Kansas Department of Health and Environment
Division of Health

Meningitis, Bacterial Disease Investigation Guideline

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Fact Sheet (vs. 12/2014)

Revision History:

Date	Replaced	Comments
12/2014	**01/2010**	Reformatted Standard Case Investigation and Data Management section to assist with EpiTrax system data entry. Added a Notification section. Updated web links. Reformatted fact sheet.

Meningitis, Bacterial Disease
Disease Management and Investigative Guidelines

CASE DEFINITION (CDC 1996)

Clinical Description for Public Health Surveillance:

- Bacterial meningitis manifests most commonly with fever, headache, and a stiff neck; the disease may progress rapidly to shock and death. However, other manifestations may be observed.

Laboratory Criteria for Case Classification:

- Isolation of bacterial species from the cerebrospinal fluid.

Case Classification:

- **Confirmed:** A clinically compatible case that is either laboratory confirmed or is accompanied by a positive blood culture.
- **Suspected** (internal use only not reported to CDC): A clinical compatible case in which laboratory results are pending or only results from positive gram stain results are available

EPIDEMIOLOGY

Neisseria meningitidis, *Streptococcus pneumoniae* and *Haemophilus influenzae* type B (Hib) account for more than 75% of all cases of bacterial meningitis in most studies, and 90% of bacterial meningitis in children. The agent causing disease varies by age group. In the United States and other countries, the medial age of persons with bacterial meningitis increased dramatically from 15 months in 1986 to 25 years or more in 1995, due to the reduction in Hib disease through vaccination programs. Meningococcal disease is unique among the major cause of bacterial meningitis in that it causes both endemic and epidemic disease. The less common bacterial causes of meningitis, such as staphylococci, enteric bacteria, group B streptococci, and *Listeria*, occur in persons with specific susceptibilities (such as neonates and patients with impaired immunity) or as a consequence of head trauma.

LABORATORY ANALYSIS

Gram stains and cultures are routinely performed by commercial laboratories.

The submission of bacterial meningitis isolates to the Kansas Health and Environmental Laboratories (KHEL) is required for ***Group A Streptococcus***, ***Streptococcus pneumoniae***, ***Neisseria meningitides****, and* ***Listeria monocytogenes*** isolates.

- Specimen type: CSF, blood
- Timing of collection: Before the administration of antibiotics
- Shipping of isolates: Use a KHEL Miscellaneous Infectious Disease mailer

For additional information concerning collection or sample transport:

- Call (785) 296-1620 or refer to www.kdheks.gov/labs/lab_ref_guide.htm

See next page for laboratory result interpretations.

CSF [1] laboratory values may suggest a presumptive diagnosis, but many cases may not be typical. Values can be affected by a number of factors (including age, gender, underlying medical conditions). This information should only be used in conjunction with the diagnosis/ impression of the infectious disease specialist based on the entire clinical presentation.

Agent	Virus	Bacteria	Subacute or chronic [4]	Normal
CSF Appearance	Cloudy	Cloudy	Cloudy	Clear, colorless
CSF WBC Count [2] (cell/mL)	< 1000 (usually 10-500)	100 - 10,000 (Usually >1000)	25-2000	< 8 (RBC and WBC)
CSF Differential (Predominate Cell)	Lymphocytes: 60-70%;	Mostly neutrophils [3] / PMNs; Few Lymphocytes & Monocytes	Lymphocytes	Lymphocytes
CSF Protein (mg/dL)	Normal / Slight increase	Elevated (50-100)	Increase / Greatly increased	< 40
CSF Glucose (mg/dL)	Normal	Below normal (< 50% of serum glucose)	Decreased	40-80
CSF Pressure (mm H20)	Normal / Slight increase	Elevated > 300	Normal / Slight increase	100-200

1 High WBC values in blood are also suggestive of infection. The blood (CBC) values will also give an impression of the patient's general health.

2 If there are numerous RBCs in the CSF due to a traumatic tap; the WBC count will need to be corrected to account for the excess WBC's from the blood.

3 Neutrophils can predominate early in viral and TB meningitis infections (first 24-48 hours).

4 Subacute or chronic infections include meningis due to: TB, cryptococci, other fungi, sarcoidosis, Lyme disease, syphilis, cyticercosis, or tumor.

Gram stain can allow rapid identification of pathogenic organisms; culture can provides a definitive diagnosis.

- Gram stain show organisms in CSF in 80% (range 60-90%) of patients with acute bacterial meningitis
- Cultures are positive in 90% but may be falsely negative in patients who are partially treated. Not all antibiotics are effective against the agents of public health concern – refer to additional resources to identify an antibiotics spectrum of activity.

Gram stain result	Bacteria	Prophylactic measures
Gram negative diplococci	*Neisseria meningitides*	Yes (refer to DIG)
Pleomorphic gram negative rods (Gram Negative cocco-bacilli)	*Haemophilus influenzae*	Yes (refer to) DIG
Gram positive cocci (gram positive dipplococci)	*Streptococus pneumoniae or Other invasive Streptococcus*	No (refer to DIG)

DISEASE OVERVIEW

A. Agent:
Various bacterial agents; including *Neisseria meningitidis*; *Streptococcus pneumoniae*; *Haemophilus influenzae*; staphylococci; streptococci, including Group A and B; enteric bacteria and *Listeria.* Today, *Streptococcus pneumoniae* and *Neisseria meningitidis* are the leading causes.

B. Clinical Description:
High fever, headache, and stiff neck are common symptoms of meningitis in anyone over the age of 2 years. These symptoms can develop over several hours, or they may take 1 to 2 days. Other symptoms may include nausea, vomiting, discomfort looking into bright lights, confusion, and sleepiness. In newborns and small infants, the classic symptoms of fever, headache, and neck stiffness may be absent or difficult to detect, and the infant may only appear slow or inactive, or be irritable, have vomiting, or be feeding poorly. As the disease progresses, patients of any age may have seizures.

C. Reservoirs:
Humans.

D. Mode(s) of Transmission:
Varies by agent. Some forms could be transmitted by direct contact with an infected person's oral and/or nasal secretions, but none are as contagious as things like the common cold or flu, and they are not spread by casual contact or by simply breathing the air where a person with meningitis has been.

E. Incubation Period: Varies by agent.

F. Period of Communicability: Varies by agent.

G. Susceptibility and Resistance: Varies by agent.

H. Treatment: Antibiotics; type will vary by agent.

NOTIFICATION TO PUBLIC HEALTH AUTHORITIES

A report shall be called in to the Kansas disease reporting hotline at 1-877-427-7317 within 4 hours of suspicion of a bacterial meningitis case.

The prompt reporting and investigation of cases of bacterial meningitis is necessary to allow for the following:

- The rapid identification of *N. meningitidis* or *H. influenza* cases to assure that proper prophylactic measures are taken,
- The complete reporting of invasive streptococcal cases, and
- To allow public health officials to provide sound recommendations in cases where chemoprophylaxis is unneeded.

INVESTIGATOR RESPONSIBILITIES

1) Report all cases to the KDHE Bureau of Epidemiology and Public Health Informatics (BEPHI) at 1-877-427-7317 within 4 hours of the initial report.

2) As soon as possible ideally within 24 hours of diagnosis, begin investigation. Use the Meningitis Investigation Worksheet to collect information that will help to confirm the diagnosis with the medical provider.
- Gram stain results and initial CSF findings should be available within 1 hour of CSF collection.
- Culture results may take more than 48 hours.
- Culture results may be negative, even with a positive gram stain, if antibiotic treatment occurred prior to specimen collection or if the culture method used was unsuitable for the specific bacterial growth

3) ***N. meningitidis* or *H. influenzae meningitis may* require prophylactic measures; investigate with disease-specific guidelines.**
- *N. meningitidis* (meningococcal infection) when there is:
  - ✓ Clinical purpura fulminans
  - ✓ Gram negative diplococci * on a gram-stain from a sterile site *(Note: N. gonorrhoeae is also gram negative diplococci, but complications of meningitis from gonorrhea are rare.)*
  - ✓ *N. meningitidis* antigen detection in a normally sterile body fluid
  - ✓ Physician's diagnosis of meningococcal, meningococcemia or meningitis caused by *N. meningitidis*
- *H. influenzae* when there is:
  - ✓ Pleomorphic gram negative rods (or gram negative coccobacilli*) on a gram-stain from a normally sterile site
  - ✓ Antigen detection of *H. influenzae* in a normally sterile body fluid
  - ✓ Physician's diagnosis of *H. influenzae* meningitis or invasive disease

  * Gram negative cocci may be over-decolorized gram positive cocci (sometimes suggestive of anaerobic bacteria) or rarely there could be a discrepancy in reporting (i.e., not reporting what is seen as pleomorphic coccobacilli).

4) **The following situations that do not require prophylactic measures but require investigation with disease-specific guidelines:**
- Streptococcal invasive: From a normally sterile site or body fluid, gram positive cocci on gram-stain and/or antigen detection or isolation of *S. pneumoniae* (in diplococci on gram stain) or Group A *Streptococcus* (in chains on gram stain).
- Listeriosis: From a normally sterile site or body fluid, gram positive rod on gram-stain and/or antigen detection or isolation of *L. monocytogenes.*
- Viral meningitis: Any laboratory tests and/or physician diagnosis that suggests aseptic or viral meningitis. The only viral meningitis that usually needs follow-up investigation is an arboviral disease and in rare instances sexually transmitted diseases and some complications from vaccine preventable diseases.

- Mycobacterium tuberculosis infection can have complications of meningitis and will also have a report of no bacteria on a gram stain.

5) Consider the following situations that do not require prophylactic measures or any special investigation or control measures unless an outbreak is suspected.

- *Staphylococcus* invasive: From normally sterile site, gram positive cocci (in clusters) on a gram stain. (Consider the possibility of Streptococcal infection described above)
- Enteric bacteria invasive: From a normally sterile site, gram negative rods on a gram stain (Consider the possibility of over-decolorized *Listeria* bacteria or *H. influenzae* whose shape is much smaller and more cocci than an enteric organism.)

6) If the agent remains unknown, consult with KDHE-BEPHI on the need for a case or contact investigation or the need to initiate control and prevention measures.

7) Perform a case investigation obtaining the following from the medical records:

For any suspected diagnosis Haemophilus influenzae, Neisseria meningitidis, group A Streptococcus, or Listeria monocytogenes investigate with specific disease investigation guidelines.

- Demographic data (birth date, county, sex, race/ethnicity) [Demographic]
- Onset date and Diagnosis date of illness [Clinical];
- Hospitalizations: location and duration of stay [Clinical];
- Symptoms [Investigation-Symptoms];
- Type of infection [Investigation-Complications];
- Outcomes: survived and date of recovery or date of death [Clinical];

Additional information to collect for cases includes:

- Attendance at a daycare facility: include name of facility [Epidemiological];
- Health care worker [Epidemiological];
- Group living [Epidemiological]

8) Educate the cases, contacts and medical providers that:

- Bacterial meningitis caused by bacteria other than *N. meningitidis*, *H. influenzae* and *S. pneumoniae* usually only occurs in persons with specific susceptibilities (such as neonates and patients with impaired immunity) or as a consequence of head trauma;
- Antibiotic treatment is not considered an effective way of protect contacts exposed to a meningitis case caused by bacteria other than *N. meningitidis* or *H. influenzae*; and
- Medical attention should be sought immediately if they begin to exhibit signs and symptoms of severe illness compatible with meningitis.

9) As appropriate, use the notification letter(s) and the disease fact sheet to the case, contacts and other individuals or groups.

10) Report all additional findings to KDHE using the Kansas electronic surveillance system.

DATA MANAGEMENT AND REPORTING TO THE KDHE

A. Accept the case assigned to the LHD and record the date the LHD investigation was started on the [Administrative] tab.

B. Organize and collect data.
- The Investigation Worksheet is provided to assist the investigator but does not have to be submitted to CDC or KDHE.
- Investigators can collect and enter all required information directly into EpiTrax [Investigation], [Clinical], [Demographics], and [Epidemiological] tabs without using the paper forms.
- During outbreak investigations, refer to guidance from a KDHE epidemiologist for appropriate collection tools.

C. Report data collected during the course of the investigation via EpiTrax**.**
- Verify that all data requested in Step 7) has been recorded on an appropriate EpiTrax [tab], or that actions are completed for a case lost to follow-up as outlined below.
- Some data that cannot be reported on an EpiTrax [tab] may need to be recorded in [Notes] or scanned and attached to the record.
- Paper report forms do not need to be sent to KDHE after the information is recorded in EpiTrax. The forms should be handled as directed by local administrative practices.

D. If a case is lost to follow-up, after the appropriate attempts:
- Indicate 'lost to follow-up' on the [Investigation] tab with the number of attempts to contact the case recorded.
- Record at least the information that was collected from the medical records.
- Record a reason for 'lost to follow-up' in [Notes].

E. Once the investigation is completed, the LHD investigator will click the "Complete" button. This will trigger an alert to the LHD Administrator so they can review the case before sending to the state.
- The LHD Administrator will then "Approve" or "Reject" the CMR.
- Once a case is "Approved" by the LHD Administrator, BEPHI staff will review the case to ensure completion before closing the case.

F. Review the EpiTrax User Guide, Case Routing for further guidance.

Note: Report *H. influenzae*, *N. meningitidis*, *S. pneumoniae*, group A *Streptococcus* or *Listeria monocytogenes* based on specific disease name. Report all other bacterial meningitis as "Meningitis, other bacterial".

If a case is first entered in as "Meningitis, other bacterial" and an organism is isolated, the case event should be changed to the appropriate event.

Review the chart on the following page.

Case Event	Organism
Haemophilus influenzae, invasive	*H. influenzae*
Listeriosis	*Listeria monocytogenes*
Meningococcal disease (Neisseria meningitidis)	*N. meningitidis*
Streptococcus pneumonia, invasive	*S. pneumoniae*
Streptococcal Disease, invasive, Group A	group A *Streptococcus* or *Steptococcus pyogenes*
Meningitis, other bacterial	All other bacterial isolates, including group B *Streptococcus,* staphylococci, and enteric bacteria.

ADDITIONAL INFORMATION / REFERENCES

A. Treatment / Differential Diagnosis: American Academy of Pediatrics. Red Book: Report of the Committee on Infectious Disease, 29th Edition. Illinois, Academy of Pediatrics, 2014.

B. Epidemiology, Investigation and Control: Heymann. D., ed., Control of Communicable Diseases Manual, Washington, DC, American Public Health Association, 2010.

C. Child Care Guidelines: American Academy of Pediatrics, American Public Health Association, and National Resource Center for Health and Safety in Child Care and Early Education. Caring for Our Children: National Health and Safety Performance Standards: Guidelines for Out-of-Home Child Care Programs, 2nd edition. Elk Grove Village, IL: American Academy of Pediatrics and Washington, DC: American Public Health Association, 2002: pg. 290. Also available at http://nrckids.org.

D. Case Definitions: wwwn.cdc.gov/nndss/

E. Kansas Regulations/Statutes Related to Infectious Disease: www.kdheks.gov/epi/regulations.htm

F. Additional Information (CDC): www.cdc.gov/health/default.htm

ATTACHMENTS

To view attachments in the electronic version:

1. Go to <View>; <Navigation Pane>; <Attachments> – OR – Click on the "Paper Clip" icon at the left.
2. Double click on the document to open.

Meningitis Investigation Worksheet

(Please refer to the Disease investigation Guideline for additional guidance.)

1. **Date**:	Time:	2. Reporter:	
3. Medical Contact: (if different from reporter)		Hospital or Clinic Location:	
Phone: ( )	Pager: ( )	Phone: ( )	Pager: ( ) Fax: ( ) Other: ( )

4. Patient Information	Last Name:	First Name:	Date of Birth:
Address:	City of Residence:	State:	County of Residence:

Date of Onset: ___/___/___ First Symptom experienced: _____

Status: ☐ Hospitalized; Location: _____Admit: ___/___/___ Discharge: ___/___/___

☐ Died; date of death: ___/___/___ ☐ Other; describe: _____

Symptoms	**No**	**Unk**	**Yes**	**Comments / Specifics:**
Fever				Highest recorded temp:
Headache				
Stiff neck				
Photophobia				
Altered mental status, confusion				
Coma / Unresponsive				
Lethargic				
Nausea				
Vomiting				
Rash (describe)				
Other symptoms (list):				

Initial Treatment /Testing

	No	**Unk**	**Yes**	**Date**	**Time**	**Notes**
Any antibiotic treatment started						
Lumbar puncture performed						
Blood culture specimen collected						

	CSF Result	**Serum/Blood Result**	**Notes**
Gram Stain:			
Color/Clarity:			
Pressure:			
Protein:			
Glucose:			
RBC Count:			
WBC Count:			
Predominate Cell Type:			
Latex Agglutination:			
Cryptococcal antigen:			
Other (specify):			

Additional Laboratory Testing

	Laboratory Performing	**CSF Result**	**Serum/Blood result**
Bacterial Culture			
PCR testing			

Additional Comments/Notes (i.e., Notifications, Contact information, Pending Results, Actions):

CSF [1] lab values may suggest a presumptive diagnosis, but many cases may not be typical. Values can be affected by a number of factors (including age, gender, underlying medical conditions). This information should only be used in conjunction with the diagnosis/ impression of the infectious disease specialist based on the entire clinical presentation.

Agent	CSF Appearance	CSF WBC Count [2] (cell/mL)	CSF Differential (Predominate Cell)	CSF Protein (mg/dL)	CSF Glucose (mg/dL)	CSF Pressure (mm H_20)
Virus	Cloudy	< 1000 (usually 10-500)	Lymphocytes: 60-70%;	Normal / Slight increase	Normal	Normal/ Slight increase
Bacteria	Cloudy	100 - 10,000 (Usually >1000)	Mostly neutrophils [3] / PMNs; Few Lymphocytes & Monocytes	Elevated (50-100)	Below normal (< 50% of serum glucose)	Elevated > 300
Subacute or chronic [4]	Cloudy	25-2000	Lymphocytes	Increase / Greatly increased	Decreased	Normal / Slight increase
Normal	Clear, colorless	< 8 (RBC and WBC)	Lymphocytes	< 40	40-80	100-200

[5] High WBC values in blood are also suggestive of infection. The blood (CBC) values will also give an impression of the patient's general health.

[6] If there are numerous RBCs in the CSF due to a traumatic tap; the WBC count will need to be corrected to account for the excess WBC's from the blood.

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