Patient education: Pneumonia in adults (Beyond the Basics)

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PNEUMONIA OVERVIEW

Pneumonia is an infection of the lungs. It is a serious illness that can affect people of any age, but it is most common and most dangerous in very young children, people older than 65, and people with underlying medical problems such as heart disease, diabetes, or chronic lung disease. Pneumonia is more common during the winter months.

This article will focus on community-acquired pneumonia (CAP), which refers to pneumonia that develops in people in the community rather than in a hospital. About four million cases of CAP occur each year in the United States, and approximately 20 percent of people with CAP require hospitalization.

LUNG FUNCTION

During normal breathing, air is inhaled through the nose and mouth and travels through the trachea (windpipe) and bronchi (airways) to smaller tubes called the bronchioles. At the end of the bronchioles, there are small air sacs, called alveoli. Alveoli have thin, porous walls that contain tiny blood vessels called capillaries (figure 1).

Your mouth and respiratory tract are constantly exposed to microorganisms (germs like viruses and bacteria) through the air you breathe. These microorganisms are transmitted from person to person most commonly via air droplets when an infected person coughs or speaks in close proximity or, less commonly via aerosol inhalation. These microorganisms

can attach to the oropharynx (called colonization) and can reach the lung by traveling down the upper airways to the lungs via a process called microaspiration. However, your body's immune system, the shape of your nose and throat (which helps trap microorganisms and tiny particles in the air, preventing them from entering the lungs), your ability to cough, and fine hair-like structures on the bronchi called "cilia" all help to prevent microorganisms from causing pneumonia. The cilia help remove particles or bacteria that enter the bronchi by moving the material up to your trachea, where it can be coughed out. You can develop pneumonia if your body's defenses are not adequate, you are exposed to a particularly strong microorganism, or you are exposed to a very large number of microorganisms.

As the microorganisms multiply, your immune system responds by sending white blood cells to the alveoli to help fight the infection. The infected alveoli become inflamed (filled with white blood cells, proteins, fluid, and red blood cells). These changes lead to the symptoms of pneumonia. (See 'Pneumonia symptoms' below.)

HIGH-RISK GROUPS

Some groups of adults are at a higher risk of developing pneumonia. You are considered at higher risk if you:

- Are older than 65 years
- Smoke cigarettes
- Are malnourished due to health conditions or lack of access to food
- Have underlying lung disease, including cystic fibrosis, asthma, or chronic obstructive pulmonary disease (emphysema)
- Have other underlying medical problems, including diabetes or heart disease
- Have a weakened immune system due to human immunodeficiency virus (HIV), organ transplant, chemotherapy, or long-term use of steroid medications
- Have difficulty coughing due to stroke, sedating drugs or alcohol, or limited mobility
- Have had a recent viral upper respiratory tract infection including influenza

PNEUMONIA CAUSES

Pneumonia can be caused by a variety of microorganisms, including viruses, bacteria, and, less commonly, fungi. The most common bacterial cause of pneumonia in the United States is a type of bacteria called *Streptococcus pneumoniae* (also called pneumococcus). Other bacteria can cause pneumonia as well.

Viruses are estimated to be the cause of community-acquired pneumonia in adults in at least 20 percent of cases. Influenza ("the flu") is a common viral cause of pneumonia. Patients with

coronavirus disease 2019 (COVID-19) often have pneumonia, which is due to the virus: severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Some of the same viruses that cause the common cold can also cause pneumonia. Fungi rarely cause pneumonia in people who are generally healthy; however, people with a weakened immune system (eg, have HIV infection, have received an organ transplant, or are on chemotherapy) are at higher risk of fungal infection.

Let your doctor know if you have traveled recently or if you been to or lived in an area where a certain type of pneumonia is more common (eg, Valley fever or coccidioidomycosis in the southwestern United States; Middle East respiratory syndrome in the Arabian Peninsula; H7N9 strain of avian influenza in Asia; Avian influenza associated with bird or cattle farms). The risk of pneumonia caused by new microorganisms (so-called "emerging pathogens") changes over time, but your doctor will know if any of the places that you have been to or lived in put you at increased risk for pneumonia. You should let your doctor know if you have been in close contact with a patient with COVID-19.

PNEUMONIA SYMPTOMS

Common symptoms of pneumonia include fever, chills, shortness of breath, chest pain with breathing, a rapid heart and breathing rate, nausea, vomiting, diarrhea, and a cough that often produces green or yellow sputum (mucus from the lungs); occasionally, the sputum is rust colored. Most people have a fever (temperature greater than 100.5°F or 38°C), although this is less common in older adults. Shaking chills (called rigors) and a change in mental status (confusion, unclear thinking) can also occur.

The characteristic symptoms of pneumonia are different from those of a more common infection, acute viral bronchitis, which does not usually cause fever and does not require treatment with an antibiotic. (See "Patient education: Acute bronchitis in adults (Beyond the Basics)".)

PNEUMONIA DIAGNOSIS

Pneumonia is usually diagnosed with a medical history and physical examination as well as a chest X-ray. The need for further testing depends upon the severity of the illness and the person's risk of complications.

Chest X-ray — If your doctor thinks you might have pneumonia based on your symptoms and examination, he or she will probably order a chest X-ray to look at your lungs. In certain cases, he or she might also order another imaging study, such as a computed tomography (CT) scan.

Sputum testing — Sometimes, the doctor might test your sputum too. Sputum testing requires a sample of sputum (mucus that you cough up). Culture of sputum is used to identify the microorganism that caused the pneumonia and can help determine which antibiotic is best. There are also tests that can identify specific microorganisms in sputum and nasopharyngeal specimens by detecting genetic characteristics; such tests are referred as molecular assays. The use of these assays varies widely among practices.

Urine testing — Urine tests can be helpful for diagnosing pneumonia caused by two bacteria, *Streptococcus pneumoniae* and *Legionella pneumophila*. These tests can be done easily by a lab technician and provide immediate results.

Blood testing — People who are hospitalized require blood testing, including a complete blood cell count (CBC) and often a blood culture. A CBC measures the number of many types of blood cells, including white blood cells (WBC); these cells increase in number when there is a bacterial infection. An increased number of WBCs is one indicator that a bacterial infection, including pneumonia, may be present.

A blood culture is used to determine whether the infection has spread from the lungs into the blood stream. It involves taking a sample of blood from a vein and testing it for bacteria. Normally, there should be no bacteria in the bloodstream. Blood cultures are used to identify the bacteria that caused the pneumonia and to guide the choice of antibiotic. Your doctor may switch you to a different antibiotic when results of the blood or sputum cultures are completed (usually after 48 to 72 hours). (See 'Antibiotic choice' below.)

Blood oxygen measurement — Pneumonia can decrease the amount of oxygen circulating in the blood. As a result, a blood oxygen level is often measured with a small clip that attaches to your finger or ear. In people who are sicker, the oxygen level may be measured by taking a sample of blood from an artery for testing.

Bronchoscopy — People who present initially with severe pneumonia or who fail to improve (or get worse) during their hospitalization despite treatment with antibiotics may require further testing with bronchoscopy. For this procedure, a doctor inserts a thin, flexible tube through your nose or mouth and into your trachea. The tube has a camera at the end, which allows the doctor to view the inside of your trachea, bronchi, and lungs; collect fluid samples or a biopsy (a small tissue sample); and determine whether there is an underlying cause of infection, such as a growth or inhaled foreign body. (See "Patient education: Flexible bronchoscopy (Beyond the Basics)".)

PNEUMONIA TREATMENT

The goal of treatment for community-acquired pneumonia (CAP) is to get rid of the infection and prevent complications. Initial treatment of CAP with antibiotics is based on which type of organism is likely to be causing pneumonia (called "empiric" treatment). Most people improve with empiric treatment.

Hospital versus home care — Most people with CAP are treated at home with oral antibiotics. People who are seriously ill or are at increased risk for complications may be hospitalized. Hospital monitoring usually includes measurement of your heart rate and breathing rate, temperature, and oxygen levels. People who are hospitalized usually get intravenous (IV) antibiotics initially. When they start improving, they can usually be switched to antibiotic pills.

Some people need extra oxygen (given through small nasal tubes or a face mask) to help them breathe more easily. People who are still having a hard time breathing may need a breathing tube connected to a machine called a "ventilator." Some people who need to stay in the hospital are also given steroid medications to help reduce inflammation in the lungs. (This medicine is not the same as the steroids athletes take to build up muscle.)

The number of days a person needs to stay in the hospital varies and depends on the person's responds to treatment and underlying medical problems. Some people, including people with previous lung damage or disease, a weakened immune system, or infection in more than one lobe of the lungs (called multilobar pneumonia), may take longer to recover and require a longer hospitalization.

Antibiotic choice — A number of antibiotic treatment regimens exist for treatment of CAP. The choice of which antibiotic to use is based upon several factors, including your underlying medical problems and the likelihood of being infected with a type of bacteria that is resistant to specific drugs.

People with certain medical problems and those who have used antibiotics in the past three months have a higher risk of infection with drug-resistant bacteria. For all antibiotic regimens, it is important to take it exactly as directed.

EXPECTED RECOVERY FROM PNEUMONIA

Most people begin to improve after three to five days of antibiotic treatment. Improvement may be defined as feeling better or having fewer symptoms, such as cough and fever. Fatigue and a persistent but milder cough can last for a month or longer, although most people are able to resume their usual activities within a week. People treated in the hospital may not be able to resume their normal activities for three weeks or longer.

Regardless of whether you are treated at home or in the hospital, it's important to take care of yourself as your body recovers. This includes getting plenty of rest at night and taking naps during the day if needed. It's also important to drink plenty of fluids to avoid becoming dehydrated. Be sure to finish all of your antibiotic medication, even if you start to feel better after a few days.

If you are treated at home, you should have a follow-up visit or communication with a health care provider within several days after being diagnosed. This allows the provider to see if you are improving and to check for any complications of pneumonia. People who have been discharged from the hospital with a pneumonia diagnosis should also have a follow-up visit, usually within one week. In addition, a later visit is often recommended to confirm that the pneumonia has resolved, both in people who were treated at home and in those who were treated in the hospital.

If your symptoms do not improve or get worse after you've started treatment, let your health care provider know.

PNEUMONIA COMPLICATIONS

Pneumonia can usually be treated successfully without leading to complications. However, complications can develop in some people, especially those in high-risk groups (see 'High-risk groups' above). Complications can be related to the pneumonia itself or to the drugs used to treat the pneumonia.

Short-term complications due to pneumonia include:

- Fluid accumulation – Fluid can develop between the covering of the lungs (pleura) and the inner lining of the chest wall; this is called a pleural effusion. If the fluid becomes infected as a result of pneumonia (called empyema), a chest tube (or, less commonly, surgery) may be needed to drain the fluid.
- Abscess – A collection of pus in the part of the lung that was infected is known as an abscess. They can usually be treated with antibiotics; rarely, surgical removal is needed.
- Bacteremia – Bacteremia occurs when the pneumonia infection spreads from the lungs to the bloodstream. This is a serious complication since infection can spread quickly from the bloodstream to other organs. Bacteremia can also cause the blood pressure to be dangerously low.
- Cardiovascular events – Some studies have shown that people who have had pneumonia are at increased risk of having a cardiovascular event, such as a heart attack, during recovery and for several years afterward.

Complications related to medications include diarrhea and rash. Each medication comes with a list of potential side effects, and it's important to be familiar with these when starting a treatment regimen.

Traditionally, community-acquired pneumonia (CAP) has been considered an acute respiratory infection that in some people causes short-term complications. However, as experts continue to study people with the condition and their health outcomes, there is increasing evidence that CAP can also impact long-term health. Important examples of long-term complications include pulmonary fibrosis with decreased lung function (lung damage similar to that seen in chronic obstructive pulmonary disease [COPD]) and heart disease resulting from cardiac stress and low blood oxygen levels. Pneumonia can also lead to worsening of chronic conditions such as COPD (eg, emphysema) or congestive heart failure. The risk of long-term complications appears to be higher in people who were seriously ill when they first got pneumonia.

Most people recover completely from pneumonia, especially those who do not require hospitalization. However, in some cases, it can be fatal. The risk of death is higher in people who are hospitalized, particularly those who are admitted to the intensive care unit. For these reasons, it's very important to see a health care provider if you have symptoms of pneumonia, so it can be treated as soon as possible. (See 'When to seek help' below.)

WHEN TO SEEK HELP

Anyone who suspects that they have pneumonia should seek medical care as soon as possible. Pneumonia is a serious illness that can be life-threatening if not treated, especially for people who are older than 65 years, abuse alcohol, have underlying medical problems, or have a weakened immune system.

If you develop any of the following symptoms, you should see your health care provider promptly:

- Fever and cough with phlegm that does not improve or worsens
- New shortness of breath with normal daily activities
- Chest pain with breathing
- Feeling suddenly worse after a cold or the flu
- Confusion along with respiratory symptoms (as listed above)

PREVENTION

The pneumococcal vaccine is one of the most effective ways to prevent pneumonia. The influenza (or "flu") vaccine is important not only for preventing influenza but also for preventing potential complications, including pneumonia. These vaccines are discussed separately. (See "Patient education: Pneumonia prevention in adults (Beyond the Basics)" and "Patient education: Influenza prevention (Beyond the Basics)".)

Avoiding smoking is another important way to prevent pneumonia as well as other health problems. If you smoke, there are treatments that can help you quit. (See "Patient education: Quitting smoking (Beyond the Basics)".)

If you have an underlying medical condition such as asthma, congestive heart failure, or diabetes, controlling this condition can also help to prevent pneumonia.

Infection control — "Infection control" refers to measures used to prevent the spread of any type of infection, including pneumonia. Infection control is most commonly practiced in health care settings but is useful in the community as well. Simple practices such as frequent hand washing with soap and water or alcohol-based hand rubs can be effective.

Because pneumonia can be spread through the air (eg, if you inhale respiratory secretions from an infected person's cough or sneeze), people with pneumonia should limit face-to-face contact with family and friends. To help prevent the infection from spreading, be careful to cover your mouth and nose while coughing or sneezing, and throw away tissues immediately after use. Sneezing or coughing into your sleeve (ie, at the inner elbow) is another way to prevent the spray of saliva and secretions; this also helps you to keep your hands clean.

WHERE TO GET MORE INFORMATION

Your health care provider is the best source of information for questions and concerns related to your medical problem.

This article will be updated as needed on our website (www.uptodate.com/patients). Related topics for patients, as well as selected articles written for health care professionals, are also available. Some of the most relevant are listed below.

Patient level information — UpToDate offers two types of patient education materials.

The Basics — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

Patient education: Pneumonia in adults (The Basics)
Patient education: Community-acquired pneumonia in adults (The Basics)
Patient education: Hospital-acquired pneumonia (The Basics)

Patient education: Aspiration pneumonia (The Basics)
Patient education: Pneumocystis pneumonia (The Basics)
Patient education: Shortness of breath (The Basics)
Patient education: Cough in adults (The Basics)
Patient education: Acute respiratory distress syndrome (The Basics)
Patient education: Pleuritic chest pain (The Basics)
Patient education: Paraplegia and quadriplegia (The Basics)
Patient education: Rib injury in adults (The Basics)
Patient education: Diabetes and infections (The Basics)
Patient education: Interstitial lung disease (The Basics)
Patient education: Diagnostic bronchoscopy (The Basics)
Patient education: How to use an incentive spirometer (The Basics)
Patient education: How to use a pulse oximeter (The Basics)
Patient education: Deep breathing and coughing after surgery (The Basics)

Beyond the Basics — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

Patient education: Acute bronchitis in adults (Beyond the Basics)
Patient education: Flexible bronchoscopy (Beyond the Basics)
Patient education: Pneumonia prevention in adults (Beyond the Basics)

Professional level information — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

Aspiration pneumonia in adults
Bacterial pulmonary infections in patients with HIV
Clinical manifestations and diagnosis of *Legionella* infection
Epidemiology, clinical presentation, and diagnosis of Pneumocystis pulmonary infection in patients with HIV
Clinical presentation and diagnostic evaluation of ventilator-associated pneumonia
Community-acquired pneumonia in adults: Assessing severity and determining the appropriate site of care
Clinical evaluation and diagnostic testing for community-acquired pneumonia in adults
Microbiology, epidemiology, and pathogenesis of *Legionella* infection
Epidemiology, pathogenesis, and microbiology of community-acquired pneumonia in adults
Epidemiology, pathogenesis, microbiology, and diagnosis of hospital-acquired and

ventilator-associated pneumonia in adults
Mycoplasma pneumoniae infection in adults
Nonresolving pneumonia
Pneumococcal pneumonia in patients requiring hospitalization
Pneumonia caused by *Chlamydia pneumoniae* in adults
Pseudomonas aeruginosa pneumonia
Risk factors and prevention of hospital-acquired and ventilator-associated pneumonia in adults
Sputum cultures for the evaluation of bacterial pneumonia
Treatment of community-acquired pneumonia in adults in the outpatient setting
Treatment of community-acquired pneumonia in adults who require hospitalization
Treatment of hospital-acquired and ventilator-associated pneumonia in adults
Principles of antimicrobial therapy of Pseudomonas aeruginosa infections

The following organizations also provide reliable health information.

- National Library of Medicine

(www.nlm.nih.gov/medlineplus/ency/article/000145.htm, available in Spanish)

- National Institute of Allergy and Infectious Diseases

(www.niaid.nih.gov)

- American Lung Association

(www.lung.org, click on "Diseases A to Z", then click on "P")

- Canadian Lung Association

(http://www.lung.ca/lung-health/lung-disease/pneumonia)

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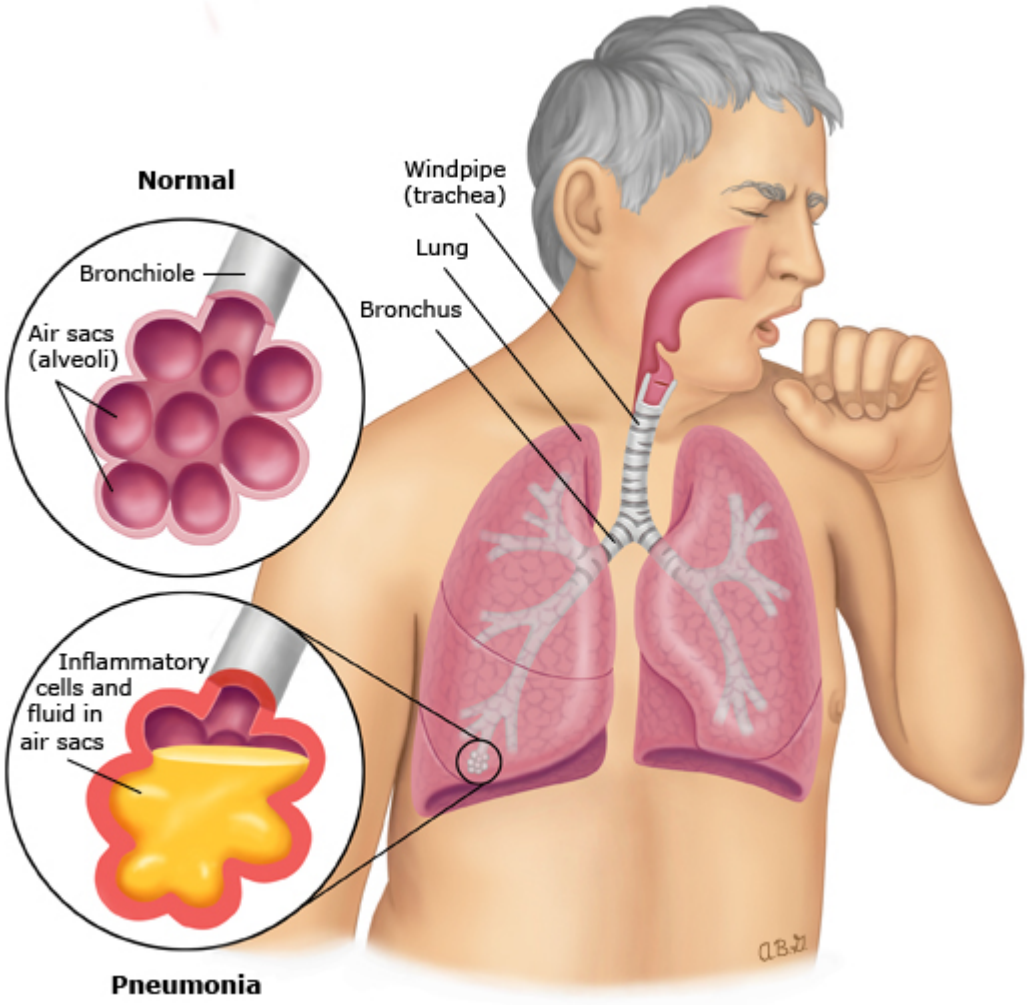
GRAPHICS

Pneumonia



Pneumonia is an infection of the lungs. When you have pneumonia, the air sacs in your lungs become inflamed. They can fill with fluid and cells trying to fight the infection. This can make it hard to breathe.

Graphic 55943 Version 9.0