Meningococcal Disease
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Meningococcal Disease

Overview[1, 2, 3, 6, 9, 11]

Meningococcal disease is an acute and often a serious illness caused by the bacterium *Neisseria meningitidis (N. meningitidis).* This bacterium has at least 13 different serogroups. Five of these serogroups, A, B, C, Y, and W-135, cause almost all invasive disease. The relative importance of these five serogroups depends on geographic location and other factors. Humans are the only host for *N. meningitidis*. Meningococcal disease is more commonly diagnosed among infants, adolescents, and young adults. *N. meningitidis* bacteria are spread through the exchange of respiratory and throat secretions like spit (e.g., by coughing, sneezing, kissing, living in close quarters, sharing of drinking glasses, eating utensils, or cigarettes). Host factors that increase risk of disease include asplenia, certain immunodeficiencies, and genetic risk factors. Environmental risk factors include household exposure; concurrent upper respiratory infections; crowded housing; and active or passive smoking.

The incubation period ranges from 1 to 10 days (usually less than 4 days) after exposure.[2] The period of communicability varies, but usually lasts less than 24 hours after onset of appropriate antibiotic treatment. Meningococcal disease is seasonal, with the number of cases generally peaking each year in January and February. Meningococcal disease can include a variety of serious clinical illnesses, including meningitis (infection of the lining of the spinal cord), septicemia or bacteremia (bacteria in the blood), and rarely, pneumonia (infection of the lungs).

When someone has meningococcal meningitis the symptoms include sudden onset of fever, headache, and stiff neck. It is often accompanied by other symptoms, such as nausea, vomiting, photophobia (increased sensitivity to light), and altered mental status (confusion). In newborns and infants, the classic symptoms of fever, headache, and neck stiffness may be absent or difficult to notice. The infant may appear to be slow or inactive, irritable, vomiting, or feeding poorly. In young children, doctors may also look at the child's reflexes, which can also be a sign of meningitis. Another common outcome of meningococcal infection is either septicemia or bacteremia. Symptoms may include; fatigue, vomiting, cold hands and feet, cold chills, severe aches or pain in the muscles, joints, chest or abdomen, rapid breathing, diarrhea, and in the later stages, a dark purple rash.

Meningococcal disease is potentially fatal and should always be viewed as a medical emergency which requires prompt treatment. Consequently, empiric antibiotic treatment must be started early in the course of the disease, after appropriate cultures have been obtained, because of the short period of time between progressions from initial symptoms to death. A systematic study of the occurrence of symptoms, before hospitalization, in children and adolescents (aged 16 or younger) with meningococcal disease was conducted with the following results: (1) Nonspecific symptoms occurred for the first 4 to 6 hours, (2) More severe symptoms developing by 8 hours, such as leg pains, cold hands, cold feet, and abnormal skin color, (3) The median time to hospital admission was 19 hours, and (4) By 24 hours children were close to death.[6, 11]

Although meningococcal disease can be very serious, meningococcal disease can be treated with antibiotics that prevent severe illness and reduce the spread of infection from person-to-person.

However, the case-fatality rate in the U.S. is still 10%-14%. Of patients who recover 11%-19% will have permanent hearing loss, mental retardation, loss of limbs, or other serious sequelae. Persons who develop meningococcal disease more than once should be evaluated by a medical provider for possible underlying immune deficiency.

Vaccination is the best way to prevent meningococcal disease. There are several vaccines available to help protect against the three serogroups (B, C, and Y) of meningococcal disease that are commonly seen in the U.S:

- Meningococcal conjugate vaccine (MCV) is the preferred vaccine for people 55 years of age and younger. Menactra and Menveo are quadrivalent vaccines, known as MenACWY, which protect against serogroups A, C, Y, and W-135. Menactra was licensed by the U.S. Food and Drug Administration (FDA) in January 2005 and is approved for persons 9 months through 55 years of age. Menveo was licensed by the FDA in February 2010 and is approved for persons 2 months through 55 years of age for whom MCV4 is indicated, including revaccination. MenHibrix is a combination vaccine that protects against serogroups C and Y, and also against *Haemophilus influenzae* type b. MenHibrix was licensed by the FDA in June 2012 for infants and children 6 weeks through 18 months of age.
- Meningococcal polysaccharide vaccine (MPSV4) has been available since the 1970s. It is the only meningococcal vaccine licensed for people older than 55 years of age. Menomune protects against serogroups A, C, Y, and W-135 and is approved for persons 2 years of age and older.
- On October 29, 2014, the FDA licensed the first serogroup B meningococcal vaccine, Trumenba, which is a 3-dose series approved for persons 10 through 25 years of age. On January 23, 2015, the FDA licensed a second serogroup B meningococcal vaccine, Bexsero, which is a 2-dose series approved for persons 10 through 25 years of age. While there is no routine recommendation for serogroup B meningococcal vaccines at this time, physicians can use these vaccines for people 10 through 25 years of age consistent with the labeled indication. Based on the Centers for Disease Control and Prevention (CDC) interim guidance (http://www.cdc.gov/meningococcal/downloads/interim-guidance.pdf), this vaccine can also be an important tool for controlling outbreaks of serogroup B meningococcal disease.

For a more complete description of meningococcal disease refer to:

- *Control of Communicable Diseases Manual* (CCDM), American Public Health Association, 2015.
- American Academy of Pediatrics. *Red Book: 2015 Report of the Committee on Infectious Diseases.* 30th ed. 2015.
- *Epidemiology and Prevention of Vaccine-Preventable Diseases*, "Pink Book", CDC. 13th ed., second printing, May 2015: http://www.cdc.gov/vaccines/pubs/pinkbook/mening.html.
- Apicella, Michael A. *Neisseria meningitidis*. In: Gerald L. Mandell, John E. Bennett, & Raphael Dolin, Eds. *Principles and Practice of Infectious Diseases*, 7th ed. 2010.

2015 Case Definition Meningococcal Disease[5]

Clinical Criteria

Clinical purpura fulminans in the absence of a positive blood culture.

Laboratory Criteria for Diagnosis

- Gram-negative diplococci, not yet identified, isolated from a normally sterile body site [e.g., blood or cerebrospinal fluid (CSF)]
- Detection of *N. meningitidis* antigen
  - In formalin-fixed tissue by immunohistochemistry (IHC); or
  - In CSF by latex agglutination
- Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood or CSF), using a validated polymerase chain reaction (PCR) assay; or
- Isolation of *N. meningitidis*
  - From a normally sterile body site (e.g., blood or CSF, or less commonly, synovial, pleural, or pericardial fluid); or
  - From purpuric lesions

Epidemiologic Linkage

Not applicable for case classification.

Case Classification

Confirmed

- Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood or CSF), using a validated PCR assay, **OR**
- Isolation of *N. meningitidis*:
  - From a normally sterile body site (e.g., blood or CSF, or less commonly, synovial, pleural, or pericardial fluid), **OR**
  - From purpuric lesions.

Probable

- Detection of *N. meningitidis* antigen
  - In formalin-fixed tissue by IHC; **OR**
  - In CSF by latex agglutination.

Suspected

- Clinical purpura fulminans in the absence of a positive blood culture; **OR**
- Gram-negative diplococci, not yet identified, isolated from a normally sterile body site (e.g., blood or CSF).

Information Needed for Investigation

Verify Clinical Diagnosis. Because of the risks of severe morbidity and death, effective antibiotics should be administered promptly to patients suspected of having meningococcal

disease; do not wait for confirmation by culture to begin treatment (see Meningococcal Disease Treatment Overview). [10] Obtain demographic, clinical, laboratory information, and other epidemiological information necessary to complete the **"**Disease Case Report" (CD-1), and the "Record of Investigation of Bacterial Meningitis or Bacteremia Case Report" (CD-2M) from the attending physician, hospital and/or laboratory, and patient or a knowledgeable family member. ***NOTE****: Ensure appropriate confirmatory laboratory tests are performed.*

Establish the Extent of Illness. Determine if household or other close contacts are or have been ill by contacting the patient, family members, or health care provider. Contacts who have or develop a febrile illness should receive *prompt* medical evaluation, and if indicated, antimicrobial treatment appropriate for invasive meningococcal infection. Appropriate laboratory testing should be done (see Laboratory Procedures), but treatment should *not* be delayed.[2] Determine if the case provided child or patient care for anyone outside the household.

Identification of High-Risk of Exposure Contacts.[2, 6, 10] Identify all high-risk of exposure contacts (i.e. close contacts who may have been exposed to the respiratory aerosols of a case in the 7 days before the onset of symptoms in the case and until the case has 24 hours of effective antimicrobial therapy). All high-risk of exposure contacts should receive chemoprophylaxis (*regardless of immunization status*). Chemoprophylaxis ideally should be initiated *within 24 hours after the case is identified*; prophylaxis given more than two weeks after exposure has little value. ***COMMENT***: *Interview the case, their household members, and close friends* (for cases that are adolescents and/or young adults, close friends may be the only source of information about contacts during school or in other non-household settings). ***NOTE***: *The rationale behind this methodology is to eradicate carriage from asymptomatic carriers who may be a potential source of further cases; and eradicate carriage for those who have just acquired the organism and may themselves be at risk of developing meningococcal disease.*

Examples of High-risk of Exposure Contacts.[2]

- Household contact, especially children younger than 2 years of age.
- Child care or preschool contact at any time during 7 days before onset of illness.
- Direct exposure to index patient's secretions through kissing or through sharing toothbrushes or eating utensils, markers of close social contact, at any time during 7 days before onset of illness.
- Mouth-to-mouth resuscitation, unprotected contact during endotracheal intubation at any time 7 days before onset of illness.
- Frequently slept in same dwelling as index patient during 7 days before onset of illness.
- Passengers seated directly next to the index case during airline flights lasting more than 8 hours.

See the following table extracted from the American Academy of Pediatrics, *Red Book: 2015 Report of the Committee on Infectious Diseases.* 30th ed. for recommended chemoprophylaxis regimens.

TABLE 1 - Recommended Chemoprophylaxis Regimens for High-Risk Contacts and People with Invasive Meningococcal Disease[2]

Age of Infants, Children, and Adults	Dose	Duration	Efficacy, %	Cautions
Rifampin[a]				
< 1 mo	5 mg/kg, orally, every 12 h	2 days		
≥ 1 mo	10 mg/kg (maximum 600 mg), orally, every 12 h	2 days	90–95	Can interfere with efficacy of oral contraceptives and some seizure and anticoagulant medications; can stain soft contact lenses
Ceftriaxone				
< 15 y	125 mg, intramuscularly	Single dose	90–95	To decrease pain at injection site, dilute with 1% lidocaine
≥ 15 y	250 mg, intramuscularly	Single dose	90–95	To decrease pain at injection site, dilute with 1% lidocaine
Ciprofloxacin[a,b]				
≥ 1 mo	20 mg/kg (maximum 500 mg), orally	Single dose	90–95	Not recommended routinely for people younger than 18 years of age; use may be justified after assessment of risks and benefits for the individual patient
Azithromycin	10 mg/kg (maximum 500 mg)	Single dose	90	Not recommended routinely; equivalent to rifampin for eradication of *Neisseria meningitidis* from nasopharynx in one study

[a] Not recommended for use in pregnant women.

[b] Use only if fluoroquinolone-resistant strains of *N meningitidis* have not been identified in the community; Centers for Disease Control and Prevention. Emergence of fluoroquinolone-resistant *Neisseria meningitidis*—Minnesota and North Dakota, 2007–2008. *MMWR Morbidity Mortal Wkly Rep*. 2008; 57(7):173–175.

NOTE: *In July 2016, the FDA approved safety labeling changes for fluoroquinolones, to enhance warnings about their association with disabling and potentially permanent side effects and to limit their use in patients with less serious bacterial infections. FDA-approved fluroquinolones include ciprofloxacin, one of the antibiotics recommended for treatment and prevention of meningococcal disease. The labeling changes include an updated Boxed Warning and revisions to the Warnings and Precautions section of the label about the risk of disabling and potentially irreversible adverse reactions that can occur together. For more information, visit http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm513183.htm.*[13]

Because secondary cases can occur several weeks or more after onset of disease in the index case, meningococcal vaccine is an adjunct to chemoprophylaxis when an *outbreak* is caused by a serogroup prevented by a meningococcal vaccine.[2] For control of meningococcal outbreaks caused by vaccine-preventable serogroups (A, B, C, Y, and W-135), see the Outbreak Investigation and Control section contained below in this document.

Provide Information on Meningococcal Disease to Contacts and the General Public as needed. Efforts should be made to promote meningococcal disease awareness to high-risk contacts, medical providers, and the public as needed to reduce the risk of infection. Information on meningococcal disease prevention can be found on CDC's website at: http://www.cdc.gov/meningococcal/about/index.html or several excellent fact sheets are available from the Immunization Action Coalition at:
http://www.immunize.org/catg.d/p4210.pdf - Meningococcal: Questions and Answers, Information about the disease and vaccines.
http://www.immunize.org/catg.d/p4316.pdf - Meningococcal disease is serious...Make sure your child is protected!
http://www.immunize.org/catg.d/p2018.pdf - Meningococcal Vaccination Recommendations by Age and/or Risk Factor.

Contacts should be encouraged to seek medical evaluation immediately if he or she develops a febrile illness. Meningococcal disease cases should be reported promptly. Active or passive exposure to tobacco smoke and concurrent upper respiratory tract infections increase the risk of meningococcal disease.[8] A sample parent letter and a physician notification letter are provided in this manual section. These may be adapted if necessary, duplicated, and distributed as needed.

Meningococcal Disease Surveillance. Conduct close surveillance of high-risk contacts for at least 10 days after the case's onset of illness to assure prompt medical evaluation, and treatment of anyone who develops a febrile illness.[6] Establish close contact with key, local medical providers to assure prompt reporting of any additional cases.

Review WebSurv to determine if there are cases related by person, place, time, and serogroup. Is an outbreak or cluster suspected? Information obtained through the Record of Investigation of Bacterial Meningitis or Bacteremia Case Report (CD-2M) is used to: (1) Characterize persons or geographic areas in which additional efforts may be needed to raise awareness and reduce disease incidence, (2) To detect outbreaks of meningococcal disease so that appropriate control measures can be promptly instituted, and (3) To assess changes in the epidemiology of meningococcal disease over time, to permit the most efficient allocation of resources and formulation of the most effective disease control and prevention policies. In addition, meningococcal serogroup surveillance data are important to monitor the impact of the meningococcal vaccines and to determine the epidemiologic link between cases in cluster or outbreak situations.

In the past few years, several clusters and outbreaks have increased awareness of meningococcal disease cases occurring among men who have sex with men (MSM). Even though information on MSM and human immunodeficiency virus (HIV) status of men reported with meningococcal disease is not currently noted on most meningococcal case report forms, representative and

complete data on MSM and HIV status is needed to better understand the epidemiology of and potential risk factors for meningococcal disease among MSM in the U.S. and to inform prevention and control recommendations. Local public health agencies (LPHAs) are encouraged to attempt to determine MSM and HIV status during investigations of meningococcal disease cases caused by any serogroup occurring among males at least 16 years of age. A supplemental case report form (Meningococcal Disease Among Men who have Sex with Men (MSM)) should be completed for all cases of meningococcal disease occurring among MSM at least 16 years of age.[14] The completed supplemental form should be reported to DHSS in the same process used to report the completed "Record of Investigation of Bacterial Meningitis or Bacteremia Case Report" (CD-2M). Currently, MSM are not included in the groups of persons reported to be at increased risk for meningococcal disease.

Notification

- If meningococcal disease is suspected, the local public health agency (LPHA) should contact the District Communicable Disease Coordinator, the District Senior Epidemiology Specialist, or the Missouri Department of Health and Senior Services (DHSS) – Bureau of Communicable Disease Control and Prevention (BCDCP), phone (573) 751-6113, Fax (573) 526-0235, or for afterhours notification contact the DHSS/Emergency Response Center (ERC) at (800) 392-0272 (24/7).
- If a case(s) is associated with a child care center, BCDCP or the LPHA will contact the Bureau of Environmental Health Services (BEHS), phone (573) 751-6095, Fax (573) 526-7377 and the Section for Child Care Regulation, phone (573) 751-2450, Fax (573) 526-5345.
- If a case(s) is associated with a long-term care facility, BCDCP or the LPHA will contact the Section for Long Term Care Regulation, phone (573) 526-8524, Fax (573) 751-8493.
- If a case is associated with a hospital, hospital-based long-term care facility, or ambulatory surgical center BCDCP or the LPHA will contact the Bureau of Health Services Regulation phone (573) 751-6303, Fax (573) 526-3621.

Control Measures

Meningococcal Disease Treatment Overview. The clinical presentation of meningococcal meningitis is similar to other forms of bacterial meningitis. Suspected cases should be treated promptly without waiting for laboratory confirmation. Several antibiotics are effective for *N. meningitidis* infection, including penicillin. Few penicillin-resistant strains of meningococcus have been reported in the United States. Once *N. meningitidis* infection has been confirmed, penicillin alone is recommended.[3] ***NOTES***: *For patients who receive penicillin, eradication of nasopharyngeal carriage with rifampin, ciprofloxacin, or ceftriaxone is recommended prior to discharge from the hospital.*[10] *In July 2016, the FDA approved safety labeling changes for fluoroquinolones to enhance warnings about their association with disabling and potentially permanent side effects and to limit their use in patients with less serious bacterial infections.*[13] For hospitalized meningococcal disease cases in addition to standard precautions, droplet precautions are recommended until 24 hours after initiation of effective antimicrobial therapy.[2] Some experts recommend that patients with invasive meningococcal disease be evaluated for a

terminal complement deficiency. If a deficiency is detected, patients should receive a meningococcal conjugate vaccine if nine months of age or older, and patients should be counseled about the risk of recurrent invasive meningococcal disease.[2]

For additional information on the medical management of meningococcal disease cases see the, American Academy of Pediatrics. *Red Book: 2015 Report of the Committee on Infectious Diseases.* 30th ed. 2015, or *Principles and Practice of Infectious Diseases*, 7th ed., Pennsylvania: Churchill Livingstone Elsevier, 2010, or other suitable reference; several such references are listed at the end of this document.

Meningococcal Conjugate Vaccine. The Advisory Committee on Immunization Practices (ACIP) recommends routine administration of a MenACWY vaccine for all persons aged 11 through 18 years. A single dose of vaccine should be administered at age 11 or 12 years and a booster dose should be administered at age 16 years. Adolescents who receive their first dose at age 13 through 15 years should receive a booster dose at age 16 through 18 years. The minimum interval between doses of MenACWY is 8 weeks. Adolescents who receive a first dose after their 16th birthday do **not** need a booster dose unless they become at increased risk for meningococcal disease. Persons aged 19 through 21 years are **not** recommended routinely to receive MenACWY. MenACWY may be administered up to age 21 years as catch-up vaccination for those who have not received a dose after their 16th birthday. Health-care personnel should use every opportunity to provide the booster dose when indicated.[1] The ACIP also recommends routine use of meningococcal conjugate vaccine for persons aged ≥2 months at increased risk for meningococcal disease, including:

- Persons aged ≥2 months with certain medical conditions such as anatomic or functional asplenia (including persons with sickle cell disease), or complement component deficiency (dosing schedule and interval for booster dose varies by age at time of previous vaccination).
- Persons receiving eculizumab (Solaris, Alexion Pharmaceuticals) for treatment of atypical hemolytic uremic syndrome or paroxysmal nocturnal hemoglobinuria (because the drug binds C5 and inhibits the terminal complement pathway).
- Special populations such as unvaccinated or incompletely vaccinated first-year college students living in residence halls, military recruits, or microbiologists with occupational exposure (indication for booster dose 5 years after prior dose if at continued risk).
- Persons aged ≥9 months who travel to or reside in countries in which meningococcal disease is hyperendemic or epidemic, particularly if contact with the local population will be prolonged.
- Vaccination of persons in at-risk groups to control outbreaks.

The ACIP also recommends routine use of meningococcal conjugate vaccine for persons aged ≥2 months with human immunodeficiency virus (HIV) infection. Children aged <2 years should be vaccinated using a multidose schedule. Persons aged ≥2 years with HIV who have not been previously vaccinated should receive a 2-dose primary series of MenACWY conjugate vaccine. Persons with HIV who have been previously vaccinated with meningococcal conjugate vaccine

should receive a booster dose at the earliest opportunity (at least 8 weeks after the previous dose) and then continue to receive boosters at the appropriate intervals. If the most recent dose was received before age 7 years, a booster dose should be administered 3 years later. If the most recent dose was received at age ≥7 years, a booster should be administered 5 years later and every 5 years thereafter throughout life.

The same vaccine product should be used for all doses, however if the product used for previous doses is unknown or unavailable, the vaccination series may be completed with any age- and formulation-appropriate meningococcal conjugate vaccine.

Serogroup B Meningococcal Vaccine. Teens and young adults (16 through 23 years old) may also be vaccinated with a serogroup B meningococcal vaccine (Bexsero or Trumenba), preferably at 16 through 18 years old. Two or three doses are needed depending on the brand. The same vaccine product should be used for all doses whenever possible. Certain persons aged at least 10 years who are at increased risk for meningococcal disease should receive the meningococcal B vaccine. These persons include:

- Persons with persistent complement component deficiencies.
- Persons with anatomic or functional asplenia.
- Microbiologists routinely exposed to isolates of *Neisseria meningitidis.*
- Persons identified as at increased risk because of a serogroup B meningococcal disease outbreak.

For more information on meningococcal vaccination, visit the following reports from the Centers for Disease Control and Prevention, *Prevention and Control of Meningococcal Disease: Recommendations of the Advisory Committee on Immunization Practices (ACIP)*, *Recommendations for Use of Meningococcal Conjugate Vaccines in HIV-Infected Persons – Advisory Committee on Immunization Practices, 2016* and *Use of Serogroup B Meningococcal Vaccines in Adolescents and Young Adults: Recommendations of the Advisotry Committee on Immunization Practicers, 2015*, which compile and summarize the recommendations from the ACIP regarding prevention and control of meningococcal disease in the United States.

COMMENTS: *The currently available vaccines do not cover all serogroups of N. meningitidis. Also, like with any vaccine, meningococcal vaccines are not 100% effective. This means that even if a persons has been vaccinated, there is still a chance of developing a meningococcal infection.*

Postexposure Chemoprophylaxis of High-Risk of Exposure Contacts. All high-risk of exposure contacts should receive appropriate antimicrobial prophylaxis *as soon as possible* (see Identification of High-Risk of Exposure Contacts and Examples of High-Risk of Exposure Contacts for more information). Ideally, chemoprophylaxis should begin within 24 hours of diagnosis of the primary case. Close surveillance of this group, for at least 10 days is recommended, to ensure prompt treatment in the absence of effective chemoprophylaxis.[6] Beginning chemoprophylaxis more than 2 weeks after exposure to the index case would be too late to prevent secondary cases.[6] Throat and nasopharyngeal cultures are of no value in deciding who should receive chemoprophylaxis and are *not* recommended. A contact does *not* require

prophylaxis if the *only* exposure occurred 24 hours or more after the case began appropriate antimicrobial treatment.[2]

Rifampin, ceftriaxone, ciprofloxacin, and azithromycin are appropriate drugs for chemoprophylaxis in adults, but neither rifampin nor ciprofloxacin are recommended for pregnant women. The drug of choice for most children is rifampin. For more information see TABLE 1 - Recommended Chemoprophylaxis Regimens for High Risk Contacts and People with Invasive Meningococcal Disease[2]. ***NOTE**: In July 2016, the FDA approved safety labeling changes for fluoroquinolones to enhance warnings about their association with disabling and potentially permanent side effects and to limit their use in patients with less serious bacterial infections.*[13]

Important: Chemoprophylaxis is not recommended for close contacts of patients with evidence of *Neisseria meningitidis* only in nonsterile sites such as an oropharyngeal swab, endotracheal secretions, or conjunctival swab. Reports of secondary cases after close contact to persons with noninvasive pneumonia or conjunctivitis are rare; there is no evidence of substantive excess risk. Furthermore, there is no indication to treat persons who are asymptomatic nasopharyngeal carriers.[4]

Outbreak Investigation and Control.[10]

More than 98% of meningococcal disease cases in the United States are sporadic, while the other 2% are associated with outbreaks. Historically, the majority of outbreaks have been caused by serogroup C, although in recent years serogroup Y and serogroup B outbreaks have been reported (CDC, unpublished data).

An organization-based outbreak is defined as the occurrence of three or more confirmed or probable cases of meningococcal disease of the same serogroup in a period of 3 months or less among persons who have a common affiliation but no close contact with each other, resulting in a primary disease attack rate of 10 or more cases per 100,000 persons. In some instances the attack rate will be greater than 10 cases per 100,000 population with only two or three cases. In these situations, vaccination may be considered after only two primary cases are identified. Examples of an organization-based outbreak include cases in schools, churches, and universities.

A community-based outbreak is defined as the occurrence of three or more confirmed or probable primary cases of meningococcal disease in a period of 3 months or less among persons residing in the same area who are not close contacts and who do not share a common affiliation, with a primary attack rate of 10 or more cases per 100,000 population. Examples of a community-based outbreak include a neighborhood, town, or county.

Mass chemoprophylaxis is not recommended for control of large outbreaks of disease for multiple reasons: cost of drug and administration, difficulty of ensuring simultaneous administration of drugs to substantial populations, drug side effects, and emergence of resistant organisms. In most outbreak settings, these disadvantages outweigh the potential benefit. Situations in which mass chemoprophylaxis could be successful include those involving limited

or closed populations, such as a single school or residential facility. If the decision is made to use mass chemoprophylaxis, it should be administered to all persons.

It is possible that even in a vaccine-preventable, organization-based outbreak, antibiotic distribution may be a more timely intervention, since preventive antibodies take 7–10 days to develop after vaccination. Again, the potential benefit of mass chemoprophylaxis must be weighed against the possible emergence of antibiotic resistance and the logistics of launching a prophylaxis campaign.

When deciding to implement a mass vaccination campaign to prevent meningococcal disease, one must consider whether the cases represent an outbreak or an unusual clustering of endemic cases. Mass vaccination programs are expensive, require considerable public health effort, and may create excessive concern among the public. Because the number of cases in outbreaks is usually not substantial, this determination requires evaluation and analysis of the patterns of disease occurrence.

Vaccination of the population at risk should be considered if the attack rate is greater than 10 cases per 100,000 population, but the actual attack rate at which the decision to vaccinate is made will vary. The following factors should be considered when making the decision to vaccinate:

- Completeness of case reporting and number of possible cases of meningococcal disease for which bacteriologic confirmation or serogroup data are not available.
- Occurrence of additional cases of meningococcal disease after recognition of a suspected outbreak (e.g., if the outbreak occurred 2 months previously and no additional case have occurred, vaccination might be unlikely to prevent additional cases of meningococcal disease).
- Logistic and financial considerations.

Restricting travel to areas with an outbreak, closing schools or universities, or cancelling sporting or social events are not recommended measures for outbreak control in the United States. A crucial part of managing suspected meningococcal disease outbreaks and promoting early case recognition is educating communities, physicians, and other healthcare workers about meningococcal disease.

Laboratory Procedures[10]

- Invasive meningococcal disease is typically diagnosed by isolation of *N. meningitidis* from a normally sterile site. Typically, the isolate comes from blood or CSF, but it can also be from joint, pleural, or pericardial fluid. Aspirates or skin biopsies of purpura or petechiae can yield meningococci in cases of meningococcemia. However, sensitivity of bacterial culture may be low, particularly when performed after initiation of antibiotic therapy.
- Polymerase chain reaction (PCR) or immunohistochemistry (IHC) may be used to establish a probable case. Real-time PCR detects DNA of meningococci in blood, CSF, or other clinical specimens. ***COMMENT:*** *A major advantage of PCR is that it allows for detection of N. meningitidis from clinical samples in which the organism could not be detected by culture methods, such as when a patient has been treated with antibiotics before obtaining*

a clinical specimen for culture. Even when the organisms are nonviable following antimicrobial treatment, PCR can still detect N. meningitidis DNA.[16] *Because of the severity of meningococcal disease, it is critical to treat the patient as soon as infection is suspected, and not to delay to obtain culture or laboratory results first.*

- A Gram stain of cerebrospinal fluid showing gram-negative diplococci strongly suggests meningococcal meningitis.
- Kits to detect polysaccharide antigen in cerebrospinal fluid are rapid and specific, but false-negative results are common, particularly in serogroup B disease. Antigen agglutination tests of urine or serum are unreliable.
- Serologic testing (e.g., enzyme immunoassay) for antibodies to polysaccharide may be used as part of the evaluation if meningococcal disease is suspected but should not be used to establish the diagnosis.

NOTE: *Initial clinical specimen testing is NOT provided by the Missouri State Public Health Laboratory (MSPHL).* However, private laboratories that obtain positive test results are required by the state reporting rule to send positive isolates of the cultured organism to the MSPHL for confirmation and epidemiological testing. The MSPHL performs this testing at no charge to the submitting laboratory. *N. meningitidis* testing to be performed by the MSPHL should go through the Special Bacteriology Unit, phone (573) 751-3334 before submission. Information on acceptable specimen types, collection, shipment, and testing to be performed by the MSPHL can be viewed at: http://health.mo.gov/lab/specialbacteriology.php.

Reporting Requirements

Meningococcal disease is a Category 2(A) disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services (DHSS) within 24 hours of first knowledge or suspicion by telephone, facsimile, or other rapid communication. The DHSS may be contacted after hours through the Emergency Response Center (ERC) at (800) 392-0272 (24/7).

As a Nationally Notifiable Condition, confirmed and probable cases are a **STANDARD** report to the Centers for Disease Control and Prevention (CDC). **STANDARD** reporting requires the Missouri Department of Health and Senior Services (DHSS) to report to CDC by electronic transmission via WebSurv within the next normal reporting cycle.

1. For confirmed, probable, and suspect cases; local public health agencies should complete a "Disease Case Report" (CD-1) and a "Record of Investigation of Bacterial Meningitis or Bacteremia Case Report" (CD-2M). For all cases of meningococcal disease occurring among MSM ≥16 years of age, also complete the "Meningococcal Disease Among Men who have Sex with Men (MSM)" case report form. For all cases of meningococcal disease occurring among people taking Eculizumab (Soliris®), also complete the "Meningococcal Disease Among People taking Eculizumab (Soliris®)" case report form.
2. DHSS will submit weekly electronic reports to CDC.

3. Entry of the CD-1 by the local public health agencies into WebSurv negates the need for the paper CD-1 to be forwarded to the District Health Office.
4. Send the completed CD-2M and the CDC supplemental form to the District Communicable Disease Coordinator or the District Senior Epidemiology Specialist.
5. All outbreaks or suspected outbreaks must be reported as soon as possible (by phone, fax, or e-mail) to the District Communicable Disease Coordinator. This can be accomplished by completing the "Missouri Outbreak Surveillance Report" (CD-51) and faxing or e-mailing it to the District Communicable Disease Coordinator or the District Senior Epidemiology Specialist.
6. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Communicable Disease Coordinator or the District Senior Epidemiology Specialist.

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Sample Physician Notification Letter

[Date]

[Health Care Provider's name]
[Address]
[City, State, Zip Code]

Dear [Dr.] _____:

A case of [meningococcal disease] [meningococcal meningitis] has been diagnosed in a child at the _____ (name) _____ [child care center / head start / school]. Children from this [child care center / head start / school] are being referred to their medical providers for chemoprophylaxis. Please be alert to the presence of this disease in your community and report any suspected cases promptly.

If you have any questions, please contact the _____ (local) _____ Health Department at [phone number].

Sincerely,

Sample Letter to Parents of Children Exposed to Meningococcal Disease at Child Care Centers / Head Starts / Nursery Schools

[Date]

To Parents of Children at:
_____ (name) _____
[Child Care Center /Head Start / School]

Dear Parent:

A child who attends the _____ (name) _____ [child care center / head start / school] in the _____ classroom has been diagnosed with [meningococcal meningitis / meningococcal disease].

So that others do not get this illness, the Missouri Department of Health and Senior Services and the _____ (local) _____ County Health Department recommends that children who have had close contact with the ill child from _____ to _____ receive preventive medication. Preventive treatment will help protect your child from becoming ill. An antibiotic is usually used for this treatment.

All persons who were in contact with the sick child should be watched. Anyone who has an unusual fever, headache, stiff neck, rash or any other unusual symptoms should contact their health care provider immediately. Meningococcal disease can progress very rapidly and lead to severe illness and even death.

An information sheet on meningococcal disease is enclosed. [Examples are:]
http://www.immunize.org/catg.d/p4210.pdf or
http://www.immunize.org/catg.d/p4316.pdf

If you have additional questions please contact your health care provider or the _____ (local) _____ Health Department at [phone number].

Sincerely,

NOTE: If arrangements have been made for [rifampin or ciprofloxacin] prophylaxis, you will need to add a paragraph regarding this. Example:

The Missouri Department of Health and Senior Services and _____(local)_____ Health Department will provide [rifampin / ciprofloxacin] free-of-charge for your child. You may pick up the prescription at _____ pharmacy after _____a.m./p.m.