



# CEU Update

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## Whooping Cough

Whooping cough is an infectious bacterial illness that affects the respiratory passages. First described in the 1640s, whooping cough is so named because spasms of coughing are punctuated by a characteristic "whoop" when the person inhales.

Whooping cough is the most common vaccine-preventable disease among children younger than 5 years in the United States. It is also known as pertussis—the "P" in the familiar DTaP combination inoculation routinely given to children and the "p" in Tdap given to adolescents and adults.

Despite the widespread use of vaccines, whooping cough has made a comeback in recent years. According to the U.S. Centers for Disease Control and Prevention (CDC), prior to the introduction of the pertussis vaccine, there was an average of 175,000 cases of whooping cough each year. This dropped off to fewer than 3,000 cases per year in the 1980s; however, in the U.S. alone, a total of 25,827 cases of pertussis were reported in 2004. This was a huge increase compared to the only 8,296 cases reported in 2002.

The World Health Organization estimates there were over 17.6 million cases of whooping cough and 297,000 deaths worldwide in 2004, making this easy-to-prevent disease one of the leading causes of illness and death. The WHO estimates that global vaccination prevented about 38.3 million cases and 607,000 deaths.

### *What causes whooping cough*

Whooping cough is caused by the bacteria *Bordetella pertussis*. Humans are the only known reservoir of these bacteria.

Whooping cough is spread by contact with droplets coughed out by someone with the disease or by contact with recently contaminated hard surfaces upon which the droplets landed. The bacteria thrive in the respiratory passages where they produce toxins that damage the tiny hairs (cilia) that are needed to remove particulate matter and cellular debris that are normally introduced into the airways with each breath. This results in an increased inflammation of the respiratory passages, and the typical cough which is the hallmark of the infection. Whooping cough is contagious from seven days after exposure to the bacteria and up to three weeks after the onset of coughing spasms. The most contagious time is during the first stage of the illness.

Initially thought to be a disease of childhood, recent studies have shown that adults are susceptible to whooping cough and account for up to 25% of cases. The disease, however, tends to be milder in adults and adolescents—a persistent cough much like an upper respiratory infection or cold. Because of this fine distinction, the diagnosis of whooping cough is frequently missed in that population and thus allows the bacteria to spread to more susceptible infants and children.

Whooping cough is highly contagious. Between 75%-100% of unimmunized household contacts of a person with pertussis will develop the disease. Even among fully immunized and naturally immunized people living in the same household, there have been reports of undetectable infection following ex-

treme exposure.

### *Symptoms of whooping cough*

The course of whooping cough is divided into three stages.

The first stage of whooping cough is the catarrhal stage. This phase typically lasts for one to two weeks. Symptoms during this phase resemble that of an upper respiratory illness: runny nose, nasal congestion, sneezing, and occasional cough. A low-grade fever may be present in some cases.

The second stage of whooping cough is the paroxysmal stage. The duration of this phase is highly variable, lasting between one to six weeks, or up to 10 weeks. It is characterized by intense and drawn out bouts of coughing. The attacks tend to be more frequent at night, with an average of 15 attacks in a 24-hour period. Often a "whoop" can be heard caused by the gasping person inhaling between coughs. Infants, in particular, may appear to stop breathing and perhaps turn blue during the coughing spasms. Vomiting is also common during this stage as well.

The third stage of whooping cough is the convalescent stage. This can last for weeks or months and is characterized by a chronic cough that becomes less paroxysmal (fewer sudden outbursts of coughing) in nature.

### **Seeking medical care**

#### *When to call the doctor:*

If you suspect you or your child has whooping cough, has been exposed to someone with whooping cough, regardless of whether the child has received immunization shots, turns blue during a coughing spell, has a fever that cannot be controlled with over-the-counter medication, or is unable to keep solids and liquids down (vomits).

#### *When to go to the hospital:*

If breathing stops, call 911 emergency services and begin CPR.

Go to a hospital's emergency department if someone with whooping cough shows these symptoms: inability to tolerate liquids (vomiting), uncontrolled fever even with antifever medications, signs of respiratory distress including rapid breathing and turning blue, or signs of dehydration, including weight loss, dry mucous membranes, decreased urine output.

### *Tests and exams for whooping cough*

The best way to diagnose whooping cough is by confirming the presence of the specific disease-causing bacteria *Bordetella pertussis* in mucus taken from the nose and throat.

Because the growth of the bacteria is inhibited by cotton, either calcium alginate or Dacron swabs must be used in obtaining the sample. Studies have shown that cultures are more likely to be positive if the sample is collected during the first stage of the illness or early in the second. The likelihood for isolating the organism (and confirming the diagnosis) declines with any delay in specimen collection beyond the first three weeks of illness. A culture negative for *Bordetella pertussis* is usually seen after five days of treatment with antibiotics.

Other laboratory methods used to diagnosis pertussis infection such as serologic testing and PCR are available in certain labs. However, neither method has been shown to be more specific than culture isolation of the organism.

A complete blood count may be performed.

## **Treatments for whooping cough**

### *Self-Care at Home*

Because younger children are at higher risk to develop a severe case of whooping cough than adults, most are admitted to the hospital.

For children and adults who do not require hospitalization, here are some tips to manage the disease at home after a doctor has diagnosed whooping cough.

Isolate the person (separate bedroom) until he or she has received five days of antibiotics. During this time, everyone who comes into contact with the sick person should wear a surgical mask to cover their face.

Practice good hand washing. Whooping cough bacteria can be transmitted through contact with contaminated inanimate objects such as dishes.

Drink plenty of fluids, including water, juices, soups, and eat fruits to prevent dehydration.

Eat small, frequent meals to decrease the amount of vomiting.

Do not give cough medications unless otherwise instructed by your doctor.

Use a cool mist vaporizer to help loosen secretions and soothe the cough.

Keep the home environment free from irritants that can trigger coughing, such as smoke, aerosols, and fumes.

Monitor a sick child for signs of dehydration, such as dry lips and tongue, dry skin, decrease in the amount of urine or wet diapers, and crying without producing tears. Report any signs of dehydration to your doctor immediately.

### *Medical Treatment*

Antibiotics are used to lessen the severity of whooping cough and make the person taking them non-contagious. Antibiotics are most effective if given early in the first phase of the illness.

The 2005 Sanford Guide to Antimicrobial Therapy recommends the following antibiotic treatments: a five-day course of azithromycin, a seven-day course of clarithromycin, or a 14-day course of either erythromycin or trimethoprim/sulfamethoxazole (TMP/SMX).

Some strains of whooping cough are resistant to certain antibiotics. Symptoms worsen if this is the case.

In addition to treating the adult or child who has whooping cough, everyone in the household should be treated with antibiotics.

All close contacts younger than 7 years who have not completed their primary vaccinations (including the DTaP to prevent pertussis) should complete this series with the minimum time between shots.

Close contacts younger than 7 years who have completed their primary series but have not received a booster of DTaP within three years of exposure should be given the booster dose.

Exposed adults should be vaccinated with Tdap.

Anyone with whooping cough should be isolated for five days after starting antibiotics or until three weeks after the onset of the coughing spasms if the person has not received antibiotic treatment.

### *Follow-up care*

Schools and daycare facilities should be notified of whooping cough illnesses. Children who later develop cough should be evaluated by their doctors. Children younger than 7 years who attend the school or daycare and are behind in their vaccinations should receive them.

School-wide treatment with antibiotics is not currently recommended.

Children with mild cases of whooping cough may return to school or daycare after receiving antibiotics for at least five days.

### *Prevention*

Both frequent hand washing and the use of masks will help lessen the likelihood that the bacteria will spread to other members of a household where someone has whooping cough. Also avoid touching your nose or mouth, and thus introducing the bacteria you may have picked up, during outbreaks. For children, follow the recommended schedule for the DTaP (diphtheria, tetanus, pertussis) inoculations. Shots are given at the ages of 2 months, 4 months, 6 months, 15-18 months, and 4-6 years for full immunity, according to the American Academy of Pediatrics.

In 2005, the U.S. government approved Tdap, the first pertussis booster shot for children 10 to 18 years of age. The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control recommends one dose of Tdap in place of one Td booster.

For adults 19-64 years, the ACIP recommends a single dose of Tdap;

If you have never received a dose of Tdap, one dose of Tdap should replace one dose of Td for booster immunization if the most recent tetanus toxoid-containing vaccine was received at least 10 years earlier.

Adults in close contact with infants aged 12 months or younger who have not previously received Tdap should receive a dose of Tdap; an interval as short as two years since the most recent Td is suggested. Health-care personnel in settings with direct patient contact who have not previously received Tdap should receive a dose of Tdap; an interval as short as two years since the most recent Td is recommended.

### *Whooping cough outlook*

Complications of whooping cough are most commonly seen in children younger than 1 year, with an increased risk of severe whooping cough in premature infants.

Between 1999-2003, 17,000 cases of whooping cough in children under two years of age required hospitalization.

Among all pertussis hospitalizations during 1994-2003 in children under age 2 years, 92% occurred in infants under 6 months of age.

In 2001-2003, 16% of whooping cough cases in children and adults required hospitalization.

From 2004-2005, 66 deaths due to whooping cough were reported to the CDC.

Bacterial pneumonia is the most common complication of whooping cough. It is also the most common cause of pertussis-related deaths. Between the years 2001-2003, 4.9% of all people with whooping cough developed a bacterial pneumonia—17% were infants younger than 6 months.

Other complications include bluish skin from lack of oxygen, collapse of a lung, sinusitis, otitis media (ear infection), dehydration, nosebleed, bruising, hernias, retinal detachment, rectal prolapse, seizures, diseases of the brain, and failure to thrive.

## **Bacterial Pneumonia**

Pneumonia is an infection of the lungs. People with pneumonia usually complain of coughing, fever, shortness of breath, and chest pain.

Your body's immune system usually keeps bacteria from infecting your lungs. In bacterial pneumonia, bacteria reproduce in your lungs, while your body tries to fight off the infection. This response to bacterial invaders is called inflammation.

When the inflammation occurs in the alveoli (microscopic air sacs in the lungs), they fill with fluid.

Your lungs become less elastic and cannot take oxygen into the blood or remove carbon dioxide from the blood as efficiently as usual.

When the alveoli don't work efficiently, your lungs have to work harder to satisfy your body's need for oxygen. This causes the feeling of being short of breath, which is one of the most common symptoms of pneumonia. Inflammation causes many of the other symptoms, including fever and chest pain. Pneumonia can be very serious, because it directly interferes with your body's ability to exchange carbon dioxide and oxygen.

Pneumonia is different in this way from acute bronchitis, which is another disease that can cause fever, cough, chest pain, and shortness of breath. Bronchitis is caused by inflammation in the air passages (called bronchi) leading to the alveoli, not the alveoli themselves. Sometimes it is very difficult, even for a doctor, to tell pneumonia and bronchitis apart. The symptoms and physical examination can be identical. Sometimes a chest x-ray is the only way to tell pneumonia and bronchitis apart.

### *Causes of bacterial pneumonia*

Most pneumonia is caused by bacteria or a virus. Pneumonia from any cause can occur at any age, but people in certain age groups are at higher risk for certain types of pneumonia.

The most common cause of bacterial pneumonia is a type of bacteria known as *Streptococcus pneumoniae*. *Haemophilus influenzae*, *Chlamydia trachomatis*, *Mycoplasma pneumoniae*, and *Legionella pneumophila* are some other major bacteria that cause pneumonia.

If you inhale toxic materials, you can injure your lungs and cause chemical pneumonia.

Fungi can also cause pneumonia. In certain areas of the United States, specific fungi are well known. *Coccidioidomycosis* is a type of fungal infection that causes a pneumonia called "San Joaquin fever" or "Valley fever." *Histoplasmosis* and *blastomycosis* are other fungal diseases that cause pneumonias.

The most common way you catch pneumonia is to breathe infected air droplets from someone who has pneumonia. Another cause is an improperly cleaned air conditioner. Yet another source of infection in your lungs is spread of an infection from somewhere else in your body, such as the kidney.

Your risk of catching pneumonia is determined by the specific bacteria, virus, or fungus, the number of organisms you inhale, and your body's ability to fight infections.

You do not catch pneumonia by not dressing properly for cold weather or by being caught in the rain.

### *Bacterial Pneumonia Symptoms*

Doctors often refer to typical and atypical pneumonias, based on the signs and symptoms of the condition. This can help to predict the type of bacteria causing the pneumonia, the duration of the illness, and the optimal treatment method.

Typical pneumonia comes on very quickly, usually results in a high fever and shaking chills, usually leads to the production of yellow or brown sputum when coughing, and can cause shortness of breath, especially if you have any chronic lung conditions such as asthma or emphysema.

There may be chest pain, which is usually worse with breathing or coughing. The chest also may be sore when you touch or press it.

Because chest pain also can be a sign of other serious medical conditions, do not try to diagnose yourself.

Older people can have confusion or a change in their mental abilities as a sign of pneumonia or other infection.

Atypical pneumonia has a gradual onset.

It is called "walking pneumonia."

Sometimes it follows another illness in the days to weeks before the pneumonia.

The fever is usually lower, and shaking chills are less likely.  
There may be headache, body aches, and joint pain.  
Coughing may be dry or produce only a little sputum. You may not have any chest pain.  
Abdominal pain may be present.  
There may be other symptoms, such as feeling tired or weak.

### **Seeking medical care**

#### *When to call the doctor*

If you have a fever and cough up yellow, green, or brown sputum, make an appointment with your doctor.

If you have shortness of breath, chest pain, or confusion, you should seek emergency care.

If you are healthy, you can safely make an appointment to see your doctor. A day or two of waiting should not make a big difference, unless you are experiencing significant shortness of breath or if any signs of confusion are present.

#### *When to go to the hospital*

If you have shortness of breath, you should always seek emergency care. Shortness of breath is not simply the feeling that you can't take a full breath. Shortness of breath means that you cannot take in enough air to meet your body's needs. It is a potentially serious symptom and always requires a visit to an emergency department, no matter how healthy you are.

If you have chest pain or confusion, you should seek emergency care.

You are at higher risk of developing pneumonia if you have the following:

a chronic health problem, such as diabetes, a poor immune system because of HIV, AIDS, steroid use, or immune-suppressant medications (people with organ transplants take these medications), diseased or damaged lungs, such as with asthma or emphysema, or are very young or very old.

#### *Exams and tests*

Pneumonia can be diagnosed simply by a doctor listening to your lungs. Certain sounds heard through a stethoscope may indicate infection.

One of the easiest tests to perform is pulse oximetry, sometimes called "pulse ox." A probe that looks like a clothespin is gently attached to your finger, toe, or ear. A special light shines through your skin to estimate how much oxygen you have in your bloodstream. If your oxygen level is lower than expected, it may mean you have pneumonia.

An x-ray of your chest can help identify which part of your lung is infected. An x-ray also can show abnormal fluid collections which also can help diagnose pneumonia.

You may have blood drawn. Laboratory tests can show that your immune system is working properly to fight off your infection. They also show whether you have enough red blood cells to carry oxygen or whether the bacteria have gotten into your bloodstream.

Occasionally your doctor may need to sample blood from one of your arteries (usually in your wrist) in order to get an exact measurement of how well you are exchanging oxygen and carbon dioxide. This test, called an arterial blood gas ("ABG" or "blood gas"), is very important, takes only a minute, and is done with a very small needle and syringe. This test cannot be run on the other blood that is sampled from your veins.

Sometimes your doctor will collect some of your sputum and look at it under a microscope. Certain stains, or dyes, help your doctor tell which specific bacterium is causing your pneumonia. Sputum cultures may also be performed. In these tests, your sputum is put on a plate to help it grow so a laboratory

specialist can identify the specific bacteria.

If you are admitted to the hospital, your doctor will draw blood and send it to the laboratory so that it may also be cultured to determine whether bacteria are present in the bloodstream.

### *Bacterial Pneumonia Treatment*

If you suspect pneumonia based on the signs or symptoms, see your doctor as soon as possible. There is no home treatment for pneumonia. Although cough suppressants, expectorants, or fever-lowering drugs may be helpful, they should not be started without discussing their use with your doctor.

### *Medical Treatment*

If you have a bacterial pneumonia, you will need to take an antibiotic. The antibiotic choice depends on your age, your chronic medical conditions, whether or not you smoke or drink alcohol, and other medications you are taking. Tell your doctor about allergies or bad reactions to any medicines you have taken before and bring a list of your current medicines with you.

Drink plenty of nonalcoholic fluids to stay hydrated. This helps your body fight the pneumonia. Fever-reducing medicines such as acetaminophen (Tylenol) or ibuprofen (Advil) may also help you feel better.

Because coughing helps clear infection out of your lungs, your doctor may recommend that you not use a cough suppressant.

You must avoid cigarette or other tobacco smoke while you recover from pneumonia. Smoking hurts your body's ability to fight infection and makes the healing process take a lot longer.

If you are severely short of breath or if you have significantly lowered oxygen levels in your bloodstream, you may need to be admitted to the hospital. You will get extra oxygen to help you breathe, and you may get your antibiotic by an IV catheter through your veins.

If your pneumonia is very severe, you may need a breathing tube in your windpipe so that a machine can do the work of breathing for you.

### *Prevention*

Vaccines are available that prevent certain types of pneumonia. Yet there are so many bacteria that cause pneumonia, you are not guaranteed to avoid it even with an immunization.

Pneumovax and Pnu-Immune are vaccines to prevent *Streptococcus pneumoniae* infection. According to the U.S. Centers for Disease Control and Prevention (CDC), people in the following groups should ask their doctor about receiving the pneumococcus immunization:

people age 65 and older, people with serious long-term health problems such as heart failure, liver failure (cirrhosis of the liver), diabetes, or lung disease (other than asthma), people with lowered immunity due to cancer, chemotherapy, diseases or removal of the spleen, chronic kidney problems, or have had an organ or bone marrow transplant, or people who are Alaskan Native Americans or certain other Native American populations.

In 2000, the U.S. Food and Drug Administration (FDA) licensed a new vaccine, Prevnar, for the prevention of pneumococcal disease in children.

This vaccine is recommended for healthy infants under the age of 2 and for children between the ages of 2 and 5 who have not previously been vaccinated and who are at highest risk for developing pneumococcal disease, such as those with HIV/AIDS, have certain chronic diseases, and have decreased immune function.

### CEU QUESTIONNAIRE

Complete the questions below to receive 10 continuing education credits. All questions must be answered completely to receive credit.

1. What does whooping cough affect? \_\_\_\_\_  
\_\_\_\_\_
2. What is another name for whooping cough? \_\_\_\_\_  
\_\_\_\_\_
3. What is the name of the bacteria that causes whooping cough? \_\_\_\_\_  
\_\_\_\_\_
4. What is the WHO? \_\_\_\_\_  
\_\_\_\_\_
5. How is whooping cough spread? \_\_\_\_\_  
\_\_\_\_\_
6. What is the hallmark of the infection? \_\_\_\_\_  
\_\_\_\_\_
7. How many stages is whooping cough divided into? \_\_\_\_\_  
\_\_\_\_\_
8. Name the stages. \_\_\_\_\_  
\_\_\_\_\_
9. Define paroxysmal. \_\_\_\_\_  
\_\_\_\_\_
10. Name 3 reasons to call the doctor. \_\_\_\_\_  
\_\_\_\_\_
11. When does the likelihood for isolating the organism begin to decline? \_\_\_\_\_  
\_\_\_\_\_
12. What are the signs of dehydration? \_\_\_\_\_  
\_\_\_\_\_
13. List the 3 antibiotic treatments recommended by the Sanford Guide to Antimicrobial Therapy? \_\_\_\_\_  
\_\_\_\_\_
14. What vaccine prevents pertussis? \_\_\_\_\_  
\_\_\_\_\_
15. What does DTaP vaccinate against? \_\_\_\_\_  
\_\_\_\_\_

16. At what ages do children receive these vaccinations? \_\_\_\_\_  
\_\_\_\_\_
17. What is the government approved Tdap? \_\_\_\_\_  
\_\_\_\_\_
18. What is the most common complication of whooping cough? \_\_\_\_\_  
\_\_\_\_\_
19. List 5 other complications of whooping cough. \_\_\_\_\_  
\_\_\_\_\_
20. What organ of the body does pneumonia affect? \_\_\_\_\_  
\_\_\_\_\_
21. Define inflammation. \_\_\_\_\_  
\_\_\_\_\_
22. What is the most common symptom of pneumonia? \_\_\_\_\_  
\_\_\_\_\_
23. Name 3 major bacteria that can cause pneumonia? \_\_\_\_\_  
\_\_\_\_\_
24. What causes chemical pneumonia? \_\_\_\_\_  
\_\_\_\_\_
25. What is the most common way to catch pneumonia? \_\_\_\_\_  
\_\_\_\_\_
26. What are Symptoms of typical pneumonia? \_\_\_\_\_  
\_\_\_\_\_
27. What is another name for Atypical pneumonia? \_\_\_\_\_  
\_\_\_\_\_
28. Emergency care should always be sought out when? \_\_\_\_\_  
\_\_\_\_\_
29. What is the name of the test using blood drawn from an artery? \_\_\_\_\_  
\_\_\_\_\_
30. What is the home treatment for pneumonia? \_\_\_\_\_  
\_\_\_\_\_
31. Why would cough suppressants not be recommended? \_\_\_\_\_  
\_\_\_\_\_
32. Why are immunizations for pneumonia not guaranteed to work? \_\_\_\_\_  
\_\_\_\_\_
33. What does the abbreviation CDC stand for? \_\_\_\_\_  
\_\_\_\_\_

34. What new vaccine did the FDA license and what does it prevent? \_\_\_\_\_  
\_\_\_\_\_

35. What is the FDA? \_\_\_\_\_  
\_\_\_\_\_

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