Meningitis Epidemiological Surveillance Bulletins

STANDARD OPERATING PROCEDURES (SOP)

Final Version

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Acronyms

PHEOC	Public Health Emergency Operations Centre
ICG	International Coordination Group
CSF	Cerebrospinal Fluid
NRL	National Reference Laboratory
PCR	Polymerase Chain Reaction
SOP	Standard Operating Procedures
TI	Trans-isolate

Section 1: Purpose of these Standard Operating Procedures (SOP)

1.1 A Standardized Approach to Surveillance Bulletins

This SOP provides step-by-step guidance for developing a meningitis epidemiological surveillance bulletin. By documenting clear procedures for preparation, data management, analysis, and formatting, this resource supports the production of a bulletin that strengthens the reporting of national and subnational meningitis surveillance data. A standardized approach to developing a meningitis epidemiological surveillance bulletin ensures consistency, accuracy, and reproducibility across reporting years and comparability between countries. Users are encouraged to adapt this SOP to align with their own jurisdiction's bulletin production steps. Once adapted to each country's needs, the goal is for this document to guide staff to ensure consistent reporting. Additionally, this SOP will facilitate transfer of this capacity to subnational levels or new staff, as needed.

1.2 Intended Users

This SOP is intended for national-level Ministry of Health surveillance officers, epidemiologists, data managers, and public health professionals involved in the analysis, interpretation, and reporting of meningitis surveillance data.

1.3 Meningitis Epidemiological Surveillance Bulletins

i. Background and objectives

Effective meningitis surveillance is essential for monitoring disease trends, identifying outbreaks, and informing timely public health interventions. An epidemiological surveillance bulletin is a useful tool to summarize meningitis data and ensure that public health leaders have the appropriate information and evidence to guide prevention strategies.

The objectives of the meningitis epidemiological surveillance bulletin are to:

- Provide an epidemiological summary of bacterial meningitis cases at the national and subnational levels;
- Monitor trends in bacterial meningitis;
- Highlight outbreaks, response efforts, and interventions that occurred during the meningitis season;
- Inform public health decisions related to vaccination campaigns, particularly with respect to the introduction of new vaccines such as Men5CV;

- Share epidemiological updates with national and international partners; and
- Help assess performance of surveillance over time (can highlight strengths and gaps which can be used to prioritize future resources).

ii. Frequency of bulletins

This document focuses on the development of an annual bulletin for meningitis epidemiological surveillance. An annual bulletin should ideally be produced at the end of the year or at the end of the meningitis season, after data validation has been completed so it uses the most accurate version of the dataset. However, data review, monitoring surveillance performance, and data analysis should be conducted regularly throughout the year to ensure accurate and timely reporting and appropriate public health actions. Additional information regarding developing weekly reports or alert/outbreak situation reports is provided in Appendix 1.

iii. Audience of bulletins

The meningitis epidemiological surveillance bulletin should be developed and formatted for a wide range of viewers. Individuals or groups who may benefit from viewing the bulletin are senior ministry leadership (e.g., Directors, Ministers of Health), national and international partners, and other health professionals. The complexity and description of the bulletin content should align with the audience.

Section 2: Preparation of bulletins

2.1. Roles and responsibilities

Before developing a bulletin, it is important to identify the focal points who have access to the data required for its production.

Table 2.a. Meningitis bulletin data focal points

Role	Name of personnel
Meningitis surveillance focal point	
Vaccination focal point	
Surveillance data manager	
Laboratory data manager	
Laboratory focal point	

Identifying the staff responsible for bulletin production (i.e., who are the people that would be involved in the creation process), as well as the Ministry of Health officials responsible for review and approval is also essential. This information can be updated as staffing changes occur but should otherwise remain consistent.

Table 2.b. Identification of staff responsible for bulletin production

Responsibilities	Personnel Responsible
Bulletin production	Surveillance and laboratory data managers Surveillance officers
Data analysis	Surveillance and laboratory data managers Surveillance officers
Review/approval	Chief or Head of surveillance divisions Public Health Emergency Operations Center (PHEOC) coordinators Directors of surveillance and disease control Chiefs or Heads of laboratory divisions Director General of Health/Surveillance Directors of information systems
Dissemination	Chief or Heads of surveillance divisions

2.2. Checklist for bulletin production

There are several process steps required to produce the bulletin. Use the table below as a summary guide of the required activities and individuals responsible for each stage of bulletin production.

Table 2.c. Activities required for each stage of bulletin production

Process Step	Activities	Personnel Responsible
Gather data necessary for bulletin production	☐ Availability of validated dataset? Surveillance data, Laboratory data Populations by district	☐ Surveillance and laboratory data managers
Preparation of analytic dataset for bulletins/data cleaning	☐ Technical/epidemiological review of datasets ☐ Use of validated datasets	☐ Surveillance and laboratory data managers ☐ Surveillance officers
Conduct epidemiological analyses	☐ Preparation of tables, figures, maps, and calculation of indicators ☐ Interpretation of results	☐ Surveillance and laboratory data managers ☐ Surveillance officers
Develop the bulletin	☐ Integrate analyses into the bulletin template ☐ Generate the first draft ☐ Submit to the team for comments ☐ Incorporate team input	☐ Surveillance and laboratory data managers ☐ Surveillance officers ☐ Head of surveillance ☐ Head of laboratory
Validate the bulletin	☐ Technical/epidemiological review of the annual bulletin ☐ Analyses and summary information were checked to reflect validated SOP ☐ Review formatting and clarity of the bulletin	☐ Head of surveillance ☐ Head of laboratory ☐ PHEOC coordinators ☐ Directorate of archives and communication/Communications department ☐ Health information system ☐ Other relevant stakeholders
Authorization procedure	☐ Review of the document ☐ Authorization for dissemination	☐ Director General of Health/Head of surveillance
Archive and disseminate the bulletin	☐ Determine the archiving mechanism ☐ Establish how the bulletin will be distributed ☐ Define the distribution list, including global partners	☐ Directorate of archives and communication/Communications department ☐ Heads of surveillance ☐ Other relevant stakeholders

Bulletin dissemination schedule	☐ Determine frequency/regularity of dissemination ☐ Define the date of distribution	☐ Person responsible for bulletin dissemination ☐ Heads of surveillance

A checklist for managing the bulletin production process is also provided in Appendix 2.

Section 3: Surveillance Datasets and Access

Before developing the bulletin, the team should identify and compile the surveillance, laboratory, and vaccination datasets that will be needed. Whenever possible, sources should include validated data.

Table 3.a. Definitions of surveillance, laboratory, and vaccination datasets required for the bulletin.

Dataset	**Minimum data variables required**	**Location/storage of datasets**	**Relevant data dictionary**
Line lists	Age, sex, region, district of residence, vaccination status by antigen, date of notification, date of illness onset, date of specimen collection, specimen collected, date of specimen shipment, epidemiological week, case outcome, trans-isolate inoculation (TI)	District-level surveillance units National surveillance unit	Under "Case Report form and Data Dictionary," select "Editable Data Dictionary"
Case-based surveillance	*Depending on the analyses included*: age, sex, region, district of residence, vaccination status by antigen, date of notification, date of illness onset, date of specimen collection, specimen collected, date of specimen shipment, epidemiological week, outcome, TI inoculation	National surveillance/Surveillance unit	
Aggregated data	Cases and deaths by district	National surveillance/Surveillance unit	
Population denominators	Population denominators by district for the reporting period	Statistics and demography unit	
Laboratory data	1- FinalResult, final result by PCR or culture, culture or PCR performed, serotype, specimen received at the National Reference Laboratory (NRL), date received at the laboratory, contamination 2- Gram stain performed at district/regional laboratory level, white blood cell count, cerebrospinal fluid aspect	1- National Reference Laboratory 2- District/Regional laboratory	

Vaccination information	Campaign sites (region, district or sub-district), vaccination coverage by target population and location, campaign dates, and type of vaccine used	Immunization division	
Geographic boundary files (shapefiles)	Administrative boundary files at country, regional, and district levels	Statistics and demography unit	
Indicators from previous Meningitis Epidemiological Surveillance Bulletins	Cases and deaths by week, and performance indicators (to be compared with current analysis or bulletin)	National surveillance/Surveillance unit	

Section 4: Data Management (Cleaning)

Once the datasets have been compiled, a minimum set of data cleaning and management standards should be implemented. This includes:

- Merging datasets to ensure completeness of epidemiological, surveillance, and laboratory data for the reporting period.
- Verifying/creating the laboratory result variable, which involves ensuring that the final result variable reflects the RT-PCR and culture results from the National Reference Laboratory (NRL).
- Checking data quality:
    - Identify duplicate cases (EPIDnumber = Epidemiological Case Identification Number), inconsistencies, missing data, etc.
    - For data cleaning, use the list of key variables that will be included in bulletin analyses, as detailed in Section 5.
    - Create new variables required for analysis (such as age groups).
    - Any new variable derived or recoded from existing variables (e.g., age group, final result) should be labeled with a "_recoded" suffix to clearly indicate it was newly created during data cleaning. Run frequencies on each of the key variables used in the bulletin to determine the proportion of missing values.
    - Review the format and frequency of all variables included in the report
        - Ensure format and coding is consistent
        - Recommend using the detailed cleaning methods described in Meningitis Case-Based Data Validation Checklist
- Correct inconsistencies, remove duplicates, and standardize the formats of dates, categorical, and numerical variables.
- Save the cleaned dataset.

For data cleaning, the use of statistical software (e.g., RStudio) and standardized scripts is recommended. Some examples of cleaning code are included in Appendix 3.

Section 5: Analyses

Countries are encouraged to use these guidelines to reflect the analyses that will appear in their bulletins.

With the clean datasets, the team responsible for developing the bulletin can generate analyses to summarize the surveillance data by key epidemiological characteristics, geography, and time. Below is a list of potential analyses that can be produced; examples of data presentation and corresponding R code are included in Appendix 3. The analyses conducted should be as simple and succinct as possible, using tables and figures where appropriate. The tables below (5.a to 5.e) highlight the minimum data to be presented and additional analyses that could be included.

5.1. Key points

Table 5.a. Elements and variables included in the "Key points" section of the bulletin analysis.

Bulletin Element	Variables	Minimum	Expanded
Total number of cases (suspected, probable, confirmed), incidence rate at the national level	District of residence FinalResultNRL* Population	X	
Total death count and case fatality rate at the national level	Outcome District of residence	X	
Number and proportion of specimens collected and specimens tested at the national level	Specimen collected* FinalresultNRL*	X	
Number and proportion of main pathogens identified at the national level	FinalresultNRL*	X	
Number of districts that crossed alert/epidemic thresholds	District of residence Population	X	
Identification of districts/regions with the highest number of cases and deaths	District of residence FinalResultNRL* Specimen collected* Population		X

Key public health interventions (e.g., vaccination campaigns)	Key public health interventions (e.g., district of residence, region, year of interventions[+], vaccine campaigns, vaccination coverage by target population and antigen, vaccine campaign dates)		X

Note: * Indicates variables that need to be cleaned using the Data Validation Checklist recommendations.
[+]Indicates variables that need to be created.

5.2. Epidemiological characteristics

Table 5.b. Elements and variables included in the "Epidemiological characteristics" section of the bulletin analysis.

Bulletin Element	Variables	Minimum	Expanded
Summary table: Columns: total number of cases (suspected, probable, and confirmed), incidence rate, deaths, and case fatality rate Rows: sex, age groups, pathogen	District of residence Population Outcome* Sex Age/AgeGroup⁺ (AgeDays, AgeMonths, AgeYears) FinalresultNRL*	X	
Stacked bar chart of pathogens overall and by age group	Age/AgeGroup⁺ (AgeDays, AgeMonths, AgeYears) FinalresultNRL*	X	
Summary table of total cases (suspected, probable, and confirmed) by region: Columns: regions Rows: sex, age groups, pathogen, vaccination status (if known)	District of residence Population Outcome* Region Sex Age/AgeGroup⁺ (AgeDays, AgeMonths, AgeYears) FinalresultNRL*		X
Age-sex pyramid of total cases (suspected, probable, and confirmed)	Age/AgeGroup⁺ (AgeDays, AgeMonths, AgeYears) Sex		X

Note: * Indicates variables that need to be cleaned using the Data Validation Checklist recommendations.
⁺Indicates variables that need to be created.

5.3. Temporal trends (National & subnational)

Table 5.c. Elements and variables included in the "Temporal trends (National & subnational)" section of the bulletin analysis.

Bulletin Element	Variables	Minimum	Expanded
Epidemic curve of total cases (suspected, probable, confirmed) and deaths per week at the national level	Outcome* Epi week	X	
Epidemic curve of confirmed cases and deaths per week at the national level	FinalresultNRL* Outcome* Epi week		X
Epidemic curve of total cases and deaths per week at the subnational level	Outcome* Epi week		X
Epidemic curve of pathogen types per week at the national or subnational level	Epi week FinalresultNRL* PCR and Culture		X

Note: * Indicates variables that need to be cleaned using the Data Validation Checklist recommendations.

5.4. Maps and geographic summary

Table 5.d. Elements and variables included in the "Maps and geographic summary" section of the bulletin analysis.

Bulletin Element	Variables	Minimum	Expanded
Map of confirmed cases by pathogen and by district/region • A single map with pie charts illustrating the distribution of pathogens by region, or separate choropleth maps for each pathogen	PCR and Culture FinalresultNRL* District of residence Region of residence	X	
Map of total cases (suspected, probable, confirmed) by district	District of residence		X
Map (or table) of alert and epidemic thresholds crossed by district	District of residence Population Epi week		X

Note: * Indicates variables that need to be cleaned using the Data Validation Checklist recommendations.

5.5. Surveillance system performance process indicators at the national and subnational levels

Surveillance system performance indicators provide information on data completeness and the timeliness of case identification and confirmation. These indicators can be reviewed at the national or subnational level, by region or by district, to identify areas where training or supervision could help improve performance. A full list of process indicators is presented in Appendix 4.

Table 5.e. Elements and variables included in the indicators section of the bulletin analysis.

Bulletin Element	Variables	Minimum	Expanded
Percentage of cases with a delay of < 7 days between specimen collection date and date specimens received at NRL	Specimen collected* Date of collection Date of receipt at the NRL*	X	
Percentage of specimens received at the NRL and analyzed by a confirmatory test (culture, PCR)	PCR and Culture Date of receipt at the NRL*	X	
Percentage of cases reported through case-based notification	District/case-based Aggregated data		X
Percentage of cases with specimens collected, or Map showing the percentage of cases with specimens collected by district/region	District of residence Region of residence Specimen collected*		X
Percentage of cases with known vaccination status	Vaccination status District of residence		X
Percentage of specimens received at the NRL	Specimen collected* Date of receipt at the NRL*		X

Percentage of specimens tested at labs other than the NRL by a Gram stain test	Gram staining performed at the district/regional laboratory level Specimen collected*		X
Percentage of specimens received at any lab in trans-isolate (T-I)	T-I inoculation Date of receipt at the NRL/ performed at the regional laboratory level*		X
Percentage of specimens contaminated for culture procedure at the NRL	Contamination of CSF in the laboratory (PCR and culture)		X

Note: * Indicates variables that need to be cleaned using the Data Validation Checklist recommendations.

Section 6: Template Structure for Bulletin

6.1 General recommendations

Ensure consistency in the formatting of the following elements:

- Titles, including the reporting period for all graphs, tables, and maps;
- Consistent use of colours in graphs, particularly for categories such as pathogens, age groups, and deaths;
- Present data in the same order across different graphics for ease of understanding; and
- Ensure that all abbreviations used in tables or graphics are defined in the legend or in a footnote.

After data are presented in each section, include a brief summary that provides additional information or context where needed.

Include data sources, case definitions, calculations of indicators, and any terminology used in the bulletin, in an "**Author's Notes**" section to ensure a clear understanding of the information presented. This information may be placed at the end of the document to keep the data presented as concise as possible.

6.2 Bulletin template

The following elements should be included in a standard bulletin and should be concise:

Title

Data source (aggregated data, case-based surveillance, enhanced surveillance)
Date of production
Reporting period (epidemiological weeks, quarterly, semi-annual, or annual)
Directorate or division responsible for dissemination and contact details (mailing address or phone number)

Introduction

The introduction should include:

- A historical summary of cases observed in previous years;
- The introduction of meningococcal vaccines, whether MenA and/or Men5CV or others, along with the corresponding vaccination coverage rates; and

- Contextual information related to other vaccinations (PCV, Hib), depending on vaccine preventable disease trends identified.

Key points

- Summary of key points from Section 5.1.

Epidemiological characteristics

- Summary of graphs and tables from Section 5.2.

Temporal trends (national and subnational)

- Summary of temporal trends – epidemic curves and tables from Section 5.3.

Maps and geographic summary

- Summary of maps from Section 5.4.

Surveillance system performance process indicators at national and subnational levels

- Summary of surveillance performance indicators from Section 5.5.

Summary observations and actions

- The summary should include a simple risk assessment—based on the analyses presented.
- Document any challenges observed.
- Document actions carried out during the reporting period, including vaccination campaigns, training, supervision activities, and identified needs. Details included should be high level but complete. For example, vaccination campaigns should detail districts included, target age groups, dates, and coverage rates attained.

Recommendations

- Provide any future recommendations based on findings presented in bulletin.

References

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Appendices

Appendix 1: Types of bulletins

Weekly situation reports

- Summary of counts by district and week of suspected cases and deaths, attack rate, and case fatality ratio. Highlight any district with an attack rate above the alert or epidemic threshold (refer to Section 7: Epidemiological thresholds in the **Standard Operating Procedures for meningitis surveillance, preparedness, and response in Africa**)
- An epidemic curve of suspected cases confirmed cases, and deaths, by epidemiological week.
- A map of suspected cases by district (choropleth or dot density).
- Summary table of cases (suspected and confirmed), specimens collected, and pathogens identified, by district and week.
- Graphs summarizing pathogen (based on PCR/culture), age, sex, and outcome (deaths) distribution by week and overall.

Situation reports based on alerts or epidemic thresholds identified

Situation report or specific Disease Surveillance summary focused on a specific geographic district(s) or region where epidemic or alerts thresholds have been crossed. The following elements are required to make a request to the International Coordinating Group (ICG) on Vaccine Provision:

- Produce a map of districts in alert or epidemic status for the epidemiological week in which the district crossed the alert or epidemic threshold (specify the relevant week in the title).
- Summary table of the number of suspected cases and deaths by epidemiological week for district(s) that crossed the epidemic threshold (Annex 1 of the ICG request).
- Summary table of the number of suspected cases and deaths by epidemiological week for districts adjacent to the district(s) that crossed the epidemic threshold.
- Summary table of cases and deaths by age group and by district (Annex 2 of the ICG request).
- Summary table of identified pathogens by district, according to diagnostic method (rapid diagnostic tests and PCR/culture) (Annex 3 of the ICG request).
    - The ICG request requires confirmation of 10 positive cases per district or sub-district (for a population of 100,000 inhabitants).

- Determine the distribution by age groups for micro-planning of vaccination campaigns, by district or sub-district.
- Document vaccination coverage by district or sub-district, and dates of campaigns.
- Ensure follow-up of cases until the end of the epidemic (i.e., two consecutive weeks below the alert threshold).
- Generate an epidemic curve of suspected and confirmed cases by week, indicating the date of the vaccination campaign on the graph.

Appendix 2: Activities required for bulletin production

Complete the checklist below to document process management steps. Identify the personnel responsible as well as the specific location of documents:

- Compile datasets for bulletin production
  - ☐ Availability of validated datasets:
    - ☐ Surveillance data
    - ☐ Laboratory data
    - ☐ Population by district
- Prepare the analytic dataset for bulletins (i.e., data cleaning)
  - ☐ Technical / epidemiological review of dataset by the surveillance data manager:_____
- Conduct epidemiological analyses:
  - ☐ Tables, graphs, maps, and indicator calculations have been developed
  - ☐ Results have been interpreted
- Develop the bulletin:
  - ☐ Integrate analyses into the bulletin template and generate the first draft, by:_____
  - ☐ Submit it to the team for comments and incorporate team input
  - ☐ Feedback has been incorporated
- Validate the bulletin
  - ☐ Technical / epidemiological review of the annual bulletin conducted, by:_____
  - ☐ Analyses and summary information verified to ensure alignment with SOP, by: _____
  - ☐ Formatting and revision of the bulletin to ensure clarity, by:_____
- Approval process
  - ☐ Authorization for dissemination by: _____
- Archive and disseminate the bulletin
  - ☐ Identify those responsible for archiving and the bulletin distribution list:_____
  - ☐ Storage location of the bulletin:_____

- ☐ Bulletin dissemination strategy:_____
- ☐ Distribution list:_____

- Timeline for dissemination of bulletin
  - ☐ Approximate date of bulletin dissemination:_____
  - ☐ Date of bulletin dissemination:_____

Appendix 3: Analysis – Code Bank and Reference Figures

The table below includes an example of a full draft bulletin, as well as the code and data files used to create this example.

Analysis Section	**Reference Figures**	**Code Bank**
Full draft bulletin	Download an example bulletin in an HTML format here	Download a file that contains i) the R code markdown script, ii) example data, and iii) geographic boundary files (Shapefiles) used to create the example bulletin here.

The table below contains the reference figures for each analysis section. These figures are the same as those included in the full draft bulletin example above.

Analysis Section	**Reference Figures**	**Code Bank**
Key Points		See the "KEY POINTS" section for the corresponding code.
Epidemiological Characteristics		See the "EPIDEMIOLOGICAL CHARACTERISTICS" section for the corresponding code.
Temporal Trends (National and Subnational)		See the "TEMPORAL TRENDS (NATIONAL AND SUBNATIONAL)" section for the corresponding code.
Maps and Geographic Summary		See the "MAPS AND GEOGRAPHIC SUMMARY" section for the corresponding code.
Surveillance System Performance Indicators		See the "SURVEILLANCE SYSTEM PERFORMANCE INDICATORS AT THE NATIONAL AND SUBNATIONAL LEVEL FOR MENINGITIS" section for the corresponding code.

Appendix 4: Potential Process Indicators

No.	Indicator	Threshold	Numerator	Denominator
1	**Percentage of cases reported through case-based notification**	> 90%	Number of cases reported through case-based surveillance	Total number of reported cases
2	**Percentage of cases with specimens collected**	> 80%	Number of suspected cases for which a specimen was collected	Number of suspected cases
3	**Percentage of specimens received at the NRL**	> 70%	Number of specimens received at the NRL	Number of suspected cases with specimens
4	**Percentage of cases with a delay of < 7 days between specimen collection date and date specimens received at NRL**	> 50%	Number of specimens for which the delay between sampling date and receipt at the NRL is ≤ 7 days	Number of specimens received at the NRL
5	**Percentage of specimens received at the NRL and analyzed by a confirmatory test (culture, PCR)**	> 90%	Number of specimens tested by a confirmatory test at the NRL (culture, PCR)	Number of specimens received at the NRL
6	**Percentage of cases with known vaccination status**	> 90 %	Number of cases with known vaccination status	Number of suspected cases
7	**Percentage of specimens tested at labs other than the NRL by a Gram stain test**	> 70%	Number of specimens analyzed in district or regional laboratories by Gram stain	Number of suspected cases with specimens
8	**Percentage of specimens received at any lab in trans-isolate (T-I)**	> 50%	Number of specimens received in any laboratory in a T-I transport medium	Number of suspected cases with specimens
9	**Percentage of specimens contaminated for culture procedure at the NRL**	< 10 %	Number of specimens contaminated during the culture process at the NRL	Number of specimens tested by culture at the NRL