REPUBLIC OF LEBANON

Ministry of Public Health

Epidemiological Surveillance Program

Surveillance
Standard Operating Procedures:
Meningitis

Version 1:

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I Purpose

The purpose of this standard operating procedure (SOP) is to describe the steps to be followed by the epidemiological surveillance program in case of meningitis alerts or outbreaks.

II Generalities

This document compiles background information and resources for the investigation of suspected or proven bacterial meningitis (mainly *Neisseria meningitidis*, *Haemophilus influenzae* type B, and *Streptococcus pneumonia*, *Mycobacteruim tuberculosis* and *Listeria monocytogenes)* and aseptic meningitis.

Meningitis is a disease caused by the inflammation of the fluid and membranes that surround the spinal cord and brain, and has many potential infectious causes including bacterial, fungal, tuberculous, and viral pathogens. The severity of illness and the treatment for meningitis differ depending on the cause.

Generalities

Agents	Several agents: 1) Bacteria: - Neisseria meningitides (meningococcus): the serotypes responsible of invasive infection are A, B, C, W135, Y, X - Haemophilus influenza: there are 6 serotypes from (a) to (f). The serotype (b) is responsible of invasive infection - Streptococcus pneumonia (pneumococcus): there are more than 90 serotypes - Other bacterial agents: listeria, staphylococcus, enteric bacteria, group B streptococci, tuberculosis … 2) Virus: - Mumps - Measles - West Nile virus: a flavivirus - Enterovirus: including Coxsackieviruses A (1-11, 14, 16-18, 22, 24), Coxsackieviruses B (1-6), Echoviruses (1-7, 9-23, 25, 27, 30-33), Enterovirus 71, Poliovirus (1-3) - Herpes Simplex virus: with 2 types 1 and 2 - Varicella / Chicken-pox: Human (alpha) herpesvirus 3 (varicella-zoster) from the group Herpesvirus - Adenovirus: Adenovirus, several types (1, 2, 3, 4, 5 and 7), genus Mastadenovirus, family Adenoviridae, - Lymphocytic choriomeningitis: lymphocytic choriomeningitis virus (arenavirus) - Sandfly fever viruses: genus phlebovirus, family Bunyaviridae. They include more than 60 antigenically distinct virus serotypes. Two main groups are identified: the sandfly fever group including the *Naples* serocomplex (*Karimabad* virus, *Arabia* virus, *Massilia* virus, *Punique* virus, *Tehran* virus, *Toscana* virus …) and Sicilian serocomplex; and the Uukuniemi group. -Other virus: arboviruses… 3) Parasites and fungi: - Leptospirosis: Spirochetes, Leptospira interrogans (25 serogroups) - Other: Candida albicans, cryptococcal, syphilis …
Incubation	The incubation varies with the agent.

Agent	Incubation
Bacteria	
Neisseria meningitidis	3-4 days (2-10 days)
Haemophilus influenza	2-4 days
Streptococcus pneumoniae	1-4 days
Listeria monocytogenes	3-70 days (median of 3 weeks)
Virus	
West Nile virus	3-12 days
Enterovirus	7-14 days (2-35 days)
Herpes	2-12 days
Varicella / Chicken-pox	2-3 weeks
Lymphocytic choriomeningitis virus	8-13 days (15-21 days for meningitis)
Adenovirus	1-10 days
Sandfly fever viruses	3-4 days (up to 6 days)

Parasites and Mycoses	
Leptospira	2-30 days (10 days)

Period of communicability

The period of communicability varies with the agent.

Agent	Period of communicability
Bacteria	
Neisseria meningitidis	From onset and up to 24 hours after starting antibiotherapy that has effective concentrations in nasopharynx.
Haemophilus influenza	From onset and up to 24-48 hours of starting effective antibiotherapy.
Streptococcus pneumoniae	As long as the bacteria is present in the upper respiratory tract.
Listeria monocytogenes	- Mothers of infected newborns can shed the bacteria in vaginal discharges and urine 7-0 days after delivery - Infected patients can shed the bacteria in stool for several months
Virus	
West Nile virus	No person-to-person transmission.
Enterovirus	- Virus excreted in stools for several weeks - Virus excreted in pharynx for the first 2 weeks post infection
Herpes	2-7 weeks after skin lesions onset.
Varicella / Chicken-pox	2 days before until the skin lesions are crusted (5 days).
Lymphocytic choriomeningitis virus	No person to person transmission.
Adenovirus	Shortly prior to and for the duration of the active disease
Sandfly fever viruses	Virus present in blood of infected patients 1 day before and 1 day after onset of illness.
Parasites and Mycoses	
Leptospira	Excreted in urine for 1 month

Reservoir

The reservoir varies with the agent.

Agent	Reservoir
Bacteria	
Neisseria meningitidis	Humans
Haemophilus influenza	Humans
Streptococcus pneumoniae	Humans, possible carriage.
Listeria monocytogenes	Soil, forage, water, mud and silage.
Virus	
West Nile virus	Birds
Enterovirus	Humans
Herpes	Humans
Varicella / Chicken-pox	Humans
Lymphocytic choriomeningitis virus	House mouse (Mus musculus), hamster colonies. The mouse excretes the virus in saliva, feces and urine.

Adenovirus	Humans
Sandfly fever viruses	Humans, rodents.
Parasites and Mycoses	
Leptospira	Wild and domestic animals

Modes of transmission

The modes of transmission vary with the agent.

Agent	Modes of transmission
Bacteria	
Neisseria meningitidis	Person to person transmission: direct contact with droplet, nasal and throat discharge
Haemophilus influenza	Person to person transmission: direct contact with respiratory, nasal and throat discharge.
Streptococcus pneumoniae	Person to person transmission: direct contact with respiratory discharge
Listeria monocytogenes	- Food-borne: ingestion of raw or contaminated milk, soft cheese vegetables and ready-to-eat meats (Pate) - Direct contact with infectious material - Neonatal: from mother to fetus or from mother to newborn (through the infected birth canal) - Nosocomial transmission in nursery: via contaminated equipment or material
Virus	
West Nile virus	Bite by infected mosquitoes (Culex sp, or Anophele sp)

Enterovirus	- Person-to-person:
	  - Fecal-oral
	  - Contact with respiratory secretions
	  - Contact with conjunctival secretions
	- Contaminated water / swimming pools
	- Flies

Herpes	- Person-to-person:
	  - Contact with saliva
	  - Sexual contact
	  - Soiled hands
	  - Neonatal (infected birth canal)

Varicella / Chicken-pox	- Person-to-person:
	  - Contact with droplets
	  - Contact with vesicle fluid
	  - Indirect contact
	- Airborne

Lymphocytic choriomeningitis virus	- Airborne: contaminated dust - Food-borne: ingestion of contaminated food - Direct contact: skin contamination or cuts

Adenovirus	- Person-to-person:
	  - Fecal-oral route
	  - Respiratory transmission
	  - Inoculation with conjunctival secretions
	  - Nosocomial
	- Contaminated water and swimming pools

Sandfly fever viruses	Bite of infective phlebotomine (Phlebotomus papatasi, P.

	perfiliewi , P. perniciosus, P. major sensu lato)
Parasites and Mycoses	
Leptospira	- Contact with abraded skin or mucous membranes with soil, vegetation, contaminated with urine of infected animals or contaminated water - Direct contact with urine or tissues of infected animals - Ingestion of food or water contaminated with urine of infected animals

Clinical

The symptoms vary with the agent.

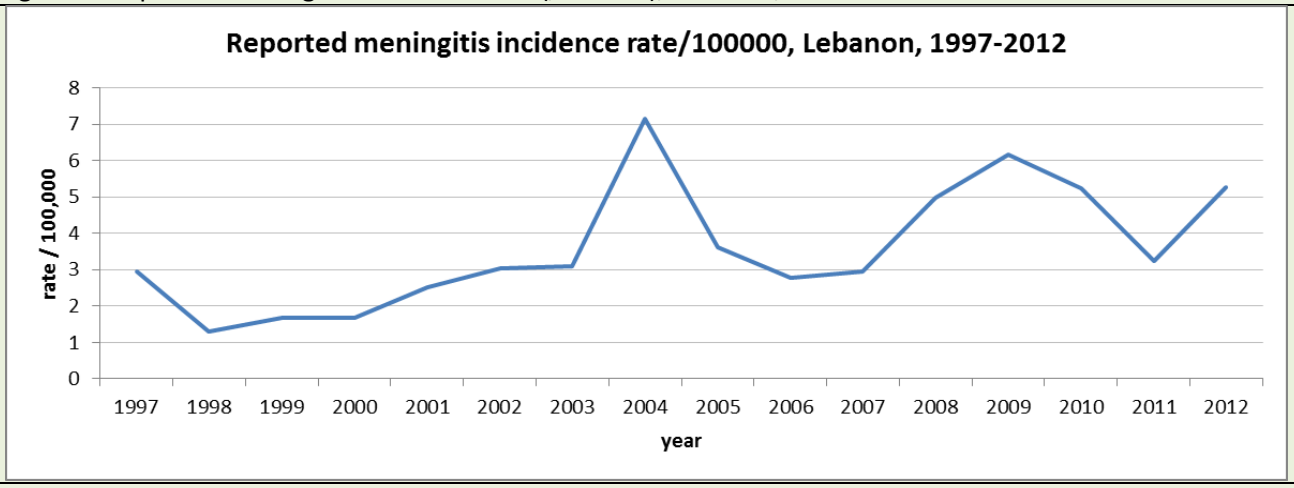
Agent	Clinical picture
Bacteria	
Neisseria meningitidis	Meningitis, septicaemia
Haemophilus influenza	Meningitis, epiglottitis, pneumonia …
Streptococcus pneumoniae	Meningitis, pneumonia, septicaemia
Listeria monocytogenes	
Virus	
West Nile virus	- Usually asymptomatic. - Complication: meningitis and encephalitis
Enterovirus	- Asymptomatic, - Gastro-enteritis, flu-like illness, aseptic meningitis, paralysis
Herpes	- Gingivostomatitis (type1), genital infection (type 2) - Complications: meningoencephalitis - Reactivation is possible
Varicella / Chicken-pox	- Skin eruption: first maculo-papular then vesicular. - Complications: pneumonia, hemorrhage, meningoencephalitis
Lymphocytic choriomeningitis virus	- Influenza-like illness. - Complications: meningitis, parotiditis, arthritis, myocarditis…
Adenovirus	- Epidemic herato-conjunctivitis, gastro-enteritis, pharyngo-conjunctival fever, acute respiratory infection - Complications: meningoencephalitis
Sandfly fever viruses	- Usually self-limited disease: fever, myalgia, headache, photophobia … - Complications: Aseptic meningitis and meningoencephalitis (Toscana),
Parasites and Mycoses	
Leptospira	Rash, hemolytic anemia, hemorrhage, hepato-renal failure, mental confusion, myocarditis…

Worldwide

Agent	Profil
Bacteria	
Neisseria meningitidis	Endemic in the African meninigitis belt (from Senegal to Ethiopa)
Haemophilus influenza	Worldwide under 5 years

	Streptococcus pneumoniae – Worldwide Listeria monocytogenes – Worldwide **Virus** West Nile virus – Widespread in Africa, Middle East, North America, India. Enterovirus – Worldwide Herpes – Worldwide Varicella / Chicken-pox – Worldwide Lymphocytic choriomeningitis virus – America, Europe. Adenovirus – Worldwide Sandfly fever viruses – In Mediterranean counties, Europe and Middle East **Parasites and Mycoses** Leptospirose – Worldwide
Lebanon	The annual average of reported cases of meningitis is 192. Among them, meningitis due to Neisseria meningitis occurs with 6 (2-12) cases per year. Among them, meningitis due to Haemophilus influenza occurs with 1 (0-2) cases per year. Among them, meningitis due to Streptococcus pneumoniae occurs with 19 (16-21) cases per year.
Control objective	Control
Surveillance	
Surveillance approach	Syndromic approach: meningitis
Investigation: data collection	Demography, clinical presentation, complications, vaccination status, travel history …
Investigation: clinical specimen collection from case	CSF, blood
Investigation: data collection about contacts	Age, travel history
Investigation: clinical specimen collection from contact	If symptoms
Test	- CSF: cytology, biochemistry, solubles antigens, culture, PCR - Blood: CBC, culture
Laboratories	- Clinical laboratories - Reference laboratories: serotypes
Outbreak level	3 epidemiologically-linked cases with same agent and type = outbreak
Notification to WHO	According to the International Health Regulations
Meningitis case definitions	
Neisseria meningitides: cf invasive meningococcal infection	
Haemophilus influenza b (MOPH circular no. 54 dated on the 10th April 2007)	
Confirmed case: HIb	A case of bacterial meningitis that is laboratory-confirmed: – Isolation of *Haemophilus influenzae* type b (CSF or blood); – Or identification of Hib antigen from normally sterile fluids (CSF or blood).
West Nile virus (MOPH circular no. 36 dated on the 5th May 2012)	
Confirmed case:	A case with meningitis or encephalitis with laboratory confirmation:

West Nile	• IgG antibody sero-conversion (or significant increase in antibody titers) in two serial specimen collected at a one week interval by enzyme-linked immunosorbent assay (ELISA) • Or IgM antibody capture enzyme-linked immunosorbent assay (ELISA) • Or neutralisation assays • Or viral detection by reverse transcription polymerase chain reaction (RT-PCR) assay • Or virus isolation by cell culture
Other meningitis	
Confirmed cases	Meningitis with laboratory confirmation of the causative agent by culture, soluble antigens or PCR or other confirmatory tests.
Meningitis (MOPH circular no. 52 dated on the 10th April 2007)	
Suspected case	Case presenting fever >= 38.5ºC with: – And neck stiffness; – And/or other meningeal sign: severe altered consciousness, unexplained headache, photophobia, nausea, vomiting; – And/ or petechial/purpural rash or other rash; For children under 2 years of age, a case presenting fever >= 38.5ºC with: – Bulging fontanelle; – And/or irritability; – And/or lethargy
Forms	
Reporting	Specific meningitis reporting form or standard reporting form
Investigation	Specific investigation form for meningitis
National figures. Reported meningitis cases due to NM, HI and SP, Lebanon, 2010-2013. Source: MOPH	
Figure 1: Reported meningitis incidence rate (/100000), Lebanon, 1997-2012	



International figures	
Figure 2: Haemophilus influenza b: Incidence of Hib (per 100000) for the under 5 years, 2000. Source: www.who.int	

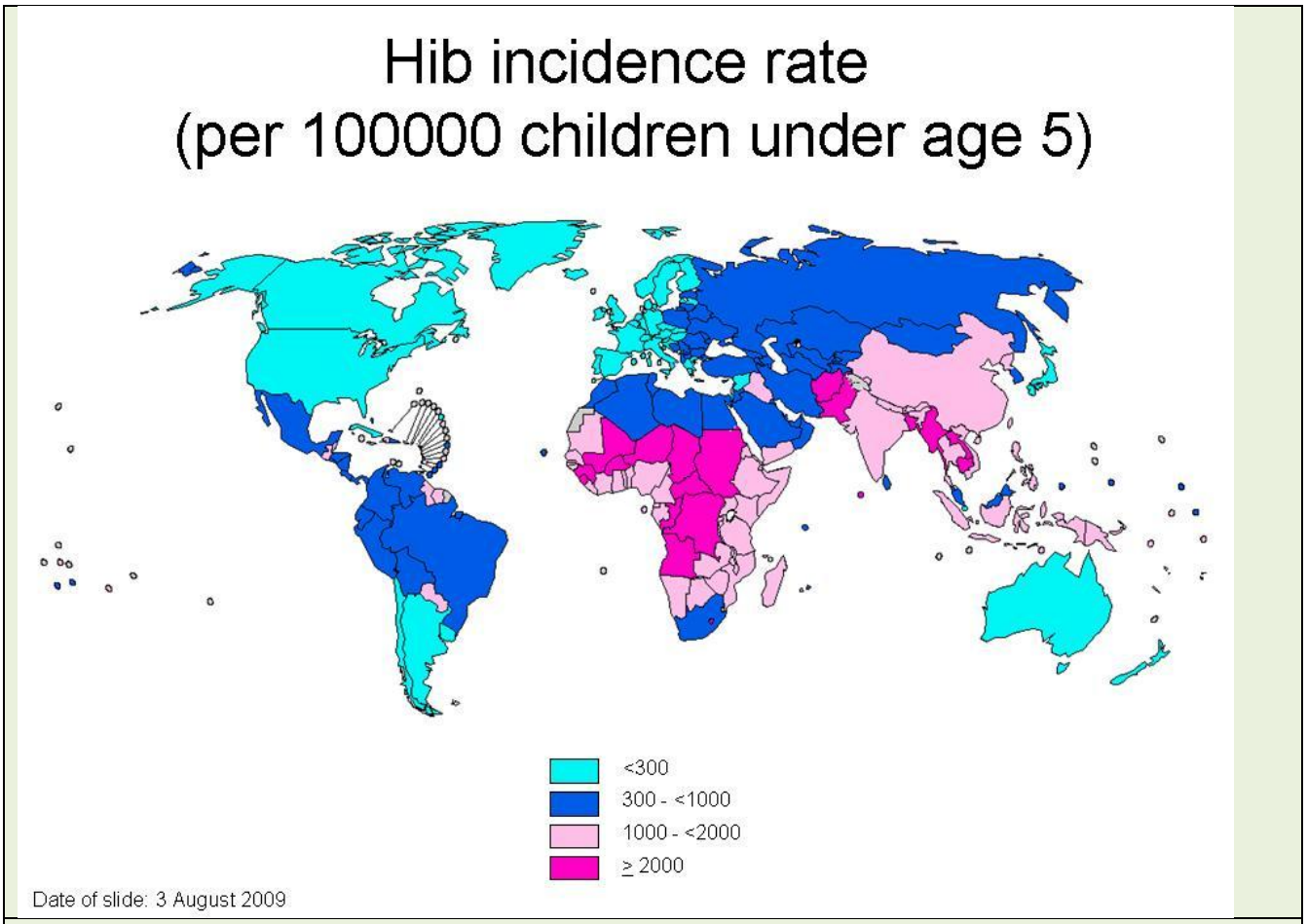


Figure 3: Incidence of pneumococcus (per 100000) for the under 5 years, 2000. Source: www.who.int

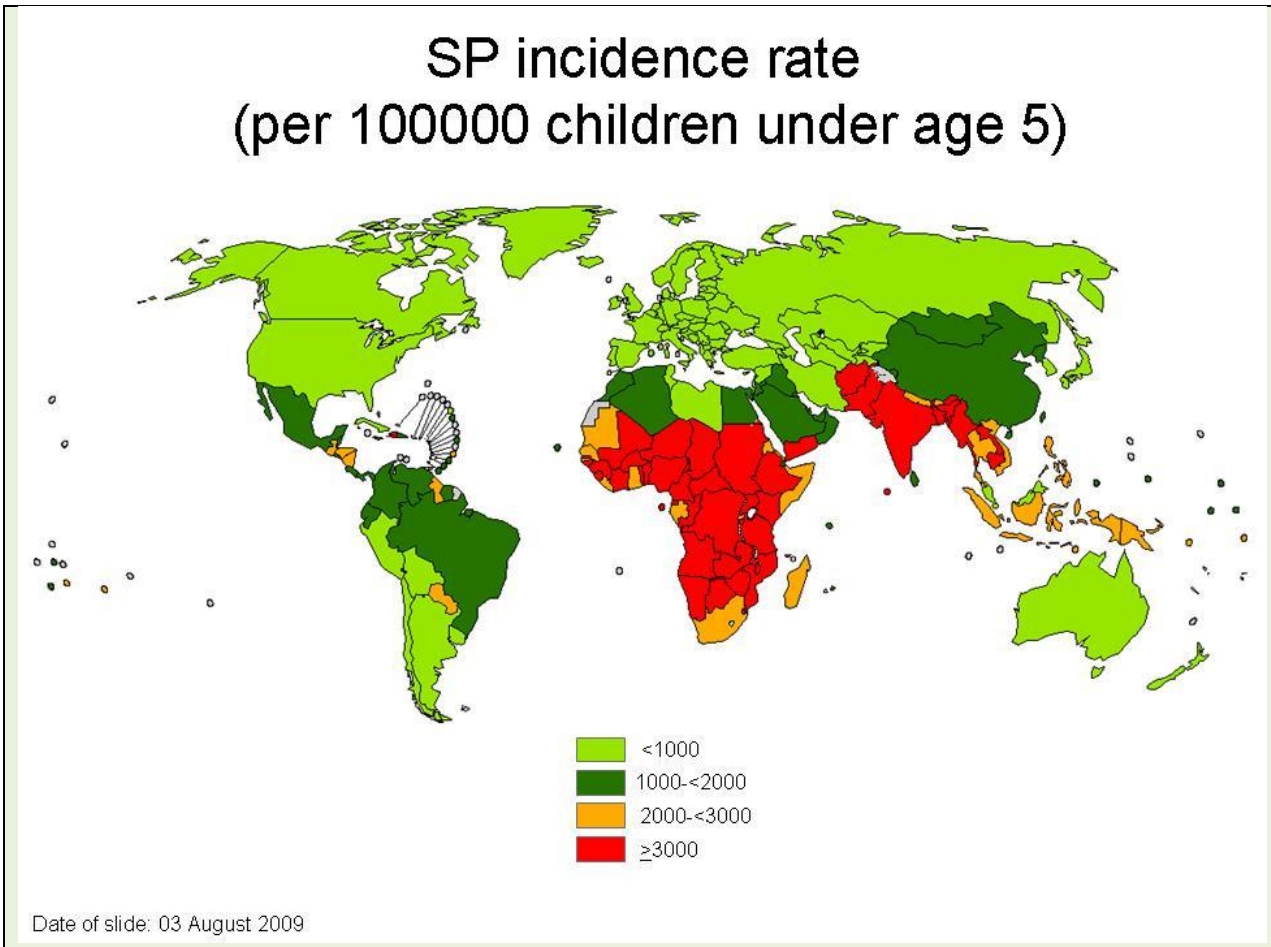


Figure 4: West Nile Fever Virus

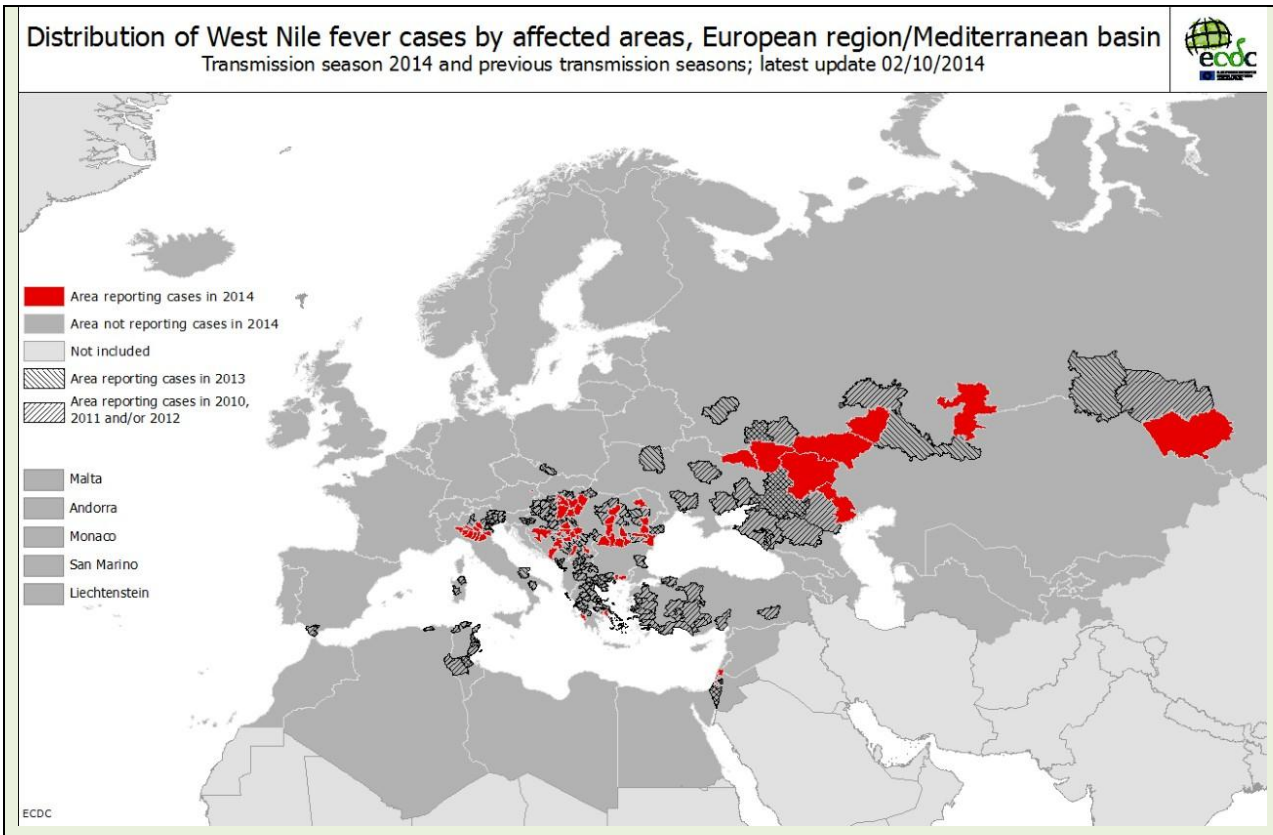
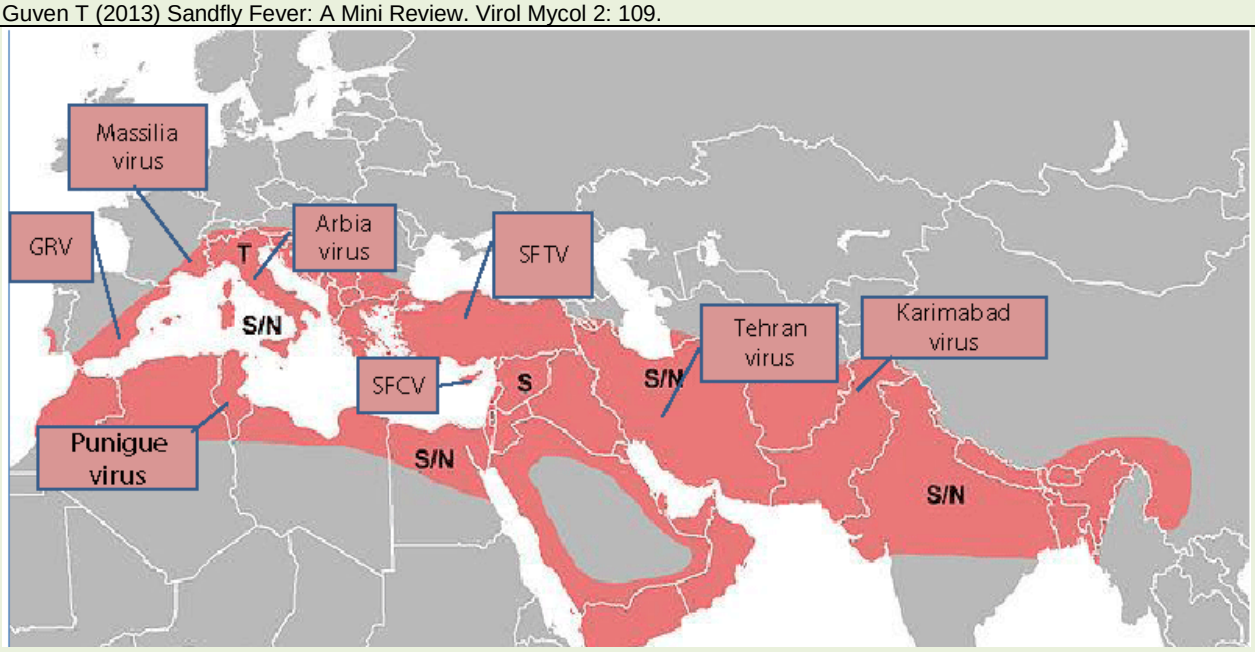


Figure 5: Sandfly fever viruses

Distribution of sandfly fever viruses by serotype. S: Sandfly Sicilian Virus, N: Sandfly Naples Virus, T: Toscana virus, SFTV: Sandfly Fever Turkey Virus; SFCV: Sandfly Fever Cyprus Virus; GRV: Granada Virus. Source: Kocak Tufan Z, Tasyaran MA, Guven T (2013) Sandfly Fever: A Mini Review. Virol Mycol 2: 109.



III Objectives of surveillance

The objectives of bacterial meningitis surveillance are:

- To monitor incidence of meningitis
- To identify and monitor circulating infectious agents (species and types) of meningitis
- To detect alert and outbreak
- To detect meningitis due to *Neisseria meningitidis*, and *Haemophilus influenzae* b and ensure needed preventive measures

IV Alert and outbreak thresholds

An alert is defined by any reportd case of meningitis. All reported cases of meningitis need to be investigated.

High alert is defined by one of the following:

- A cluster of acute meningitis (>=3 cases same time and place)
- Relative increase

An outbreak is defined by one of the following:

- At least of 3 confirmed cases same district within 2 incubation periods, same agent and type
- At least of 3 confirmed cases epi-linked or in same setting within 2 incubation periods, same agent and type
- At least one confirmed case of West Nile Fever

V Procedural steps

The below steps are recommended for the verification and investigation of bacterial meningitis cases, alerts and outbreaks. Figure 6 summarizes those steps.

Step 1: Verify alert

Cases of suspected bacterial meningitis are notified to the MOPH immediately, without waiting for microbial confirmation.

Upon notification, the hospital is asked to fill the meningitis reporting form provided in Annex 1.

Step 2: Complete data collection

The Esumoh caza team checks the completeness of reporting. For each case, the needed information is:

- Demography variables: age, gender, nationality, place of residence (caza and locality)
- Illness: date on onset
- Vaccination status
- Laboratory results: CSF findings (culture, cytology, biochemistry soluble antigens), blood culture …
- Occupation: student, military staff…
- Travel history of the case or family members

It is very important to collect copies of the CSF testing results and blood culture.In case of death, a copy of the medical file is requested.

Once the information is completed, the Esumoh caza teams sends all the documents to the Esumoh mohafaza and central level.

Based on the clinical, laboratory and epidemiological data, the meningitis investigation form is filled. The investigation form is provided in Annex 2.

Step 3: Identify agent

Based on available clinical, epidemiological and laboratory data, the causal agent is suspected and/or identified.

a) Bacterial agents

In case of positive culture, CSF soluble antigens, or PCR, the case is then confirmed.

In case of positive isolate at CSF or blood culture for *Neisseria meningitis* or *Haemophilus influenza*, the Esumoh central team coordinates the collection of any isolate to reference laboratory.

At designated reference laboratories, the isolates are confirmed, typed and tested for antimicrobial resistance.

It is important to identify the types:

- Of *Neisseria meningitidis* as some are not covered by vaccines (type B is not covered).
- Of *Strepotococcus pneumonia* as used vaccines do not cover all types of SP.
- Of *Haemophilus influenza* to ensure the type *b*

b) Viral agents

In case of aseptic meningitis, collection of specimens to be tested in reference laboratories to identify the agents is indicated in the following circunstances:

- Cluster for cases
- Relative increase in aseptic meningitis
- Testing for West Nile Virus

Step 4: Search additional cases

Additional cases are searched:

- Passive reporting
- Active surveillance: meningitis is included in the weekly visits to hospitals
- Review of the MOPH hospital admission database
- Community-based surveillance

Step 5: Describe cases

a) Description

Cases are described by:

- Time: day, week, month of onset

- Place: residence, specific setting
- Person: age group, gender, nationality
- Disease: classification, outcome
- Agent: species and types

Indicators are presented as counts and rates per 100,000.

The annex 4 provides a template for descriptive analysis.

b) Outbreak confirmation

Based on the clinical, laboratory and epidemiological data, the outbreak is declared if the outbreak criteria are met.

c) Results dissemination

The Esumoh central team informs the MOPH units.

The MOPH informs:

- Health professionals
- WHO
- Other governmental institutions: Ministry of Education and High Education, Ministry of Defense, Ministry of Social Affairs…

Step 6: Specific approaches

a) Close contacts targeted for chemoprophylaxis or follow up

Neisseria meningitis, Haemophilus influenza and *Mycobacteruim tuberculosis* can spreads to close contacts via droplet transmission.

Close contacts are defined by:

- Household members
- Classmates in school
- Bus school

- All children in kindergarden
- Military members sharing barraks

All close contacts are listed in a line listing. The line listing includes the following:

- Name
- Age
- Pregnancy
- Relationship with the patient
- Vaccination status (Hib)

Refer to SOP meningococcal meningitis for *Neisseria meningitis.*

Prophylaxis with antibiotics is provided to close contacts of *Neisseria meningitis, Haemophilus influenza* cases. It is initiated as soon as possible till 14 days from identification of the index patient. Chemoprophylaxis is provided by the caza health physician in coordination with the department for communicable diseases.
Close contacts of TB meningitis are screened for illness, IDR, sputum exam, and Chest-X ray.

b) Vaccine preventable disease

If there is a cluster or increase in meningitis due to vaccine preventable diseases: Hib, mumps… there is need to verify the vaccine coverage, vaccine efficacy and the genotypes.

Vaccine coverage is verified via rapid survey. The objective is to measure the proportion of adequately vaccinated persons in a sample population. The target Children can be defined as under 5, 10 or 15 years are 10 years in the vicinity of the case. Vaccination cards or health files are checked.

Vaccine efficacy is conducted via case control studies or retrospective cohort studies.

Genotypes of strains if identified are compared with used vaccines in the country.

c) Source of infection

For Mycobacterium tuberculosis, there is need to identify potential sources. All close contacts are screened to identity other cases. The screen includes:

- IDR test twice with 2 months interval
- Chest X ray if symptoms or positive IDR
- Sputum exam if symptoms or positive IDR

d) Food safety

In case of Listeria monocytogenes, specific investigation on potential food items is conducted:

- Identification of suspected food items
- Food sampling in the market
- Food inspection (if possible)

e) Vector borne diseases

Meningitis can due to virus with vector-borne transmission.

In such case, entomological investigation is conducted, including

- Assessing the environment
- Collection of vectors (mosquitoes and sandflies)
- Identify vector species
- Confirm infection of the vectors
- Mapping the vectors
- Assess susceptibility for insecticides.

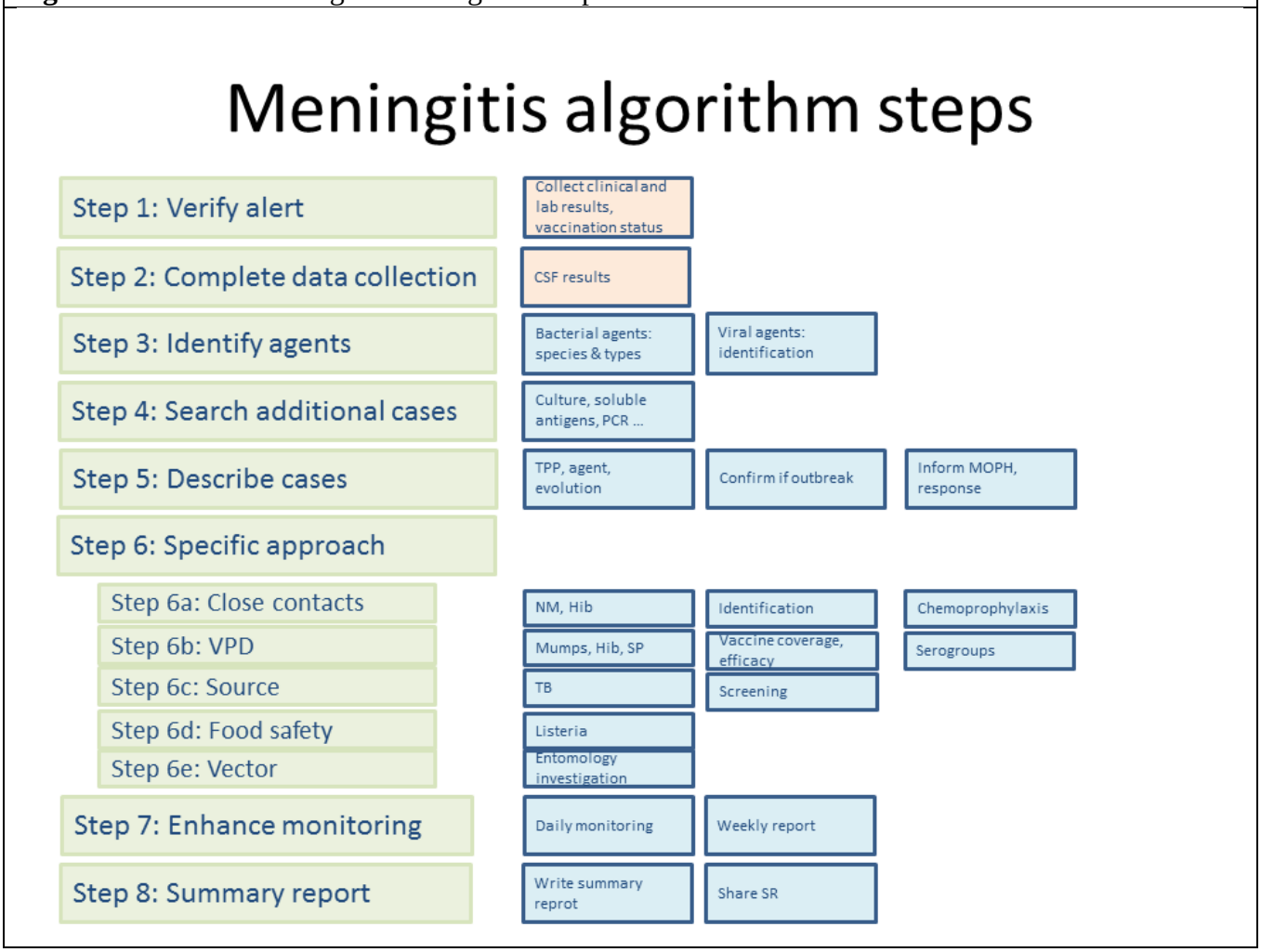
Step 7: Enhance monitoring

During the outbreak, cases are monitored on daily basis. Weekly report is prepared and shared with partners.

Step 8: Communicate

At the end of the event, the Esumoh central team prepares a summary report. The report is shared with partners.

Figure 6: Bacterial meningitis investigation steps



VI Annexes

Annex 1: Standard reporting form

Annex 2: Meningitis investigation form

Annex 3: Meningitis line listing

Annex 4: Meningitis descriptive report