



## Bacterial Meningitis

Bacterial meningitis is usually severe. While most people with meningitis recover, it can cause serious complications, such as brain damage, hearing loss, or learning disabilities.

There are several pathogens (types of germs) that can cause bacterial meningitis. Some of the leading causes of bacterial meningitis in the United States include *Haemophilus influenzae* (most often caused by type b, Hib), *Streptococcus pneumoniae*, group B *Streptococcus*, *Listeria monocytogenes*, and *Neisseria meningitidis*.

In the United States, about 4,100 cases of bacterial meningitis, including 500 deaths, occurred each year between 2003–2007.\* (#f1) [1] (#reference)

### Causes

Common causes of bacterial meningitis vary by age group:

Age Group	Causes
Newborns	Group B <i>Streptococcus</i> , <i>Escherichia coli</i> , <i>Listeria monocytogenes</i>
Infants and Children	<i>Streptococcus pneumoniae</i> , <i>Neisseria meningitidis</i> , <i>Haemophilus influenzae</i> type b
Adolescents and Young Adults	<i>Neisseria meningitidis</i> , <i>Streptococcus pneumoniae</i>
Older Adults	<i>Streptococcus pneumoniae</i> , <i>Neisseria meningitidis</i> , <i>Listeria monocytogenes</i>

### Risk Factors

Factors that can **increase** your risk of bacterial meningitis include:

- Age
  - Infants are at higher risk for bacterial meningitis than people in other age groups. However, people of any age are at risk. See the table above for which pathogens more commonly affect which age groups.
- Community setting
  - Infectious diseases tend to spread more quickly where larger groups of people gather together. College students living in dormitories and military personnel are at increased risk for meningococcal meningitis.
- Certain medical conditions
  - There are certain diseases, medications, and surgical procedures that may weaken the immune system or increase risk of meningitis in other ways.
- Working with meningitis-causing pathogens
  - Microbiologists who are routinely exposed to meningitis-causing pathogens are at increased risk.
- Travel
  - Travelers to the meningitis belt in sub-Saharan Africa may be at risk for meningococcal meningitis, particularly during the dry season. Also at risk for meningococcal meningitis are travelers to Mecca during the annual Hajj and Umrah pilgrimage.

### Transmission

The germs that cause bacterial meningitis can be contagious. Some bacteria can spread through the exchange of respiratory and throat secretions (e.g., kissing). **Fortunately, most of the bacteria that cause meningitis**

**are not as contagious as diseases like the common cold or the flu.** Also, the bacteria are not spread by casual contact or by simply breathing the air where a person with meningitis has been. Other meningitis-causing bacteria are not spread person-to-person, but can cause disease because the person has certain risk factors (such as a weak immune system or head trauma). Unlike other bacterial causes of meningitis, you can get *Listeria monocytogenes* by eating contaminated food.

Sometimes the bacteria that cause meningitis spread to other people. This usually happens when there is close or long contact with a sick person in the same household or daycare center, or if they had direct contact with a patient's oral secretions (such as a boyfriend or girlfriend). People who qualify as close contacts of a person with meningococcal or *Haemophilus influenzae* type b (Hib) meningitis are at higher risk of getting disease and may need antibiotics (see Prevention). Close contacts of a person with meningitis caused by other bacteria, such as *Streptococcus pneumoniae*, do not need antibiotics. **Tell your doctor if you think you have been exposed to someone with meningitis.**

Healthy people can carry the bacteria in their nose or throat without getting sick. Rarely, these bacteria can invade the body and cause disease. Most people who 'carry' the bacteria never become sick.

## Signs & Symptoms

Meningitis infection may show up in a person by a sudden onset of fever, headache, and stiff neck. It will often have other symptoms, such as

- Nausea
- Vomiting
- Increased sensitivity to light (photophobia)
- Altered mental status (confusion)

The symptoms of bacterial meningitis can appear quickly or over several days. Typically they develop within 3-7 days after exposure.

Babies younger than one month old are at a higher risk for severe infections, like meningitis, than older children. 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 (lack of alertness), irritable, vomiting or feeding poorly. In young infants, doctors may look for a bulging fontanelle (soft spot on infant's head) or abnormal reflexes, which can also be signs of meningitis. If you think your infant has any of these symptoms, call the doctor or clinic right away.

Later symptoms of bacterial meningitis can be very severe (e.g., seizures, coma). For this reason, **anyone who thinks they may have meningitis should see a doctor as soon as possible.**

## Diagnosis

If meningitis is suspected, samples of blood or cerebrospinal fluid (near the spinal cord) are collected and sent to the laboratory for testing. It is important to know the specific cause

## Pregnancy

Pregnant women are at increased risk of developing listeriosis (<http://www.cdc.gov/listeria/index.html>) (caused by the bacterium *Listeria monocytogenes*). Pregnant women typically experience only a mild, flu-like illness with *Listeria* infection. However, infections during pregnancy can lead to miscarriage, stillbirth, premature delivery, or life-threatening infection of the newborn, including meningitis.

Pregnant women who test positive for group B *Streptococcus* (<http://www.cdc.gov/groupbstrep/about/index.htm>) (group B strep) can pass the bacteria to their baby, most often during labor and birth. A newborn infected with group B strep bacteria can develop meningitis or other life-threatening infections soon after birth.

You can reduce your risk of meningitis caused by *Listeria monocytogenes* by learning what foods to avoid and how to safely prepare and refrigerate food (<http://www.cdc.gov/listeria/prevention.html>). If you are pregnant, you should get screened for group B strep at 35-37 weeks. Women who test positive for group B strep will be given antibiotics during labor to prevent infection in a newborn (<http://www.cdc.gov/groupbstrep/about/preventio>

of meningitis because that helps doctors understand how to treat the disease, and possibly how bad it will get. In the case of bacterial meningitis, antibiotics can help prevent severe illness and reduce the spread of infection from person to person.

Talk to your doctor to learn more about how to prevent these infections.

If bacteria are present, they can often be grown (cultured).

Growing the bacteria in the laboratory is important for confirming the presence of bacteria, identifying the specific type of bacteria that is causing the infection, and deciding which antibiotic will work best. Other tests can sometimes find and identify the bacteria if the cultures do not.

## Treatment

Bacterial meningitis can be treated effectively with antibiotics. **It is important that treatment be started as soon as possible.** Appropriate antibiotic treatment of the most common types of bacterial meningitis should reduce the risk of dying from meningitis to below 15%, although the risk remains higher among young infants and the elderly.

## Prevention

The most effective way to protect you and your child against certain types of bacterial meningitis is to **complete the recommended vaccine schedule.** There are vaccines for three types of bacteria that can cause meningitis: *Neisseria meningitidis* (meningococcus), *Streptococcus pneumoniae* (pneumococcus), and *Haemophilus influenzae* type b (Hib).

Antibiotics may be recommended for close contacts of people with meningococcal meningitis. Antibiotics may also be recommended for the entire family if a family member develops severe Hib infection and there's a high risk person in the house. This is to decrease the risk of spreading disease to a high risk person, since they are at increased risk for severe disease. Your doctor or local health department will tell you if there's a high risk person in your house and antibiotics are needed.

Maintaining healthy habits, like not smoking and avoiding cigarette smoke, getting plenty of rest, and not coming into close contact with people who are sick, can also help. This is especially important for young infants, the elderly, or for those with a weakened immune system, since they are at increased risk for severe disease.

## Laboratory Methods for the Diagnosis of Meningitis



([lab-manual/index.html](http://www.cdc.gov/lab-manual/index.html))

This manual summarizes laboratory techniques used in the isolation and identification and characterization of *Neisseria meningitidis* (the meningococcus), *Streptococcus pneumoniae* (the pneumococcus) and *Haemophilus influenzae* from the cerebrospinal fluid or blood of patients with clinical meningitis or bacteremia.

[View list of chapters \(lab-manual/index.html\)](http://www.cdc.gov/lab-manual/index.html)

## Reference

1. Thigpen MC, Whitney CG, Messonnier NE, Zell ER, Lynfield R, Hadler JL, et al. Emerging Infections Programs Network. **Bacterial meningitis in the United States, 1998-2007** (<http://www.ncbi.nlm.nih.gov/pubmed/21612470>) [Ⓞ](http://www.cdc.gov/Other/disclaimer.html) (<http://www.cdc.gov/Other/disclaimer.html>). *N Engl J Med.* 2011;364:2016-25.

## Footnote

\*This is the most recent data to date.

## Related Links

- [Preventing Infections in Pregnancy \(http://www.cdc.gov/ncbddd/pregnancy\\_gateway/infections.html\)](http://www.cdc.gov/ncbddd/pregnancy_gateway/infections.html)
- [Meningococcal Disease \(http://www.cdc.gov/meningococcal/index.html\)](http://www.cdc.gov/meningococcal/index.html)
- [Meningococcal Vaccine \(http://www.cdc.gov/vaccines/vpd-vac/mening/default.htm\)](http://www.cdc.gov/vaccines/vpd-vac/mening/default.htm)
- [Pneumococcal Vaccine \(http://www.cdc.gov/vaccines/vpd-vac/pneumo/default.htm\)](http://www.cdc.gov/vaccines/vpd-vac/pneumo/default.htm)
- [Hib Vaccine \(http://www.cdc.gov/vaccines/vpd-vac/hib/default.htm\)](http://www.cdc.gov/vaccines/vpd-vac/hib/default.htm)
- [Group B Strep \(http://www.cdc.gov/groupbstrep/about/index.html\)](http://www.cdc.gov/groupbstrep/about/index.html)
- [Listeriosis \(http://www.cdc.gov/listeria/\)](http://www.cdc.gov/listeria/)

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