diagnostic tests, anti-sera (monovalent), trans-isolate (TI) media, cryotubes and triple packaging box for specimen transport;
- pre-position these materials at provincial and district levels under the responsibility of the provincial and district disease surveillance and laboratory officers.

### 10.2. Sample collection

The diagnosis of bacterial meningitis is based on the analysis of CSF obtained by lumbar puncture (LP). The puncture is performed between the 4th and 5th lumbar vertebrae using a LP needle (Annex 9). Health personnel or rapid response teams in the field should systematically collect CSF specimens for laboratory confirmation before the start of antibiotic therapy.

Ideally 10 positive confirmed cases per district (or sub-district) are needed to determine the circulating causal pathogens and decide on the need for vaccination and the appropriate vaccine (Annex 4). It is recommended to collect as many as possible though. If possible, perform antibiotic susceptibility testing (the best methods are the E-test or Minimal Inhibitory Concentration) to guide the use of appropriate antibiotic treatments for case management. The quicker these samples are tested at the reference laboratory the better.

Where the CSF volume is <3ml, the CSF should be collected in one dry tube; 0.5 ml should be inoculated from this tube into the TI medium and priority tests should be done according to laboratory level (Annex 9). Where CSF volume is >3 ml, CSF should also be collected into a cryotube

At the health centre level: For each specimen, case investigation form should be filled out and attached to the specimen.

A copy of this form should be kept at the health facility level for record-keeping purposes.

The patient consultation register is generally used as basic information medium, emphasis will be placed on how carefully data was filled out

The label on the specimen should include the patient's identification information (Name, First name, origin...).

Once an epidemic has been declared in a district/sub-district, regular collection of a few CSF specimens should be maintained in that district throughout the epidemic season, to monitor circulating pathogens. For the purposes of enhanced surveillance, the systematic collection of CSF from every single suspected case is not necessary while the epidemic lasts. However, collection of CSF of at least 50% of cases is recommended to enable an accurate analysis of the circulating pathogens and epidemiological trends throughout the year. Health personnel at health facilities should be trained on the lumbar puncture technique, specimen collection, TI utilization and handling, and specimen transportation to the reference laboratory (Annex 8, 9). Additionally, laboratory technicians should be trained on how to perform Gram stains and rapid latex agglutination (Pastorex kits), or dipsticks.

### 10.3 Utilization of TI bottles (Annex 8)

The TI bottles are stored between 4°C and 8°C in the refrigerator. Before using a TI bottle, keep it at room temperature and away from direct sunlight and protected from dust for 30 minutes before adding the CSF. From each suspected meningitis case, 0.5 ml of CSF should be injected aseptically into TI media. After the CSF has been injected, the TI medium should be vented with a sterile needle and kept at room temperature away from direct sunlight or dust until it is sent to the reference laboratory. The inoculated TI medium should not be refrigerated.

### 10.4 Transportation of CSF specimens

The properly packaged specimen will be sent to the regional laboratory or the reference national laboratory within the prescribed deadlines, depending on their capacity to conduct the recommended tests with copy of the case investigation form and unique identifier.

For culture: The inoculated TI media should be sent from the health facility to the district within 24 hours. The district should send the inoculated TI media to the national/state reference laboratory at least twice a week. Inoculated TI media are sent (triple packaging) without venting needle and without ice packs. Once inoculated, TI media should be kept at room temperature. For other bacteriological tests: Any remaining CSF in Tube 1 should be kept at room temperature and transported rapidly (within two hours) to higher-level laboratories for additional bacteriological tests.

For polymerase chain reaction (PCR): If Tube 2 (cryotube) is available, this should be sent to a national-level laboratory, along with TI media for PCR testing. Unlike inoculated TI media, cryotubes should be refrigerated or frozen during storage and transported to the reference laboratory under reverse cold-chain system.

### 10.5 Specimen processing

The identification of causal pathogen is essential to confirm the nature of the meningitis epidemic and implement control measures. Therefore, laboratory confirmation of suspected meningitis cases should be a standard practice during the meningitis epidemic season. The following



laboratory tests should be conducted, depending on the health services or organizational levels (national, regional, district) and the technical capacity of the laboratory at that level (Annex 10):

- Gram stain and cell counts at district laboratory or health facility with appropriate equipment.
- Rapid diagnostic tests (RDTs) at health facility and district laboratory level. Note that the use of a RDT capable of identifying NmW and NmC is highly recommended during the initial phase of an outbreak. RDTs can be used at field level and substantially reduce the delay in bacteriological confirmation and decision-making. Latex tests (e.g. Pastorex<sup>®</sup>, Directigen<sup>®</sup>) and dipsticks (CERMES) are suitable tests. It is important to confirm serogroup results at a reference laboratory with culture or PCR before decisions are taken on vaccination.
- Culture and identification of serogroup at national or regional reference laboratories.
- Antibiotic susceptibility pattern should be conducted for all specimens received at national reference laboratory.
- DNA detection by polymerase chain reaction (PCR) at national level to confirm the causal agent by biomolecular (DNA) test. PCR can be used to confirm the germ on negative TI (no growth by culture). For PCR testing, CSF specimens could be stored in cryotubes preferably in a freezer (-20°C) or in sterile dry tubes in the refrigerator (+4°C) and shipped in a cool box to the national or regional reference laboratory.

## 10.6 Turn-around time of laboratory results

The laboratory results should be sent to the surveillance units (district, regional and national) and to the facility that sent the sample(s) as per the below timelines:

- District laboratories: within 48 hours upon reception of the sample(s)
- Provincial/Regional laboratories: within 5 days upon reception of the sample(s)
- National level laboratories: within 7 days upon reception of the sample(s).
- (Annex 2A for Performance Indicators).

## 10.7 Laboratory

The laboratory plays a crucial role in the confirmation of all suspected cases. It contributes to the final classification of meningitis cases. It also enables the clinician to make the differential diagnosis with other febrile meningeal syndromes and propose an appropriate treatment for the case. All health districts in any country should be organized around a network of reference laboratories responsible for the confirmation of cases through CSF analysis by PCR and culture.

The proper functioning of a laboratory network implies:

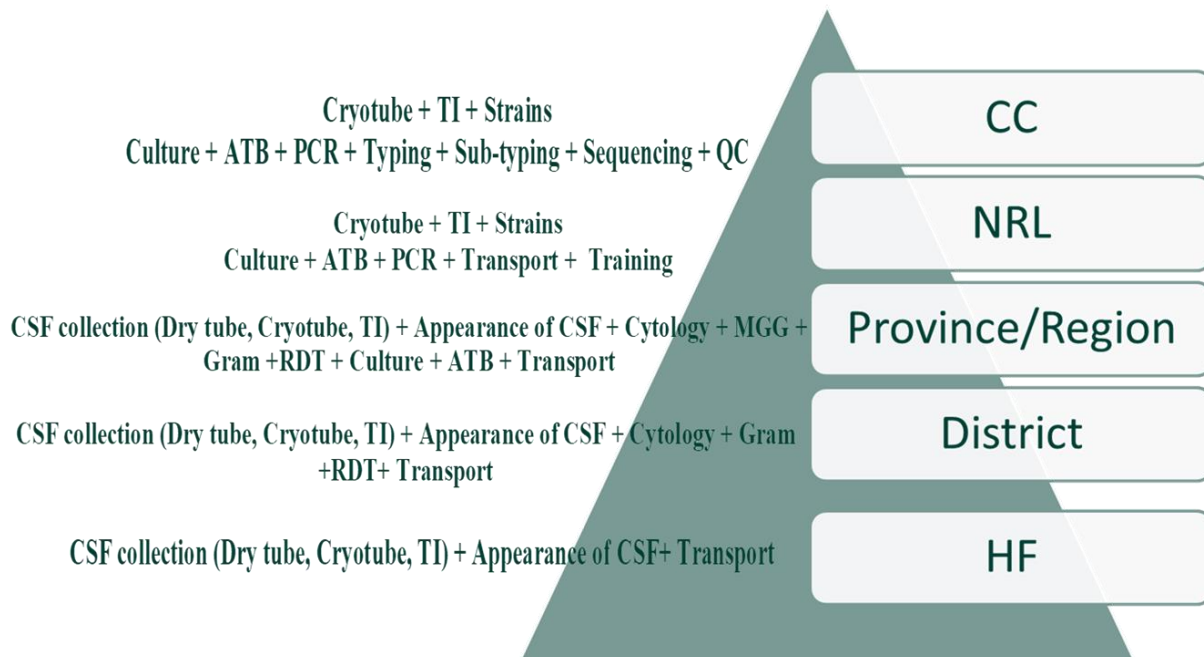
- A clear definition of roles and responsibilities of the country's various reference laboratories.
- The provision of basic equipment.
- The supply of essential reagents and consumables.
- Training and re-training of laboratory technicians.

- Regular supervision of laboratory activities.
- Establishment a national system for collecting, storing and transporting specimens from peripheral health facilities to national reference laboratories.

## 10.8 Organization of the national laboratory network

All the countries which are yet to develop such a network must officially adopt legislation establishing, organizing and ensuring the existence of a functional laboratory network. The various tests and functions that each level of the laboratory network should be able to perform are described in the diagram below.

**Figure 2: Laboratory's Tasks**



**Legend:** **ATB:** Antibiogram, **CC:** Collaborating Centre, **CSF:** Cerebrospinal Fluid, **HF:** Health Facility, **MGG:** May-Grümwald Giemsa, **NRL:** National Reference Laboratory, **PCR:** Polymerase Chain Reaction, **QC:** Quality Control, **RDT:** Rapid Diagnostic Test, **TI:** Trans-Isolate.

## 10.9 National reference laboratory

As part of the functional National Laboratory Network, the Network's manager should define (the) national reference laboratory/laboratories. He/she must also make sure that recommended high quality laboratory examinations are carried out at all levels (Districts, Regions, Central level) (Figure 2) and that results are sent very rapidly to health facilities sending CSF specimens. Detailed feedback on the collection, transportation of specimens should be provided to minimize contamination, storage or transportation-related problems. The network manager ensures that all strains are sent to WHO collaborating centres for external quality control (compliance with

international norms and standards) and for establishing circulating types and sequence types as part of molecular surveillance.

The national laboratory network must also ensure training for technicians of peripheral laboratories, their supervision and supply of reagents and equipment throughout the year. The national reference laboratory is specifically responsible for:

- Analysing through culture and/or PCR all specimens transmitted by Districts and Regions.
- Monitoring the sensitivity of pathogens to antibiotics by always conducting antibiotic sensitivity testing.
- Sending all strains to the collaborating centre to determine the typing and sequencing.
- Providing feedback to regions and districts.
- Supervising and providing technical support to laboratory activities of regional and district hospitals to ensure compliance with quality and safety.
- Ensuring supply of reagents and laboratory equipment throughout the year.
- Organizing re-training/training sessions for laboratory technicians at all levels.

Collection procedures, data and specimen transmission circuit:

- The reference laboratory will receive specimens together with individual reporting forms submitted by Districts and Regions.
- The head of the laboratory will carry out the additional tests (culture, PCR).
- The forms together with laboratory results are sent to the national surveillance officer for updating of the national database.
- The specific results of the culture, the antibiotic sensitivity testing and PCR will be sent to the districts concerned through their respective regions.

## 10.10 Quality control

For quality control and sequence-type, 10 to 20% of isolates obtained at national level should be regularly sent to the Regional Office for Africa's Inter-country Support Team for West Africa (AFRO-IST) for quality control and to WHO collaborating centres<sup>3</sup> for genotypic characterization. This will allow for monitoring of epidemiological trends of serogroups and genotypes and a better understanding of the spreading patterns of Nm epidemic complexes in the African Region.

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<sup>3</sup> The current list of WHO Collaborating Centres (WHOCC) for Meningitis, as of September 2018, is:

- National Institute of Public Health, Department of Bacteriology, P.O. Box 4404 Torshov, 0403 Oslo, Norway.
- Center for Disease Control and Prevention, Meningitis and Special Pathogens Branch, 1600 Clifton Road, C-09, Atlanta, GA 30333, United States.
- Institut Pasteur. Unité des infections bactériennes invasives. 28, Rue du Dr Roux. Paris 75724, France.

WHO's collaborating centres provide:

- external quality control by re-testing 50 or at least 10 % (the lesser of the two) of strains/specimens analysed by national laboratories.
- typing, sub-typing and sequence type of strains transmitted by national reference laboratories.

Before sending, the strains are packed in a triple package and shipped once a semester to the WHO Collaborating Centre in accordance with international regulations.

All laboratories using PCR for detection and characterization must develop a plan for monitoring and controlling nucleic acid contamination.

Moreover, national laboratories perform internal quality control for specimens analysed by peripheral laboratories involving the control of:

- the quality of the specimens arriving at the laboratory by checking the condition of the package and specimens themselves.
- the volume of CSF in the cryotubes which should be approximately 1 ml.
- the state of TI (intact tube, adequate volume for liquid phases).
- the level of concordance of peripheral laboratory results (Gram stain, agglutination test).

## 10.11 Molecular surveillance

Molecular surveillance is an important component of any meningitis surveillance system. It is the surveillance of strains of pathogens causing bacterial meningitis using molecular biology techniques. Pathogen types, sub-types and sequence types are identified throughout the year using strains sent by national reference laboratories to WHO collaborating centres. Knowing that certain types or subtypes are more virulent than others, their detection before or at the beginning of the epidemic season makes it possible to measure the risk of occurrence of a major epidemic and to take timely and appropriate steps. At least 50 strains or 10% of strains (whichever is less) should be sent to collaborating centres for molecular surveillance.

## 11. ROLES AND RESPONSIBILITIES

### 11.1 Health centre

In close collaboration with community participation bodies (Management Committee) and local authorities, the health centre's team should:

- Detect and notify any suspected case of meningitis using the standard definition of cases,
- Fill out properly the case investigation forms (there must be a form for each case (Annex 1B) and send them to the district every week (clearly specify the epidemiological week Number, which goes from Monday to Friday).

- Take CSF specimen from suspected meningitis case in a dry tube or cryotube and into a transport medium (TI) (Annex 9).
- Convey (properly labelled) CSF specimens to laboratory districts for laboratory testing (Annex 9 for CSF storage and transport).
- Conduct case investigation, if necessary
- Compile, analyse and interpret the data every week.

## 11.2 District

The District Health Management Team (DHMT) will regularly conduct formative supervision to ensure that staff in health care facilities properly carries out the instructions for implementing surveillance of meningitis. Personnel in health care facilities will be trained in lumbar puncture procedures, the collection, handling and transport of specimens as well as the filling out of the case investigation forms.

The health district will be primarily responsible for:

- Making sure that health facilities, detect and report all suspected cases of meningitis by using the standard definition of cases.
- Ensuring that health facilities, properly collect CSF specimens from suspected cases of meningitis for bacteriological confirmation.
- Receiving case investigation forms and CSF specimens sent by health facilities.
- Assigning the identification number on the reporting form.
- Ensuring that all the CSF collected in health facilities are analysed at the district laboratory, Gram stain and rapid diagnostic tests (Pastorex or dipsticks) are carried out (2 laboratory tests recommended at this level).
- Sending all properly packaged CSF specimens to reference laboratories for culture and PCR within the recommended deadlines and recommended transportation conditions.
- Conducting the investigation of confirmed meningitis cases.
- Analysing the data, draw trend lines, interpret data and prepare reports.
- Sending data to the higher level (region).
- Regularly supplying peripheral health facilities with collection kits & media and transport material (TI and leak-proof cryotubes/dry tubes).
- Validating the data from the various health facilities and capturing on electronic media (Excel, Epi info).
- Supervising and providing technical support to health facilities that are part of the district.
- Making available to clinicians as soon as possible laboratory results identifying the causal pathogens of meningitis.
- Providing regular feedback to peripheral health facilities in accordance with the frequency adopted.

### 11.3 Region/province

Monthly or bimonthly coordination meetings as part of IDSR or decentralized meetings of the Expanded Program on Immunization (EPI) will provide an opportunity to assess and make recommendations to district health management teams on the performance of meningitis case-based surveillance in the districts that are part of the region. The Regional Director of Health (DRS) will put in place a system for monitoring on a weekly basis data from Districts, with a focus on sending specimens and their transmission to regional and national reference laboratories, as well as specimen storage conditions.

At the regional level, the doctor in charge of disease control or the surveillance officer must especially:

- Ensure that case investigation forms and CSF specimens sent by the districts are transmitted to the CHR's laboratory or to national reference laboratories.
- Ensure that in case specimens must go through the regional or provincial level, specimens together with a copy of the case investigation form are transmitted to the national reference laboratory.
- Monitor the laboratory results with the national reference laboratory.
- Regularly supply peripheral health facilities with medicines, vaccines, reagents, lumbar puncture kits, transportation mediums and material (TI and cryotubes).
- The DRS will establish an adapted and sustainable system for the transportation of specimens in accordance with national orientations and guidelines.
- Support the districts in case and outbreak investigation.
- Supervise and provide technical support to district level activities.
- Summarize and analyse district data.
- Provide feedback to districts and local personnel.
- Sensitize clinicians to the interest and the need for ES/CBS and inform them as soon as possible of the pathogens causing meningitis.
- Ensure the monitoring of the surveillance process using performance indicators developed for this purpose (See Monitoring).
- Provide regular feedback to peripheral health facilities according to the frequency adopted.
- Transmit every week district data and the overall epidemiological situation of the region/province to the central level.

## 11.4 Central level

The national epidemiological surveillance service or the Directorate for Disease Control in close collaboration with the Directorate for Prevention through Immunization and the other central Directorates will be responsible for establishing a system that can monitor by district the case detection and confirmation process throughout the year (epidemic and inter-epidemic season). It will make sure that clear and surveillance comprehensive guidelines are provided on surveillance, particularly methods of collection, storage of samples as well as a systematic and sustainable mechanism for the transportation of specimens, the development of a reliable national database, while considering appropriate measures for practical control of population data.

At the central level, two levels are involved in surveillance: the national surveillance unit and the national reference laboratory, with for each of them, well-defined but complementary roles, namely:

- Receive individual reporting forms and CSF specimens sent by districts and regions
- Capture the data from the individual reporting forms from districts
- Check every week that TI bottles have reached the national reference laboratory and otherwise take appropriate concrete measures
- Monitor the availability and transmission of laboratory results
- Analyse and interpret the (epidemiological and laboratory) data by District and by Region,
- Analyse trends, interpret the surveillance and laboratory data sent by the districts and regions,
- Share the results with national and international partners,
- Ensure monitoring using performance indicators,
- Supervise and provide technical support to activities in the Regions and Health districts,
- Provide feedback to Regions and Districts,
- Use the data to assess national objectives and guide initiatives for eliminating meningitis epidemics in Africa,
- Regularly supply the Regions and Districts with collection kits, transportation media and material (TI and cryotubes) including reagents for the diagnosis (Gram stain, Pastorex®/RDT) as well as data collections media,
- Identify training needs, develop a training plan and contribute to organize the training of health personnel at the peripheral level in collaboration with Regions and Districts on Case definitions, CSF specimen collection technique and management of surveillance and laboratory data (Line listing, EPI Info and Health Mapper).

## 11.5 WHO and partners

The WHO Country Office, Intercountry Support Teams (IST), the WHO Regional Office for Africa as well as the headquarters are available alongside the countries for technical support for the implementation of surveillance of meningitis. They will also participate in the advocacy for the mobilization of financial resources and in the coordination of meningitis control activities. Support from collaborating centres and partners such as the MenAfriNet partnership (reference 5) is of vital importance. WHO will particularly provide expertise in:

- The evaluation of the surveillance system, the countries' needs and capacity-building in training, equipment / consumables.
- The development of national meningitis control plans and annual action plans.
- Technical support for the investigation of cases and meningitis outbreaks, at the request of countries.
- Supplying the countries with transport media (TI) for the transportation of CSF specimens.
- Sending specimens to collaborating Centres for external quality control, typing and sequencing.
- Training in data management.
- Risk Analysis, mapping and estimation and prediction models.
- Development of sub regional databases.
- Feedback to countries on the region's epidemiological data.

## 11.6 Other sectors (army, private, denominational, NGOs, etc.)

These sectors take care of the health of a relatively large proportion of the population. They must be involved in the overall meningitis surveillance process considering the level of the health pyramid

To achieve the additional requirements of the more intensive CBS, the roles and responsibilities described below will be found at the district, regional or central level (Annex 10). A generic role is described at each of the levels (districts and regions) but this should be adapted to the organization of each country.

## 11.7 Adapt to epidemics

In acute epidemics, where many cases occur in a short period of time, overwhelming the health system or material resources, certain criteria for identifying surveillance priorities should be established.

- First, surveillance must always lead to response decision-making in each district (detection of threshold crossing and confirmation of pathogens).



- But on the other hand, if CBS is conducted in the country, the collection of all case-based surveillance data should ideally be maintained, even if information is not made systematic and entered immediately in electronic form.

Depending on resources available at each level, surveillance activities could be adapted as follows:

- Continue to properly complete the case investigation form for all cases (one form and one EPID number for each case).
- Make sure that case information is presented aggregated and by week for actions (Annex 6).
- Collect CSF for a maximum number of cases, targeting as least 50% of cases, and in order to enable confirmation of 10 positive samples per epidemic zone, rapidly transmitted to the laboratories of the higher level.
- Specimens from districts in the alert phase or that have recently crossed the epidemic threshold should be analysed as a priority to identify the epidemic pathogen and organize the response.
- Laboratory feedback should be provided promptly to inform response measures (case management and reactive immunization).

At the end of the epidemic:

- All specimens should be analysed, and results transmitted and entered into the database.
- The data of all reporting forms will be captured and entered in the database.

## 12. PREPAREDNESS AND MENINGITIS EPIDEMIC RESPONSE PLAN

The Preparedness and Epidemic Response action plan (EPR) aims to build the district's rapid response capacity in the event of a meningitis epidemic. This plan should:

- Be based on risk assessments for the district and specify resources available for epidemic preparedness and response.
- Consider epidemic-prone diseases in the district and in neighbouring districts.
- Provide estimates of the population at risk for epidemic-prone diseases and other public health emergencies.
- Make it clear for each epidemic which reference laboratory will be used for the confirmation.
- Provide estimates of quantities of medicines, vaccines and supplies for each epidemic-prone disease that may occur in the district.
- Be tested before implementation.
- Include Standard Operational Procedures, preparedness and response to meningitis epidemics in Africa in the training plan.

***The main parts of the plan should include:***

1. Designated coordinating committees appointed at all levels;
2. Epidemiology and surveillance including data management;
3. Steps to carry out a risk communication strategy including social mobilization;
4. Operational activity according to the expected phases of the epidemic;
5. Laboratory: collection, handling, transport and processing of specimens;
6. Case management including medicines (antibiotics) and other inputs;
7. Pre- and post-exposure prophylaxis (outside epidemics and around the case);
8. Immunization strategies;
9. Capacity-building particularly training, the necessary awareness-raising meetings and simulation;
10. Logistics, procurement lists;
11. Enhanced surveillance during epidemics;
12. Operational research and documentation of outbreak management;
13. Risk communication;
14. Monitoring and evaluation;
15. Coordination.

### **13. REACTIVE IMMUNIZATION AND VACCINE SELECTION CRITERIA**

The decision on the type of vaccine to be used (Annex 4) should be based on the results of at least 10 positive specimens (by culture or PCR). Efforts should be made to collect and analyse CSF specimens as early as possible to help select the appropriate vaccine. In the absence of laboratory evidence that a specific Nm serogroup is the cause of the epidemic, the use of meningococcal vaccines should be strongly discouraged.

Whatever the situation, and especially when the number of positive specimens available is lower, the decision tree should be used flexibly to guide decision, considering all epidemiological and laboratory information available in the country. Specifically, the following elements should be considered:

- Analysis of geographical distribution can guide more targeted actions.
- Analysis of the affected age groups is important and could help target different age groups for.
- Update on the introduction and deployment of MenAfriVac® is crucial:
- In specific situations (e.g., displaced persons, refugee camps, closed institutions), different decision.
- should take place within 4 weeks of crossing the epidemic threshold.
- immunization or the use of different vaccines for different age groups.

- If a MenAfriVac<sup>®</sup> campaign is already planned, and serogroup A is identified, preference may be given to use of the MenAfriVac<sup>®</sup> vaccine;
- If a MenAfriVac<sup>®</sup> campaign has already been conducted and serogroup A is identified, an investigation should be initiated including sending CSF specimens for confirmation to the reference laboratory (Annex 5)
- criteria may be applied.
- The success of an immunization campaign depends to a large extent on timeliness. Vaccination.

## 14. CASE AND CONTACT MANAGEMENT

### 14.1 Case management<sup>4</sup>

Treat all meningitis cases as quickly as possible, using appropriate antibiotics according to the current national treatment protocol. If possible, perform the lumbar puncture before antibiotic treatment. Start presumptive treatment without waiting for laboratory results.

Recommended treatment for suspected cases of bacterial meningitis during meningococcal meningitis epidemics:

- In children aged 0 to 2 months, ceftriaxone 100mg/kg/day IM or IV once daily for 7 days.
- In children older than 2 months, ceftriaxone 100mg/kg/day, once daily (maximum 2g) IM or IV for 5 days.
- In children over 14 years and adults: ceftriaxone 2g/day once daily IM or IV for 5 days.

Patients admitted to health centres with no improvement within 48 hours or with convulsions or in quasi-coma should be transferred to the hospital.

To deal with large-scale meningococcal epidemics in remote areas with little viable infrastructure, single-dose ceftriaxone treatment protocols may be implemented. However, it is essential to ensure community follow-up of cases after 24 hours and refer to a hospital if more appropriate care is needed.

Outside epidemics, the recommended duration of treatment for bacterial meningitis in children of all ages and adults is 7–10 days. For suspected bacterial meningitis during outbreaks of

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<sup>4</sup> World Health Organization (2014). Revised guidance on meningitis outbreak response in sub-Saharan Africa., Weekly epidemiological record vol.89, pp 580-586. [http://www.who.int/wer/2014/wer8951\\_52/en/](http://www.who.int/wer/2014/wer8951_52/en/)

pneumococcal meningitis, and for confirmed pneumococcal meningitis during or outside outbreaks, extending the duration of treatment up to 14 days should be considered.<sup>5</sup>

## 14.2 Contact management

Prophylaxis for family contacts of a case is not advised during epidemics, for logistical reasons and uncertainty as to the additional benefits. Outside epidemics, it is recommended that family contacts of probable or confirmed cases of meningococcal meningitis receive chemoprophylaxis with a single dose of: either ciprofloxacin (single dose of 500 mg orally in adolescents and adults; 15 mg/kg orally in children <12 years) or ceftriaxone (single dose of 250 mg IM in adults; 125 mg IM in children <12 years). Rifampicin is not recommended in the meningitis belt because of the risk of antibiotic resistance. Prophylaxis should be administered as soon as possible (ideally within 1 to 2 days) after diagnosis to reduce the risk of new cases in the household.

Note: Ciprofloxacin is available in the form of tablets (250 mg) or as 50 mg/ml syrup (WHO model formulary for children 2010).

## 15. RISK COMMUNICATION

Risk is the factor that has the greatest influence on people's behaviour and decision-making. It now seems obvious that public health risks cannot be managed without communication. Increasingly, communication is considered as an essential tool that enables individuals and organizations, including governments, to manage risks effectively.

A strategic approach to risk communication, i.e., taking risk into account before it evolves into crisis, could help reduce communication costs if this communication is part of the overall process and planned.

Taking risk communication into account helps to achieve at least three objectives if the strategies are well implemented. The objective is to:

- prevent and reduce the risk of people being contaminated with meningitis;
- promote healthy lifestyles;
- integrate prevention, health protection and promotion in any public health approach.

During meningitis epidemics, communication aims to bridge the gap between the experts' definition of risk and the public's perception of risk. Generally, it is established that the perception of risk may vary between experts and those who are "at risk". For technical experts, risk is directly related to the nature and extent of the HAZARD. The hazard here is the meningitis epidemic. For

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<sup>5</sup> World Health Organization. (2016). Pneumococcal meningitis outbreaks in sub-Saharan Africa. Weekly Epidemiological Record. Vol 91, pp298-302.

the public (or other persons concerned), risk is perceived in relation to many other factors and their ability to generate a feeling of OUTRAGE (fear, concern, intense emotional investment). Resulting in the expression: **RISK = HAZARD + OUTRAGE.**<sup>6</sup>

To implement risk communication adapted to the preparedness and response context, it is necessary to work upstream and then propose communication responses based on the four (4) risk communication strategies.

1. Identify potential risks;
2. Identify groups to follow (population through the media, experts and donors);
3. Prepare context and target -specific messages with accurate evidence-based information. Messages must consider the cultural context;
4. Make sure of the credibility of: the spokesperson and the Organization;
5. Track communication monitoring data to identify signs of outrage and respond to this as soon as possible (before the situation turns into outrage management);
6. Communicate promptly and regularly (starting as soon as the event or crisis is announced).

The above elements must be put in place before moving on to the implementation of the 4 risk communication strategies below, in a sequenced manner, depending on the outbreak level and the perception of the populations:

**Strategy No. 1: Health education (and stakeholder and partner relationships):** Applicable when the hazard (meningitis epidemic) is relatively low and emotional investment is reduced, or in case of indifference.

**Strategy No. 2: Preventive awareness-raising (or prevention advocacy):** Applicable when the hazard (meningitis epidemic) is significant but does not cause a major concern or outrage in people, who may be indifferent to the problem.

**Strategy No. 3: Outrage management:** Applicable when the hazard (meningitis epidemic) is low (or non-existent) but causes strong outrage or concern, or a disproportionate response to the actual risk.

**Strategy No. 4<sup>7</sup>: Crisis communication:** Applicable when the hazard (meningitis epidemic) is significant or imminent, raising a high level of fear.

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<sup>6</sup> Peter Sandman in Responding to community outrage. Strategies for effective risk communications. First edition published in 1993 by the American Industrial Hygiene Association. Copyright transferred to the author, Peter M. Sandman, in 2012.  
<http://psandman.com/media/RespondingtoCommunityOutrage.pdf>.

<sup>7</sup> Risk communication strategies. Global Communication Forum Annual meeting, WHO HQ Geneva.

## 16. OPERATIONAL RESEARCH AND DOCUMENTATION OF EPIDEMIC RESPONSE

To pursue strategies to eliminate meningitis in sub-Saharan Africa, priority research areas must be developed. This research should cover several areas, surveillance, diagnostic tests, resistance to antibiotics, etc. They may be adapted according to the country.

Information from this research can be used as a basis for developing guidelines. In addition, resources should be mobilized to conduct key operational research and the results obtained should be used to improve the control of meningitis epidemics in Africa. At the end of the response, the district health management team must collect all materials relevant to the documentation and evaluation of the epidemic response, particularly minutes of meetings, activities, processes, reporting on the epidemic, evaluation reports and other relevant documents. In addition, a cover page should be prepared listing all the above-mentioned documents. These documents will become an essential data source for the assessment of the response. The local team can conduct the assessment of the response itself (internal evaluation) or be supported by other levels and partners in the response.

## 17. COORDINATION

Overall planning and coordination should be provided at the national, provincial and district levels. They are the responsibility of health authorities but require the input of a wide range of partners. The establishment of a Public Health Management Emergency Committee (PHMEC)<sup>8</sup> well before the epidemic season is the most effective way to plan, coordinate and supervise the activities of many partners to ensure that epidemics are detected early and an appropriate response is initiated without delay. The PHMEC should be led by representatives of the Ministry of Health and should include staff from major national, regional hospitals, reference laboratories and other partners who may be involved in the treatment of patients and epidemic surveillance. The PHMEC meets regularly before and throughout the epidemic season.

The role of the PHMEC is to:

- Ensure that the surveillance system is in place for the epidemic season and covers the entire country, region/province or districts and that health workers receive training in case identification, meningitis, data collection, transmission, analysis and monitoring as they become available;
- Ensure that information, training and medical supplies are made available (to provide) the best possible treatment for patients in remotest health centres;

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<sup>8</sup> Kasolo F, Congou J-B, Perry H. *Technical guidelines for integrated disease surveillance and response in the African region*. 2010. <http://www.afro.who.int/en/clusters-a-programmes/dpc/integrated-disease-surveillance/features/2775-technical-guidelines-for-integrated-disease-surveillance-and-response-in-the-african-region.html>

- Ensure the distribution of appropriate vaccines, as appropriate, and coordinate immunization campaigns;
- Disseminate information to the public on the risks of meningitis, where and how to obtain treatment and any planned immunization campaigns.

The PHMEC must ensure that meningitis is integrated into the national health plan for emergency and disaster management.

## 18. MONITORING AND SUPERVISION

### *District level*

The district chief medical officer will conduct supervision to ensure that health facility staff is well informed of the process. For health facilities known to be in areas at risk of meningitis epidemics, staff will be trained in lumbar puncture procedures and in collection, handling and transport of CSF specimens. At the same time, this training will include management of meningitis cases, concepts of alert threshold and epidemiological threshold, as well as data analysis and reporting procedures using IDSR forms.

During the epidemic season, the PHMEC must be reactivated (if not already functional) for decision-making. Weekly meetings are recommended (Annex 13).

### *Regional/provincial Level*

The Surveillance Officer at this level will support and supervise enhanced meningitis epidemic surveillance activities at the district level. Other vaccine-preventable disease (polio, measles and yellow fever) surveillance focal points will be involved for enhanced meningitis surveillance. Resources from acute flaccid paralysis surveillance can make a significant (logistic) contribution in enhanced meningitis surveillance in accordance with the IDSR strategy.

The Surveillance Officer at the regional/provincial level will put in place a system for monitoring alert or epidemic districts. He/she will ensure that CSF specimens have been collected for laboratory confirmation and will verify that specimens collected in alert or epidemic districts have been sent to the regional or national reference laboratory and that results are returned.

During the epidemic season, the PHMEC at the provincial level must be reactivated (if not functional) to improve decision-making, as well as management and coordination of the response to possible meningitis outbreaks and provide support to the districts. Weekly meetings are recommended. Continuous supervision by the national level is necessary at this stage.

### ***Level of National epidemiological surveillance unit***

Each week during the epidemic season, the national epidemiological surveillance officer should check if districts have reached the alert threshold. For those who have reached this threshold, the officer must then check with the laboratory whether CSF specimens on TI mediums or cryotubes have started arriving from this district. If specimens are not received, a way to support the district for laboratory confirmation of specimens should be found without delay.

Other important activities to be carried out at this level are:

- Monitoring the provision of vaccines
- Monitoring the provision of medicines
- Provision of data management tools
- Evaluation of performance indicators (Annex 2A, 2B)

Monitoring the performance of surveillance allows assessing whether the surveillance of meningitis is working properly and identifying problematic areas that can be improved.

The National PHMEC should be reactivated for situation analysis, recommendation of appropriate control measures and improved management of potential meningitis outbreaks. It will hold regular weekly meetings to analyse epidemiological and laboratory data with a view to deciding on supervisory and monitoring actions to support affected regions and districts. The national PHMEC must also advocate for the mobilization of resources (funds, medicines, reagents, vaccines and logistics).

A Rapid Response Team (RRT) should be established at the national level with the participation of partners to conduct field investigations and speedy implementation of control measures. For the composition of the PHMEC and RRT, refer to the IDSR technical guide<sup>9</sup> and documents of the Ministry of Health.

### ***National Reference Laboratory***

The head of the national reference laboratory (NRL) should ensure through the laboratory focal point that the tests performed are of good quality and that the results are returned very quickly to the districts. The head of the laboratory should provide regular feedback on specimens collected and processed to minimize contamination and handling/transport problems. Moreover, he/she should organize regular training and supervision of provincial and district laboratories and ensure the availability of reagents and laboratory equipment. He/she should also ensure that 10 to 20% of positive isolates are sent to the WHO collaborating centres for external quality control (compliance with international norms and standards) for genotyping and/or gene sequencing.

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<sup>9</sup> Kasolo F, Congou J-B, Perry H. *Technical guidelines for integrated disease surveillance and response in the African region*. 2010. <http://www.afro.who.int/en/clusters-a-programmes/dpc/integrated-disease-surveillance/features/2775-technical-guidelines-for-integrated-disease-surveillance-and-response-in-the-african-region.html>



### ***National Technical Coordination Group***

Each country will have a national technical coordination group composed of the epidemiological surveillance officer, the head of the national public health laboratory, the WHO's disease presence and control officer at the country level (DPC). This group will meet weekly to monitor the implementation of enhanced meningitis surveillance activities.

This group should ensure that partners' contributions are taken into account and that all the activities are well coordinated. The group will be responsible for providing feedback and accountable for the performance of surveillance to all stakeholders involved and for the final evaluation report on the country's response to the epidemic.

## **19. FEEDBACK**

Feedback is crucial to ensure improved case management, motivation of peripheral staff, better planning of control and prevention strategies at the peripheral level.

A mechanism should be put in place to provide the peripheral level with information on laboratory investigations, disease trends and surveillance performance. This mechanism should include:

- The preparation and dissemination of feedback bulletins and activity or supervision reports.
- Formative supervision visits in the field.
- Periodic exchange meetings among surveillance stakeholders.

Reports, bulletins, statistical yearbooks, websites, etc. may be used for feedback (see Annex 2A,2B for Performance Indicators).

The IST-WA produces a weekly bulletin (below) that summarizes all the data collected and reported by the countries of the meningitis belt in recent years. This bulletin is available at: <http://www.who.int/emergencies/diseases/meningitis/epidemiological/en/>

**Bulletin Hebdomadaire de retro-information sur la méningite cérébrospinale**  
*Weekly feedback bulletin on cerebrospinal meningitis*

*03 au 30 November 2014*

**I - SITUATION EPIDEMIOLOGIQUE DE LA SEMAINE 45-48 EPIDEMIOLOGICAL SITUATION OF WEEK 45-48**

**Table 1: Situation épidémiologique / *Epidemiological Situation***

Pays	Cas	Décès	Létalité (%)	District en Alerte	District en Epidémie	Complétude (%)
<i>Country</i>	<i>Case</i>	<i>Death</i>	<i>Lortality (%)</i>	<i>District in Alert</i>	<i>District in Epidemic</i>	<i>Completeness (%)</i>

## ANNEXES

### Annex 1: Case investigation form

MINISTRY OF HEALTH	I GENERIC CASE-BASED REPORTING FORM	Name of country
<b>HEALTH FACILITY:</b> _____ <b>District:</b> _____ <b>Region:</b> _____		
<input type="checkbox"/> Cholera <input type="checkbox"/> Disease 2 ..... <input type="checkbox"/> Meningitis <input type="checkbox"/> Other (specify): _____		
<b>EPID NUMBER:</b> / _ _ _ / _ _ _ / _ _ _ / _ _ _ / _ _ _ / _ _ _ / _ _ _ /		
<i>(To be completed at the district level)</i> Country      Region      District      Year      Disease Case No.		
<b>PATIENT IDENTIFICATION</b>		
Patient's name: _____ Patient's first name (s): _____		
Date of Birth: ___/___/___		
<b>or</b> Age in years: ___ <b>or</b> Age in months (if <12 months) ___ <b>or</b> Age in months (if <1 month) ___		
Sex: <input type="checkbox"/> Female <input type="checkbox"/> Male Occupation (enter child if <5 years old): _____		
<u>Patient's residence</u>		
District of residence: _____ Town/Village: _____ Neighbourhood/Area: _____		
<input type="checkbox"/> Urban / <input type="checkbox"/> Rural _____		
Name of father/mother /guardian: _____ Patient's or guardian's phone number _____		
Date seen: ___ / ___ / ___ Date of onset: ___ / ___ / ___ <input type="checkbox"/> In-patient/Under observation <input type="checkbox"/> Out-patient		
Outcome: <input type="checkbox"/> Healed <input type="checkbox"/> Deceased <input type="checkbox"/> Under treatment <input type="checkbox"/> Unknown		
<b>PATIENT VACCINATED:</b> <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> UNKNOWN		
<u>If not a meningitis case:</u>		
Type of vaccine: _____ Number of doses: ___ <input type="checkbox"/> Unknown Date of last vaccination: ___ / ___ / ___		
<u>If suspected case of meningitis vaccines received:</u>		
MenAC	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	<u>Source of vaccine information:</u> <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown <input type="checkbox"/> card <input type="checkbox"/> vaccination register <input type="checkbox"/> verbal <input type="checkbox"/> Unknown
MenACW	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
MenACWY	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Conjugate A	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
PCV13- 1	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
PCV13- 2	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
PCV13-3	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Hib 1	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Hib 2	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Hib 3	<input type="checkbox"/> Yes, Date: ___ / ___ / ___ <input type="checkbox"/> No <input type="checkbox"/> Unknown	

**SPECIMEN COLLECTED:**  YES  NO (Note: IF NO, Please fill in the form and send it to the district CISSE)

IF NO: Why:  Lack of kit  Lack of kit  Patient's condition  Other: \_\_\_\_\_

IF YES:

Date of specimen collection: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time of specimen collection: / \_\_\_\_/\_\_\_\_/ HH \_\_\_\_/\_\_\_\_/ Min

Specimen source:  Stool  Blood  CSF  Other: \_\_\_\_\_

Appearance of specimen: CSF:  Clear  Turbid  Hematic  Xanthochromic  Citrin  Cloudy  Purulent

Stool:  Aqueous  Mucoid  Bloody mucoid  Bloody

Date and time of inoculation in the transport medium: \_\_\_\_/\_\_\_\_/\_\_\_\_ and / \_\_\_\_/\_\_\_\_/HH \_\_\_\_/\_\_\_\_/ Min

Specimen(s) sent to lab:  Yes  No If not why? \_\_\_\_\_

Packaging:  Dry tube  Trans-Isolate  Cryotube  Cary blair  Other: \_\_\_\_\_

RDT carried out:  Cholera  Meningitis  Other (Specify): \_\_\_\_\_ Results: \_\_\_\_\_

Date specimen sent to lab: \_\_\_\_/\_\_\_\_/\_\_\_\_ Name of laboratory: \_\_\_\_\_

Date of reporting to the higher level: \_\_\_\_/\_\_\_\_/\_\_\_\_ Person completing form: \_\_\_\_\_ Tel: \_\_\_\_\_

Date form sent to District: \_\_\_\_/\_\_\_\_/\_\_\_\_ Date District received the form: \_\_\_\_/\_\_\_\_/\_\_\_\_

Date form sent to Region: \_\_\_\_/\_\_\_\_/\_\_\_\_ Date Region received form: \_\_\_\_/\_\_\_\_/\_\_\_\_

Date form sent to the central level: \_\_\_\_/\_\_\_\_/\_\_\_\_

**DISTRICT LABORATORY OF :** \_\_\_\_\_

Date of receipt: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_/ H \_\_\_\_/ Min **No. in laboratory register :** \_\_\_\_\_

Specimen (s) received:  Dry tube  Trans-Isolate  Cryotube  Cary blair  Other (specify): \_\_\_\_\_

Conditions of transport of Specimen (s):  Adequate  Not Adequate

Appearance of specimen: CSF:  Clear  Turbid  Hematic  Xanthochromic  Citrin  Cloudy  Purulent

Stool:  Aqueous  Mucoid  Bloody mucoid  Bloody

Type of tests performed:  Cytology  Fresh state  Gram  Latex  RDT  Other (specify): \_\_\_\_\_

**Cytology:** Leucocytes / \_\_\_\_/\_\_\_\_/\_\_\_\_/\_\_\_\_/\_\_\_\_/ mm<sup>3</sup> PN / \_\_\_\_/\_\_\_\_/% LYMPH / \_\_\_\_/\_\_\_\_/%

**Gram :**  GPD  GND  GPB  GNB  Other pathogens  Negative

**RDT carried out:** Cholera  Meningitis  Other (Specify): \_\_\_\_\_ Results: \_\_\_\_\_

**Latex:**  NmA  NmC  NmW/Y  NmB  *S. pneumoniae*  Hib  Negative

**Other test** (specify type and results): \_\_\_\_\_

Date specimens sent to reference laboratory: \_\_\_\_/\_\_\_\_/\_\_\_\_

REGIONAL LABORATORY OF : \_\_\_\_\_

Date received: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_ / H \_\_\_\_/ Min No. in laboratory register : \_\_\_\_\_

Specimen (s) received:  Dry tube  Trans-Isolate  Cryotube  Cary blair  Other (specify): \_\_\_\_\_

Conditions of transport of Specimen (s):  Adequate  Not Adequate

Appearance of specimen: CSF:  Clear  Turbid  Hematic  Xanthochromic  Citrin  Cloudy  Purulent

Stool:  Aqueous  Mucoïd  Bloody mucoïd  Bloody

Type of tests performed:  Cytology  Fresh state  Gram  Latex  RDT  Other (specify): \_\_\_\_\_

Cytology: Leucocytes /\_\_\_\_/\_\_\_\_/\_\_\_\_/\_\_\_\_/\_\_\_\_ mm<sup>3</sup> PN /\_\_\_\_/\_\_\_\_/% LYMPH /\_\_\_\_/\_\_\_\_/%

Gram :  GPD  GND  GPB  GNB  Other pathogens  Negative

RDT carried out: Cholera  Meningitis  Other (Specify): \_\_\_\_\_ Results: \_\_\_\_\_

Latex:  NmA  NmC  NmW/Y  NmB  *S. pneumoniae*  Hib  Negative

Culture:  NmA  NmC  NmW  NmB  NmX  Nm Indeterminate  {ut11 }S. Pneumoniae  
 Hib  *H. influenzae* Indeterminate  StrepB  Other pathogens (specify): \_\_\_\_\_

Contaminated  Negative

Other test (specify type and results): \_\_\_\_\_

Antibiogram: Ceftriaxone:  Sensitive  Resistant  Intermediate  Not done

Penicillin G:  Sensitive  Resistant  Intermediate  Not done

Oxacillin:  Sensitive  Resistant  Intermediate  Not done

Other \_\_\_\_\_:  Sensitive  Resistant  Intermediate  Not done

Date specimens sent to reference laboratory: \_\_\_\_/\_\_\_\_/\_\_\_\_

REFERENCE LABORATORY: \_\_\_\_\_

Date received: \_\_\_/\_\_\_/\_\_\_ Hour: \_\_\_H \_\_\_ EPID No. on tube?  YES  NO No. in laboratory register: \_\_\_\_\_

Specimen (s) received :  Dry tube  Trans-Isolate  Cryotube  Cary blair

Other (specify): \_\_\_\_\_

Conditions of transport of Specimen (s):  Adequate  Not Adequate

Appearance of specimen: CSF:  Clear  Turbid  Hematic  Xanthochromic  Citrin  Cloudy  Purulent

Stool:  Aqueous  Mucoïd  Bloody mucoïd  Bloody

Type of tests performed:  Cytology  Fresh state  Gram  Latex  RDT/Dipstick

Other (specify): \_\_\_\_\_

Cytology : Leucocytes /\_\_\_/\_\_\_/\_\_\_/\_\_\_/\_\_\_/ mm<sup>3</sup> PN /\_\_\_/\_\_\_/\_\_\_/% LYMPH /\_\_\_/\_\_\_/\_\_\_/%

Gram:  GPD  GND  GPB  GNB  Other pathogens  Negative

Rapid Diagnostic Test Results (RDT/Dipstick):  NmA  NmC  NmW  NmY  Negative

Latex:  NmA  NmC  NmW/Y  NmB  *S. pneumoniae*  Hib  Negative

Culture:  NmA  NmC  NmW  NmB  NmX  Nm Indeterminate  {ut11 }*S. Pneumoniae*

Hib  *H. influenzae* Indeterminate  StrepB  Other pathogens (specify): \_\_\_\_\_

Contaminated  Negative

PCR: date of PCR: \_\_\_/\_\_\_/\_\_\_ Type of PCR:  Real-time  Conventional

NmA  NmC  NmW  NmY  NmB  NmX  Nm Indeterminate  *S. pneumoniae*

Hib  *H. influenzae* Indeterminate  StrepB  Other pathogens (specify) : \_\_\_\_\_

Contaminated  Negative

Serotype: /\_\_\_/\_\_\_/ Other test (Specify type and results): \_\_\_\_\_

**Final Laboratory Result:**

NmA  NmC  NmW  NmY  NmB  NmX  Nm Indeterminate  *S. pneumoniae*

Hib  *H. influenzae* Indeterminate  StrepB  Other pathogens (specify): \_\_\_\_\_

Antibiogram: Ceftriaxone:  Sensitive  Resistant  Intermediate  Not done

Penicillin G:  Sensitive  Resistant  Intermediate  Not done

Oxacillin:  Sensitive  Resistant  Intermediate  Not done

Other \_\_\_\_\_:  Sensitive  Resistant  Intermediate  Not done

Comments: \_\_\_\_\_

Date results sent to the Surveillance Department of the Ministry of Health: \_\_\_/\_\_\_/\_\_\_

## Annex 2A: Performance indicator (ES)

Indicator	Target
1. Percentage of districts that have reported weekly meningitis cases and deaths on time	80%
2. Percentage of alert or epidemic districts which have been investigated and documented within the 48 hours after reaching the alert or epidemic threshold	80%
3. Percentage of districts in alert or epidemic phase that have sent at least 10 TI bottles to the national reference after reaching the alert threshold	80%
4. Percentage of epidemic districts that have confirmed the serogroup of at least 10 suspected meningitis cases within 7 days of surpassing the alert or epidemic threshold.	80%
5. Percentage of alert and epidemic districts that have received results from the samples sent to the national reference laboratory within 7 days of receiving the TI bottles by the laboratory	80%
6. Percentage of culture negative samples among CSF samples received per week by the reference laboratory	<20%
7. Percentage of contaminated samples among CSF samples received per week by the reference laboratory	<20%
8. Percentage of countries which have reported on time weekly data (surveillance and laboratory results) to WHO	80%
9. Percentage of weekly meningitis bulletins produced on time by WHO (and sent to countries, WHO/AFRO/HQ and partners).	80%
10. Percentage of cases with lumbar puncture performed	>50%

## Annex 2B: Performance indicators (CBS)

Indicator	Target
1. Percentage of districts submitting the Surveillance database to the National Surveillance Office on time	>80%
2. Percentage of cases with updated evolution	>90%
3. Percentage of suspected cases vaccinated with MenAfriVac <sup>®</sup> with immunized status reported	>80%
4. Percentage of cases with lumbar puncture performed	>80%
5. Percentage of CSF samples received at the National Reference Laboratory in Trans-Isolate medium	>50%
6. Percentage of CSF samples received at the National Reference Laboratory	>70%
7. Percentage of cases with a delay of less than 7 days between the date of collection of CSF and the date of receipt at the National Reference Laboratory	>50%
8. Percentage of CSF with Gram staining performed in the laboratory outside the National Reference Laboratory	>70%
9. Percentage of CSF samples received at the National Reference Laboratory and analysed by a confirmatory test (culture, PCR)	>90%
10. Percentage of CSF samples contaminated with culture at the National Reference Laboratory	<10%
11. Percentage of CSF samples contaminated with PCR at the National Reference Laboratory	<10%
12. Percentage of CSF samples confirmed at the National Reference Laboratory for Hib, S. pn, Nm, and other pathogens	>30%



### Annex 3: Preparing for ICG vaccine request

To access the ICG emergency vaccine stockpile, countries must:

- Provide evidence of a meningococcal disease outbreak
- Provide laboratory confirmation of the *Nm* serogroup responsible
- Develop and provide plan(s) of action for the vaccination campaign(s)
- Provide proof of necessary storage and transportation resources to ensure the safe and effective delivery and maintenance of the vaccines to the area affected.

A micro-plan must be prepared for every district targeted for a vaccination campaign. It is the responsibility of the district health authorities to complete and submit the plan to prepare thoroughly for the campaign and to secure the necessary vaccines.

The micro-plan should include:

- the names of sub-districts targeted for vaccination;
- the total population currently present in the target areas;
- the population targeted for vaccination;
- the type and quantity of vaccine needed;
- the quantity of additional supplies needed– AD syringes, safety boxes, dilution syringes (10 ml), cotton wool, gloves;
- the number of teams conducting the campaign (each team requires vaccinators, recorders, crowd controllers and a supervisor);
- the number of supervisors – at team, district, provincial and central levels;
- the mechanism for training the vaccination teams;
- logistic needs – cold chain equipment, vehicles;
- the mechanism for managing waste resulting from the campaign;
- the plans for vaccination campaign coverage surveys.

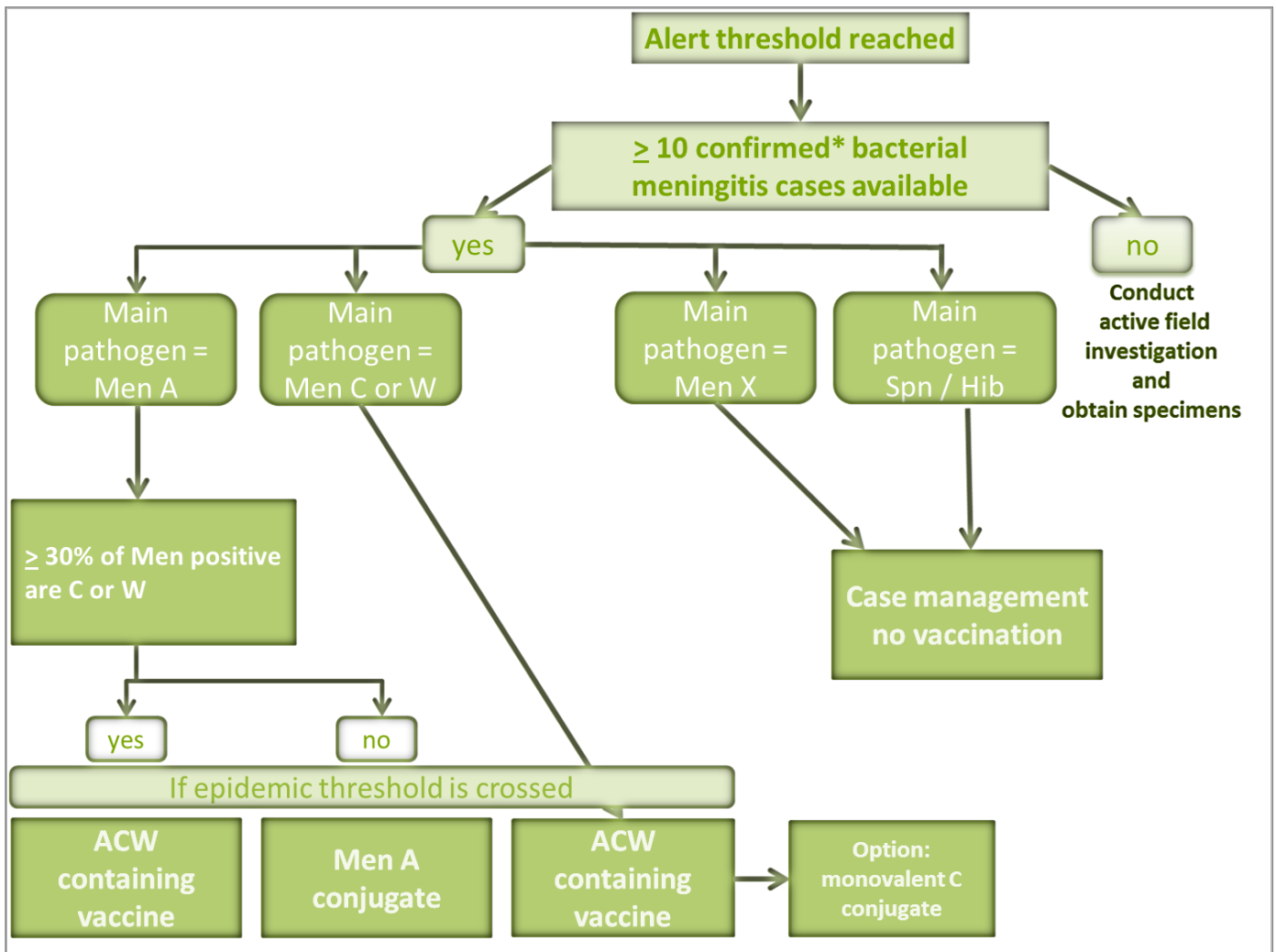
The budget should include:

- allowances for members of the vaccination team;
- social mobilization costs (including allowances for staff);
- costs of logistic equipment;
- costs of waste management;
- costs of coverage survey.

The email address of the ICG is [ICGsecretariat@who.int](mailto:ICGsecretariat@who.int)

The form is available at: <http://www.who.int/csr/disease/meningococcal/icq/en/>

**Annex 4: Decisional tree for meningitis vaccine choice in a reactive vaccination campaign**



\* Confirmation = a positive result from culture or polymerase chain reaction

## Annex 5: Investigation of *Neisseria meningitidis* serogroup A case in the meningitis belt

April 2019

### *Introduction*

Since the progressive introduction of meningococcal serogroup A conjugate vaccine (MACV) in the meningitis belt of Sub-Saharan Africa starting in 2010 via mass vaccination campaigns, 19 countries have completed mass preventive campaigns and 260 million persons vaccinated. Surveillance data and studies have documented a dramatic impact of the vaccine, reducing serogroup A *N. meningitidis* (Nm A) incidence. To sustain the success of the mass campaigns, the introduction of MACV into EPI programs has started in 2016.

Epidemiological surveillance has shown that despite the large success and the dramatic reduction of Nm A epidemics in the belt, Nm A cases have continued to occur, reported as isolated cases or small clusters. This finding indicates that the pathogen is still circulating, mainly in pockets where MACV coverage has been lower. Since countries implemented their mass campaigns, new born cohorts went unvaccinated and the number of susceptible individuals has increased. Influx of new population may also influence the number of people at risk. It is therefore important to monitor the incidence of Nm A and implement the vaccination of new cohorts as soon as possible.

Epidemiologic evaluation and microbiologic confirmation of every Nm A case is necessary in order to make sure that Nm A was the isolated pathogen, understand the primary reason for the occurrence of a Nm A case in a vaccinated area (basically whether the person was not vaccinated or if it was a vaccine failure) and understand the potential risk for the population in the area to inform an eventual public health intervention. It is also crucial to document the duration and strength of protection of the MACV.

### *Purpose of the document*

This document aims to provide standardized guidance for public health authorities and investigators at all levels to plan and conduct the investigation of every meningitis case of Nm A. This guidance applies to all countries and areas that have introduced the MACV.

This document does not intend to provide comprehensive guidance on the control measures that need to be implemented in response to the identification of an Nm A case.

### *Objectives of the investigations of Nm A cases*

The systematic investigation of a case of Nm A aims:

- to confirm the diagnosis of *Neisseria meningitidis* serogroup A in the suspected case
- to determine the vaccination status of the case and to identify any potential vaccination failure
- to detect an unreported cluster of Nm A cases

- to identify high-risk areas (unvaccinated/accumulation of susceptible) to eventually recommend catch-up vaccination
- to inform MACV vaccine effectiveness and vaccine impact

### **Case definition for Nm A**

#### **For the purpose of the investigation**

- An Nm A case is *suspected* based on laboratory findings (including identification by latex agglutination/RDT, PCR, or culture) at subnational level
- An Nm A case is *confirmed* by PCR and/or culture by the National Reference Laboratory and/or Regional Reference Laboratory.

#### **Methods**

Two categories of activities need to be undertaken to manage newly identified Nm A cases:

- Field investigation of the case for epidemiological data collection
- Microbiologic confirmation and molecular characterization of the strain

A laboratory getting a positive result for NmA (suspected or confirmed) should inform the regional and national public health authorities immediately (within 24 hours). The health authorities should then immediately:

- request the laboratory to provide details on the laboratory methods used
- get the Integrated Disease Surveillance and Response form of the case(s).
- inform WHO

The field investigation of the case should be organized as quickly as possible (within one week of the report) and laboratory confirmation sought on any suspected meningitis case.

### **1. Epidemiologic field investigation of Nm A cases**

The following key steps should be implemented

#### **A. Prepare for the investigation:**

- A multidisciplinary field investigation team should be assembled with members having experience at least in epidemiology and laboratory diagnosis.
- Preliminary background information (including any previous reports, case information, laboratory confirmation, etc.) should be collected and necessary materials (forms, guidelines, any materials to reinforce surveillance, if needed) assembled.
- Maps of the concerned area and epidemiological information on meningitis incidence and serogroup distribution in the area should be gathered.

**B. Review the available information:** The investigation team should review carefully the standard IDSR notification form filled for the case and transmitted from the field to determine whether the demographic, clinical, and epidemiological information is complete. Assess whether the suspect case definition for bacterial meningitis was correctly used (box). If not possible with the given information, verify the clinical symptoms during the patient interview.

### Standard case definitions for bacterial meningitis

#### *Suspected meningitis case:*

Any person with sudden onset of fever (>38.5 °C rectal or 38.0 °C axillary) **and** neck stiffness or other meningeal signs, including bulging fontanelle in infants.

#### *Probable meningitis case:*

Any suspected case with: macroscopic aspect of CSF turbid, cloudy, or purulent; with a CSF leukocyte count >10 cells/mm<sup>3</sup>; or with bacteria identified by Gram stain in CSF; or positive antigen detection (for example latex agglutination) in CSF.

*In infants:* CSF leucocyte count >100 cells/mm<sup>3</sup>; or CSF leucocyte count 10–100 cells/mm<sup>3</sup> AND either an elevated protein (>100 mg/dl) or decreased glucose (<40 mg/dl) level.

#### *Confirmed meningitis case:*

Any suspected or probable case that is laboratory confirmed by culture or identification of (i.e. by polymerase chain reaction) a bacterial pathogen (*Neisseria meningitidis*, *Streptococcus pneumoniae* or *Haemophilus influenzae type b*) in the CSF or blood.

### C. Conduct the field investigation:

#### ***Essential information to be collected for a suspected or confirmed Nm A case***

1. Patient identification and demographic information:
  - Patient ID number, name, sex, birth date/age
  - Place of residence and contact information
  - Name of person and relationship to the patient if a proxy is interviewed
2. Travel history of patient within 10 days of disease onset
3. Clinical information:
  - Date of consultation
  - Date of sample collection
  - Date of onset of symptoms
  - Symptoms
  - Treatment
  - Hospitalization including date of admission and duration
  - Outcome of the patient

#### 4. Vaccination status (MACV)

- Ask for the vaccination card and take a picture of the card
- Date and place of vaccination
- Batch number
- If card not available, check out for registers.
- If no written information can be found, a careful interview must be conducted including a cross validation with another person to ensure the vaccination status.

#### 5. Other cases (meeting the suspected bacterial meningitis case definition) in the household or close neighbourhood: name, age, and vaccination status. These cases should be sought for cross check at the health centre and then categorized (see classification).

#### 6. Laboratory investigation

- Date and place of lumbar puncture
- Place and kind of tests conducted
- Test results
- Final laboratory diagnosis (classification)
- Availability of lab material of the case (CSF aliquot, isolate in culture)

In addition to the medical staff, the investigation team should locate and interview the patient. During the interviews all information should be collected (form for NmA case investigation in annex). Information should also be sought on contacts (and neighbours or others surrounding) who may meet the suspect case definition for bacterial meningitis.

**Active case-finding.** A review of health facility registers should be conducted to ensure that all persons meeting the suspect case definition for meningitis have been reported and that any samples that may have been taken are tested and followed-up. The areas that should be surveyed should include the village of residence of the patient as well as area where the patient may have acquired the infection (in case patient travelled within 10 days of disease onset).

**D. Reinforce surveillance:** surveillance should be reinforced in the area where the case was reported to ensure detection, specimen collection, laboratory diagnosis and reporting of subsequent cases.

## 2. Laboratory confirmation of Nm A

All Nm A cases should undergo culture and/or PCR for confirmation at the national reference laboratory (NRL). If the specimen is still available and was not tested at the NRL, it should be referred to the national reference laboratory for confirmatory testing within 48 hours. If culture or PCR method is not available at the national level, the specimen should be referred to a WHO Collaborating Centre.

The NRL should rapidly communicate the results to the national surveillance unit that should feedback the concerned district, region, and WHO immediately.

If results are inconclusive or tests are contradictory, the sample should be sent to a WHO Collaborating Centre for confirmatory testing.

In addition, all or a subset (if large cluster) of NmA samples should be referred to a WHO Collaborating Centre for confirmatory testing and whole genome sequencing of available isolates. If only a clinical specimen is available, multi locus sequence typing may be attempted for determination of sequence type.

### Classification of the case

As soon as confirmatory laboratory results are available from the NRL and/or the WHO Collaborating Centre, these results should be integrated into the final investigation report, providing a final case classification and an orientation on the cause of the infection:

- **Nm A not confirmed**
  - Laboratory results are not conclusive
  - Sample is not available anymore and the sample has not been tested at the NRL or a WHO Collaborating Centre
- **Nm A confirmed (laboratory confirmed)**
  - patient not vaccinated
    - inform whether the patient was eligible or not eligible for vaccination at the time of the campaign.
  - vaccination failure (patient vaccinated).
  - not conclusive (vaccination status not determined).

For cases identified in the household (epi link) of a confirmed Nm A, they should be categorized as follows:

- Case already reported in the health system and confirmed with another pathogen: **discarded.**
- Case already reported in the health system and there is neither a lumbar puncture nor a negative lab result: **suspected Nm A case.**
- Case not reported in the health system: **suspected Nm A case.**

### Investigation report and dissemination

A detailed report of the case investigation findings should be elaborated and shared with health authorities and district, regional and national levels, as well with partners. This report should contain a descriptive analysis of the case (s) (person, time, and place). It is essential that information on vaccination status for all identified Nm A cases be presented. For investigations that yield multiple cases of Nm A, graphical/tabular descriptions of cases by date of onset, geographical location, age, and vaccination statuses should be developed. Any key observations and recommendations on the case detection, notification, data management, laboratory

confirmation, or other aspects of the surveillance process to be strengthened should be noted. The report of the field investigation containing this information and analysis should be disseminated within 7 days of the completion of the mission.

The conclusion from this final report should be discussed among national authorities and partners in order to decide on the need for additional evaluations/studies and any response measures that should be implemented.

Specific Form for Investigation of Meningitis Cases with Serogroup A Meningococci.

<b>Health Facility :</b> _____ <b>LGA :</b> _____ <b>State:</b> _____				
Date of MenAfriVac® campaign in the LGA (Year : _____)				
<b>EPID No. :</b> /    /    /    /    /    /    /    /    /    /				
<i>Country      State      LGA      Year      Disease      Case No.</i>				
<b>PATIENT DETAILS</b>				
Surname: _____ First name : _____ Sex : <input type="checkbox"/> Female <input type="checkbox"/> Male				
Date of birth : ____/____/____ or Age in years : ____ or Age in months (if <12 months) ____				
Residential address : _____ Village : _____ LGA: _____				
Name of Parent(s) : _____ Telephone of patient or parent(s) : _____				
Did the patient travel to another location 10 days before onset of symptoms? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know				
If yes, specify where: _____				
Date seen at health facility: ____/____/____ Date of onset of symptoms: ____/____/____				
<input type="checkbox"/> Was the patient admitted? Outcome: <input type="checkbox"/> Recovered <input type="checkbox"/> Died <input type="checkbox"/> Still on admission <input type="checkbox"/> Don't know				
Major symptoms: <input type="checkbox"/> Neck stiffness <input type="checkbox"/> Fever (T°= _____ ) <input type="checkbox"/> Loss of consciousness				
Other symptoms: _____				
<b>VACCINATION STATUS</b>				
<b>Vaccine</b>	<b>Date of last dose</b>	<b>Source</b>	<b>Lot N°</b>	<b>Place of vaccination</b>
MenA conjug. (MenAfriVac)	<input type="checkbox"/> Yes, Date: ____/____/____ <input type="checkbox"/> No	<input type="checkbox"/> card <input type="checkbox"/> verbal	_____	_____
MenAC (PS)	<input type="checkbox"/> Yes, Date: ____/____/____ <input type="checkbox"/> No	<input type="checkbox"/> card <input type="checkbox"/> verbal	_____	_____
MenACW (PS)	<input type="checkbox"/> Yes, Date: ____/____/____ <input type="checkbox"/> No	<input type="checkbox"/> card <input type="checkbox"/> verbal	_____	_____
MenACWY (PS)	<input type="checkbox"/> Yes, Date: ____/____/____ <input type="checkbox"/> No	<input type="checkbox"/> card <input type="checkbox"/> verbal	_____	_____
<b>CASE SEARCH (alive and dead):</b>				
Are there other cases known to the patient? /_____ Yes 2= No    If yes, How many? _____				
1. Name of case: _____ Age : _____				
Vaccinated?: <input type="checkbox"/> yes, card <input type="checkbox"/> yes, verbal <input type="checkbox"/> No <input type="checkbox"/> Don't know				
If yes (MenAfrivac only?) : _____ date of last vaccination ____/____/____				
Lot N°: _____ Place of vaccination _____				
2. Name of case: _____ Age : _____				
Vaccinated? : <input type="checkbox"/> yes, card <input type="checkbox"/> yes, verbal <input type="checkbox"/> No <input type="checkbox"/> Don't know				
If yes (MenAfrivac only?) : _____				
date of last vaccination ____/____/____ Lot N°: _____ Place of vaccination _____				



**CSF SAMPLE**

**Date of Lumbar Puncture:**

**Appearance of CSF:** \_\_\_\_\_

Date of injection in the transport medium: \_\_\_/\_\_\_/\_\_\_

Transport medium:  Dry tube  Trans-Isolate  Cryotube  Others: \_\_\_\_\_

**RESULTS OF THE FIRST LABORATORY REPORTING THE CASE OF Nm A**

**Name of Laboratory:**

**Latex:** Not done  Negative  NmA

**Culture:** Not done  Negative  NmA

**PCR:** Not done  Negative  Contaminated  NmA

**Rapid Test:**

**Other tests (glucose, etc):** \_\_\_\_\_

**Is the patient's sample still available:** \_\_\_\_\_ **If yes, where?** \_\_\_\_\_

**RESULT FROM REFERENCE LABORATORY (Do not complete if it is the laboratory that reported the case)**

**Date sample received:**

**Appearance of CSF:** \_\_\_\_\_

**Gram :** Not done  Negative  DGP  DGN  BGP  BGN  Other bacteria  \_\_\_\_\_

**Latex:** Not done  Negative  NmA  NmW/Y  NmX  NmC  NmB/E. Coli  S. pneumo  HiB

**Culture:** Not done  Negative  Contaminated  NmA  NmW  NmX  NmC  NmY  NmB

Nm Indeterminate  S. pneumo  HiB  H. influenzae (non-B)  Other bacteria  \_\_\_\_\_

**PCR :** Not done  Negative  Contaminated  NmA  NmW  NmX  NmC  NmY  Nm Indeterminate  S. pneumoniae  Hib  Other bacteria  \_\_\_\_\_

**Other tests (glucose, etc) :** \_\_\_\_\_

**Is the patient's sample still available:** \_\_\_\_\_ **If yes, where?** \_\_\_\_\_

**RESULTS FROM WHO COLLABORATING CENTRE (LABORATORY)**

**Date sample received :** \_\_\_/\_\_\_/\_\_\_

**Culture:** Not done  Negative  Contaminated  Result : \_\_\_\_\_

**PCR :** Not done  Negative  Contaminated  Result : \_\_\_\_\_

**Molecular typing results:**



**Annex 6: WHO generic line list for reporting from health facility to district (during outbreak)**

Health Facility: \_\_\_\_\_ Date received at District: \_\_\_\_\_

District: \_\_\_\_\_ Disease/Condition: \_\_\_\_\_

	EPID Number (CCC-PPP-DDD-YY-NNNN)	(O)ut/(I)n Patient	Name	Village or Town and Neighbourhood	Sex	Age	Date seen at health facility	Date of onset of disease
1.								
2.								
3.								
4.								
5.								
6.								
7.								



### Generic line list (continued)

	Immunization status (specify vaccine type)	Blank variable	Blank variable	Laboratory tests		Outcome (A)live (D) dead	Comments
				Specimen taken (Yes/No) If yes, date collected	Laboratory results		
1.							
2.							
3.							
4.							
5.							
6.							
7.							



## Annex 7: Standardized excel data collection tool for enhanced surveillance of meningitis

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	Surveillance renforcée de la méningite en Afrique																								
2	Pays: Bénin				2015																				
3																									
4	Region	Distriet	Isocode	Année	Population	Semaine 1				Semaine 2				Semaine 3				Semaine 4				Semaine 5			
5						cas	décès	Taux d'attaque	Létalité	cas	décès	Taux d'attaque	Létalité	cas	décès	Taux d'attaque	Létalité	cas	décès	Taux d'attaque	Létalité	cas	décès	Taux d'attaque	Létalité
6	REGION	DISTRICT	ISOCODE	AN	POP	CAS01	DCD01	TAX01	LET01	CAS02	DCD02	TAX02	LET02	CAS03	DCD03	TAX03	LET03	CAS04	DCD04	TAX04	LET04	CAS05	DCD05	TAX05	LET05
75		Lalo	BJP006005000000000000	2015	121 415	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
76		Toviklin	BJP006004000000000000	2015	92 808	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
77	Total Couffo			2015	799 306	0	0	0.0	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0
78	Mono	Alhieme	BJP009005000000000000	2015	60 157	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
79		Bopa	BJP009002000000000000	2015	107 067	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
80		Come	BJP009001000000000000	2015	88 977	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
81		Grand-Popo	BJP009004000000000000	2015	61 458	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
82		Houeyogbe	BJP009006000000000000	2015	113 503	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
83	Lokossa	BJP009003000000000000	2015	117 423	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		
84	Total Mono			2015	548 584	0	0	0.0	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0
85	Plateau	Adja-Ouere	BJP011002000000000000	2015	124 176	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
86		Ifangni	BJP011003000000000000	2015	109 105	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
87		Ketou	BJP011005000000000000	2015	153 129	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
88		Pobe	BJP011001000000000000	2015	126 329	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
89		Sakete	BJP011004000000000000	2015	107 579	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
90	Total Plateau			2015	620 318	0	0	0.0	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0
91	Oueme	Adjara	BJP010002000000000000	2015	91 592	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
92		Adjohoun	BJP010009000000000000	2015	86 020	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
93		Aguegues	BJP010005000000000000	2015	40 606	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
94		Akpro-Misserete	BJP010001000000000000	2015	110 699	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
95		Avrankou	BJP010006000000000000	2015	122 508	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
96		Bonou	BJP010007000000000000	2015	45 187	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
97		Dangbo	BJP010003000000000000	2015	100 647	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
98		Porto-Novo	BJP010008000000000000	2015	340 624	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0	
99	Seme-Kpodji	BJP010004000000000000	2015	175 587	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		
100	Total Oueme			2015	1 113 469	0	0	0.0	0	0	0.0		0	0	0.0		0	0	0.0		0	0	0.0		0
101	TOTAL GENERAL				10 315 244	8	0	0.1	0.0	5	0	0.0	0.0	8	0	0.1	0.0	7	1	0.1	14.3	10	2	0.1	20.0

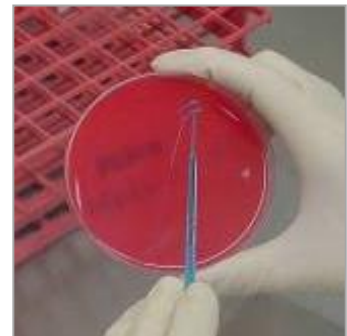


- Before transporting the vial, remove the ventilating needle from the top of the T-I vial. (This will prevent leakage and contamination during shipment). Disinfect the top of the T-I vial with 70% alcohol and replace the metallic cover.
- Transport the T-I vial at room temperature in a sealed plastic bag to minimize the risks of contamination. **And attach the case report form.**



### Culture (at the microbiology laboratory)

- Upon arrival at the reference laboratory, perform subculture of T-I media in which growth has occurred onto a blood agar plate and a chocolate agar plate, then incubate as indicated below. Vials in which no growth has occurred are re-incubated in a 37°C incubator at an upright position and observed daily for 7 days maximum.
- Prior to culture, remove the venting needle and wipe the T-I stopper with 70% alcohol.
- Use a sterile needle and syringe to transfer 50-100 µl of the liquid portion of the T-I medium onto both a Blood agar Plate (BAP) and Chocolate agar (CAP) for primary culture. Streak the BAP and CAP for isolation, incubate the plates at 35–37°C with ~5% CO<sub>2</sub>.



### Additional recommendations

- The T-I vials can be used for at least 1 year after the date of production provided that they are stored in the refrigerator.
- Freezing T-I vials destroys the T-I medium.
- Non-inoculated T-I vials should be packed in cold packs for shipment to the laboratory of reference.
- Contamination is the single most problematic point with the system. Aseptic measures and understanding the risks are necessary to achieve good recovery of the isolates.
- In previous studies,<sup>10</sup> cultures on ventilated TI vials 2 to 4 weeks after inoculation with CSF (from patients with acute bacterial meningitis), incubation and transport resulted in a loss of growth in only 20 to 25% of inoculated vials. Without ventilation the losses were much greater.

<sup>10</sup> Référence Ajello GA, Feely JC, Hayes PS, Reingold AL, Bolan G, Broome CV and Phillips CJ. Trans-isolate medium: a new medium for primary culturing and transport of *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*. J Clin Microbiol., 1984;20(1):55–58.

## Annex 9: Checklist for collection of specimens

### Check that the person meets the definition of suspected case of meningitis:

- Any person with sudden onset of fever ( $> 38.5^{\circ}\text{C}$  rectal or  $38.0^{\circ}\text{C}$  axillary) and one of the following signs: neck stiffness, or other meningeal sign.
- **Any infant with sudden onset of fever ( $>38.5^{\circ}\text{C}$  rectal or  $38.0^{\circ}\text{C}$  axillary) with one of the following signs: neck stiffness, bulging fontanelle, fixed upward gaze, convulsion and any other meningeal sign.**

### For each suspected case of meningitis:

1. Record cases and deaths in the consultation register
2. Record cases in the potentially epidemic disease reporting register
3. Record deaths on the line-listing form
4. Properly complete the case/case-based form
5. Perform a lumbar puncture

*\*Always complete the reporting form and the line list, even if LP is not feasible \**

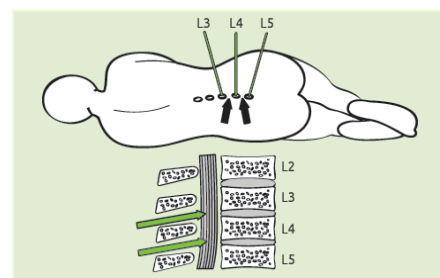
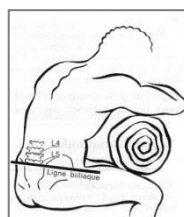
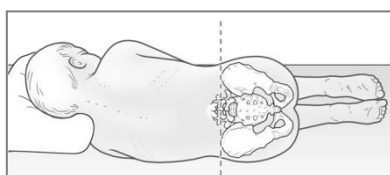
### Specimen collection equipment

- Skin disinfectant: 70% alcohol swab and povidone-iodine (*Alcohol with concentrations greater than 70% should not be used; do not use alcohol with glycerol added to it*)
- Sterile gloves
- Sterile gauze
- Surgical mask
- Adhesive bandage
- Kit for collection of cerebrospinal fluid (CSF)
  - Lumbar puncture needle (22 gauge for adults, 23 gauge for children)
  - 1 cryogenic tube
  - 1 dry tube
  - T-I medium (if CSF cannot be analyzed in the lab within 24 hours)
- Transport container
- Adhesive labels
- Safety boxes (sharp and contaminated waste)



### Lumbar Puncture Procedure

- Wash hands and wear a surgical mask and sterile gloves Change gloves between every patient.
- Label the collection tubes with appropriate information: patient's name, date and time of specimen collection.



- Ensure that the patient is kept motionless during the procedure, either sitting up or lying on the side, with his or her back arched forward so that the head almost touches the knees in order to separate the lumbar vertebrae during the procedure.
- Disinfect the skin along a line drawn between the crests of the two ilia with 70% alcohol and povidone-iodine to clean the surface and remove debris and oils. Allow to dry completely.
- Locate the space between the 2 vertebral spines at the L4-L5 by drawing a horizontal line between the crests of the two ilia.
- Position the spinal needle between the 2 vertebral spines at the L4-L5 level and introduce into the skin with the bevel of the needle facing up.
- Remove CSF (5 ml if possible).
- Withdraw the needle and cover the insertion site with an adhesive bandage. Discard the needle in a puncture-resistant, autoclavable discard container.
- Allow patient to lie flat for 30 minutes.

### Processing of CSF

- Note appearance of CSF (clear, blood stained, turbid or xanthochromic).
- Divide the CSF between tubes with corresponding numbers.
  - 1-2 ml in the dry tube for biochemistry, cytology and RDT.
  - 1-2 ml in the cryotube for PCR.
  - 0.5-1ml in the T-I for culture.
- Make sure that the tubes are tightly closed.

**NB:** Where the CSF volume is <3 ml, the CSF should be collected in one dry tube; 0.5 ml should be inoculated from this tube into the TI medium and priority tests should be done according to laboratory level (Annex 10). Where CSF volume is >3 ml, CSF should also be collected into a cryotube.

### Perform the rapid diagnostic test (RDT)

#### *Equipment for performing the test*

- 2 hemolysis tubes
- 1 pipette (CSF transfer)
- Two rapid tests (RDT1 and RDT2)
- 1 timer

#### *Rapid diagnostic procedure*

- Number the test tubes (1 and 2)
- Add 5 drops of CSF to tube 1 and 5 drops of CSF to tube 2.
- Open the packet, remove the tests and place RDT1 (green color, MenA and MenW) in tube 1 and RDT2 (Rose color, MenC and MenY) in tube 2.
- The coloured part must always be the upper part - wait 10 minutes before reading.
- Refer to instruction booklet for interpretation.

*Remove mask and gloves and discard in waste disposal bag. Wash hands with antibacterial soap and water immediately after removing gloves.*

### Storage and transport of CSF

- Ensure that the report form is properly completed and attach to all specimens. Report the case to the ESC the same day
- Specimens should not be exposed to excessive heat, or sunlight.

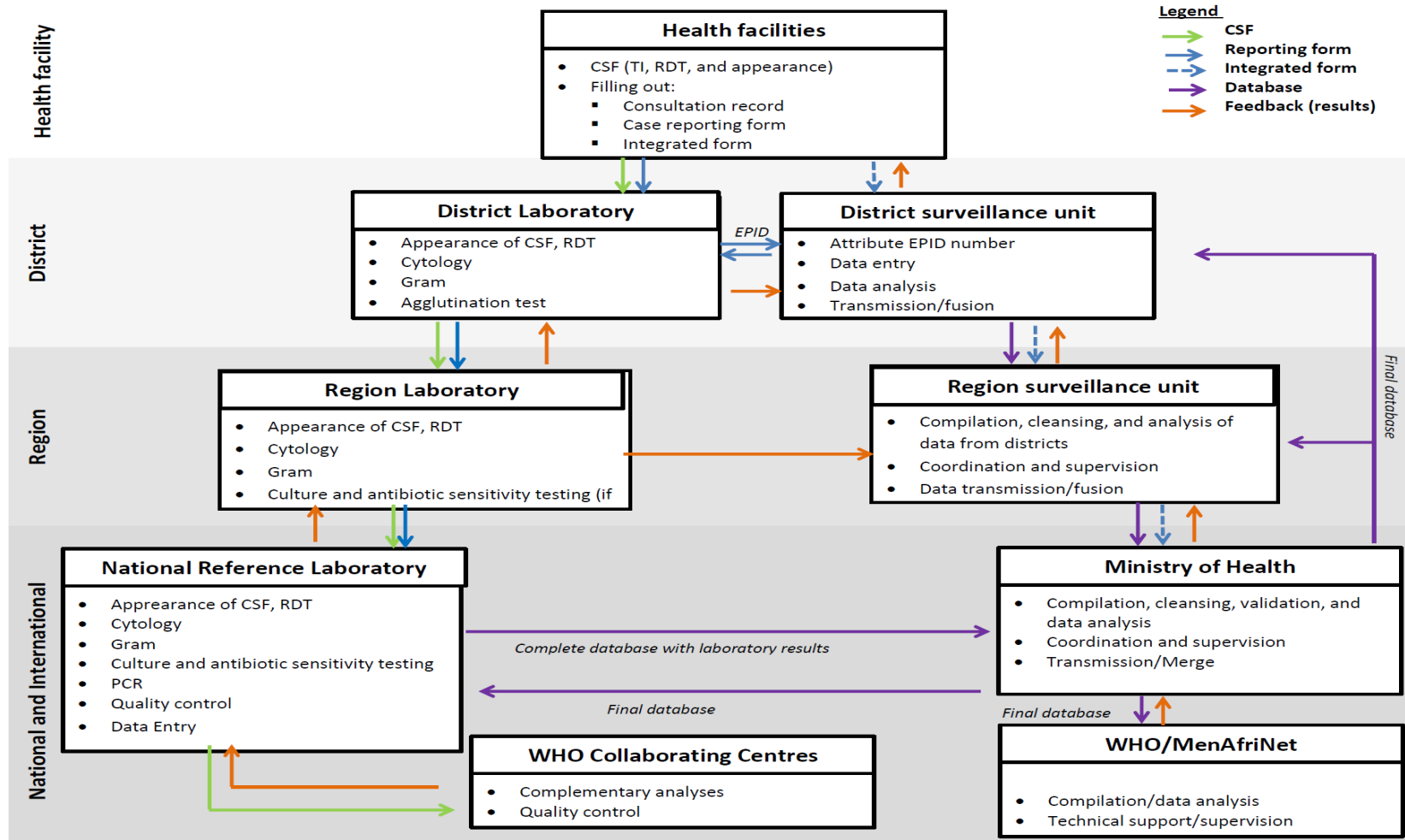


- Ideally, the CSF (dry tube) for biochemistry/cytology and microbiology should be kept at room temperature and sent to a microbiology laboratory in triple package at room temperature within 1 hour.
  - If the CSF cannot be transported to a microbiology laboratory within 1 hour, the T-I media should be inoculated with 0.5 ml of CSF and transported in triple package to a reference laboratory at room temperature (See Checklist for the use of the T-I Medium).
- The cryotube which has been kept for PCR must be stored in the freezer, or where appropriate at 4° C (for 1 week). It should be shipped in a cool box in triple package with cold packs to preserve the quality of specimens.

## Annex 10: Roles and responsibilities of the various levels in surveillance of meningitis

Health level	Data/specimen collection	Laboratory testing	Data/specimen management	Responsibility
<b>Health Facility</b>	<ul style="list-style-type: none"> <li>• CSF collection</li> <li>• Filling out: <ul style="list-style-type: none"> <li>▪ Consultation record</li> <li>▪ Reporting form</li> <li>▪ Integrated form</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Appearance of CSF</li> <li>• RDT</li> </ul>	<ul style="list-style-type: none"> <li>• Dispatch of specimens and reporting forms</li> <li>• Filing of case reporting forms (RF)</li> </ul>	<ul style="list-style-type: none"> <li>• Chief nursing or medical officer</li> </ul>
<b>District</b>	<p>To district hospitals</p> <ul style="list-style-type: none"> <li>• CSF collection</li> <li>• Filling out: <ul style="list-style-type: none"> <li>▪ Consultation record</li> <li>▪ Reporting form</li> <li>▪ Integrated form (Line list)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Appearance of CSF</li> <li>• RDT</li> <li>• Cytology</li> <li>• Gram</li> <li>• Agglutination test</li> </ul>	<ul style="list-style-type: none"> <li>• Allocation of the EPID number</li> <li>• Dispatch of specimens and the reporting form to the region's laboratory</li> <li>• Data entry</li> <li>• Data analysis</li> <li>• Weekly transmission of data to the region</li> <li>• Filing of RF</li> </ul>	<ul style="list-style-type: none"> <li>• Head of district laboratory</li> <li>• District epidemiological surveillance officer</li> </ul>
<b>Region</b>	<p>To the region's hospitals:</p> <ul style="list-style-type: none"> <li>• CSF collection</li> <li>• Filling out: <ul style="list-style-type: none"> <li>▪ Consultation record</li> <li>▪ Reporting form</li> <li>▪ Integrated form (Line list)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Appearance of CSF</li> <li>• RDT</li> <li>• Cytology</li> <li>• Gram</li> <li>• Culture and antibiotic sensitivity testing</li> </ul>	<ul style="list-style-type: none"> <li>• Compilation of data from districts</li> <li>• Data analysis</li> <li>• Weekly transmission of data to the national surveillance unit</li> <li>• Filing of RF</li> </ul>	<ul style="list-style-type: none"> <li>• Head of region's laboratory</li> <li>• Regional epidemiological surveillance officer</li> </ul>
<b>National Reference Laboratory</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• Appearance of CSF</li> <li>• RDT</li> <li>• Cytology</li> <li>• Gram</li> <li>• Culture and antibiotic sensitivity testing</li> <li>• PCR</li> <li>• Quality control</li> </ul>	<ul style="list-style-type: none"> <li>• Data entry</li> <li>• Data analysis</li> <li>• Weekly transmission of data to the national surveillance unit</li> <li>• Filing of RF</li> </ul>	<ul style="list-style-type: none"> <li>• Head of reference laboratory</li> </ul>
<b>National Surveillance Unit</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• Data fusion, cleansing, validation, and analysis</li> <li>• Transmission of the entire base to all levels</li> </ul>	<ul style="list-style-type: none"> <li>• National epidemiological surveillance officer</li> </ul>

## Annex 11: Standard data transmission circuit



## Annex 12: Checklist for data management

### A: District Level

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**Role:** the overall role of the data manager at the district level is 1) Reception and filing of reporting forms, 2) Allocation of the EPID number (in most cases), 3) Entry and cleansing of data, 4) Transmission of data to the higher level, 5) Analysis of data to guide the prevention and response to meningitis.

#### Key activities:

##### Data entry and cleansing

- Before starting the data entry, the case investigation form needs to be checked:
  - **Ensure that a EPID number has been allocated (very important).**
  - Make sure that the form has been properly filled out. In cases where data are missing or inconsistent, contact the health worker for further information.
- Capture the data using software (for example, Epi Info) from the Reporting Form
- Before transmitting or analysing the captured data, they should be cleansed to obtain a comprehensive and valid base.
- Save the base to an external drive and ensure the updating of the antivirus software to avoid loss of data.

##### Data transmission and fusion

- Every [week, month, etc.] the manager must share the epidemiological database with the [Regional Level, National, NRL, etc.]
- The results of the national reference laboratory are shared every [week, month, etc.] with the national surveillance officer.
- Once the epidemiological and laboratory data are harmonized at the national level, they are transmitted to the district level for updating the database.

##### Data analysis

- The weekly processing and analysis of data is expected to provide at least:
  - The curve of epidemiological trends to assess the situation compared to previous years.
  - Indications of alert and epidemic thresholds for countries facing epidemics.
  - The description of the situation in terms of person, place, time, and according to key variables such as the vaccination status, the pathogen, disease outcome...
  - The cross-frequency of pathogens by age and vaccination status.
  - The mapping of the distribution of cases and pathogens.
- The analysis will also generate performance indicators.

##### Data sharing and feedback

- Development and dissemination of bulletins on the epidemiological situation and performance indicators every [week, month] will facilitate the use of data for action.
- Regular formative supervisory visits at the health facility level are important to ensure prompt reporting of cases, proper completion of forms, and collection of CSF specimen from each case.

## B: National Surveillance Unit

**Role:** The overall role of the data manager at the Ministry of Health is 1) coordination of various actors (district, region, NRL), 2) harmonization of epidemiological data, 3) Supervision of data management at the levels of the NRL, region, district, and 4) supply of national data to guide the prevention and response to meningitis.

### Key activities of the Data Manager

#### 1. Validation of data

- **Ensure that a unique EPID number has been allocated to each case (very important).** Where required, contact the district surveillance officer for allocating the EPID number and write it on the reporting form.
- Ensure that the harmonized base was properly completed. In cases where data are missing or inconsistent, contact the district health worker for further information and inform them to correct their base.
- Save the base to an external drive and ensure the updating of the antivirus software to avoid loss of data.

#### 2. Fusion of data

- Each [week, month, etc.] the data manager will receive an epidemiological database from the [e.g. district, region] and a laboratory database from the National Reference Laboratory.
- The Data Manager merges the epidemiological and laboratory data using the EPID number.

#### 3. Data analysis

- The weekly processing and analysis of data is expected to provide at least:
  - The curve of epidemiological trends to assess the situation compared to previous years.
  - Indications of alert and epidemic thresholds for countries facing epidemics.
  - The description of the situation in terms of person, place, time, and according to key variables such as the vaccination status, the pathogen, disease outcome...
  - The cross-frequency of pathogens by age and vaccination status.
  - The mapping of case and pathogen distribution.
- The analysis will also generate performance indicators (see annex 2A).

#### 4. Data sharing and feedback

- Each [week, month, etc.] the data manager returns the harmonized base to all levels (district, region, reference laboratory) to ensure that all levels have access to the same data.
- Each month, the data manager sends data to WHO and other partners according to an agreed schedule.
- Development and dissemination of bulletins on the epidemiological situation and performance indicators every [week, month] will facilitate the use of data for action.
- Regular formative supervision visits at the district and NRL level are important to ensure good data management practices.

## C: National Reference Laboratory

**Role:** The overall role of the data manager in the surveillance system at the level of the national reference laboratory is 1) entry of laboratory data, 2) sharing of laboratory data with the national officer, 3) fusion of the data received by the national officer to complete the database at the laboratory level.

### Data entry and cleansing

- Before starting the entry, **ensure that an EPID number has been allocated (very important)**. Where required, contact the district surveillance officer for allocating the EPID number and write it on the reporting form.
- Capture the laboratory data using software
- Before transmitting or analysing the captured data, they should be cleansed to obtain a comprehensive and valid base.
- Save the base to an external drive and ensure the updating of the antivirus software to avoid loss of data.

### Data transmission and fusion

- Each [week, month, etc.] the Manager must share the laboratory result database with the national surveillance officer.
- After the harmonization of epidemiological and laboratory data at the national level, they will be re-transmitted to the national laboratory for updating the database.

### Data analysis

- The weekly processing and analysis of data is expected to provide at least:
  - The curve of epidemiological trends to assess the situation compared to previous years.
  - The description of the situation in terms of person, place, time, and according to key variables such as the vaccination status, pathogen.
  - The cross-frequency of pathogens by age and vaccination status.
  - The mapping of case and pathogen distribution.
- The analysis will also generate performance indicators.

### Data sharing and feedback

- Development and dissemination of bulletins on the epidemiological situation and performance indicators every [week, month] will facilitate the use of data for action.
- Regular formative supervisory visits to peripheral laboratories are important to improve the reporting of peripheral laboratories.

### Annex 13: Classification of bacterial meningitis cases according to laboratory results

Laboratory test	Result	Classification
Appearance of CSF	Not available	Refer to results of cell count
	Cloudy, purulent, xanthochromic	Probable
	Clear	Possibly suspected but refer to culture and PCR results
White Blood Cell Count	Not done	Refer to Gram staining results
	< 10 cells/mm <sup>3</sup>	Possibly suspected but refer to culture and PCR results
	≥ 10 cells/mm <sup>3</sup>	Probable
Gram	Not done	Refer to the antigen detection results
	Gram-negative diplococci, Gram-positive cocci, or Gram-negative Baccilli/Cocci	Probable
	No bacterium seen	Possibly suspected but refer to culture and PCR results
Antigen detection (Rapid test)	Not done	Refer to culture and PCR results
	Positive	Probable
	Negative	Possibly suspected but refer to culture and PCR results
Culture	Not done	See PCR results
	Positive	Confirmed
	Negative	Possibly suspected but refer to PCR results
PCR	Not done	Refer to culture results. If the culture was not done, refer to the antigen detection results, or Gram staining results combined with cell count.
	Positive	Confirmed
	Negative	Possibly suspected but refer to culture results

## Annex 14: Supervision of meningitis surveillance activities

### Supervision checklist –DH level

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#### Objectives of the supervision

- Improve the reporting and specimen collection for each suspected case of meningitis
- Improve the allocation of an EPID number for each suspected case of meningitis
- Support the CSE in data management to improve the quality of the data collected
- Recall and ensure compliance with the data and specimen transmission circuit

#### Preparation:

Review the database to reveal any anomalies related to the DH to be visited. Bring the list of cases reported in the DH to visit since the last supervision.

#### Supervisory activities:

- Take stock of the number of cases reported in the district and identify constraints
  - Number of suspected cases without specimens
  - Number of suspected cases not recorded in the database
- Ensure that reporting forms are correctly completed, especially the EPID number, age, vaccination status, date of consultation and specimen collection
- Examine the database for completeness and correct input of data and identify constraints
  - Number of cases with missing, invalid, or duplicated EPID number.
  - Number of cases without laboratory results
- Ensure weekly transmission and possibly identify data transmission constraints
- If the database is not up to date, provide the district with an up-to-date copy
- Ensure a sufficient stock of collection materials (LP kits, reporting forms)
- Ensure a sufficient stock of Checklists and other documents
- Ensure the availability of specimen storage and transport equipment (e.g. refrigerator, vaccine carrier, etc.) and their proper use
- Remind the CSE of the importance of supervising CSIs and possibly remind them of how to conduct formative supervision at the CSI level
- At the level of the DH laboratory:
  - Check whether a case investigation form is attached to all specimens
  - Check the conformity of specimens (e.g., condition of transport, storage, etc.)
  - Check whether the register is correctly completed (EPID, date of collection, and lab result)



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