[Template:Other uses](/wiki/Template:Other_uses" \o "Template:Other uses) [Template:Pp-semi-indef](/wiki/Template:Pp-semi-indef) [Template:Use dmy dates](/wiki/Template:Use_dmy_dates) [Template:Infobox medical condition](/wiki/Template:Infobox_medical_condition)

**Pneumonia** is an [inflammatory](/wiki/Inflammation) condition of the [lung](/wiki/Lung) affecting primarily the microscopic air sacs known as [alveoli](/wiki/Alveoli).<ref name=RespText09>[Template:Cite book](/wiki/Template:Cite_book)</ref><ref name=AcuteCare09>[Template:Cite book](/wiki/Template:Cite_book)</ref> Typical signs and symptoms include a varying severity and combination of [productive](/wiki/Phlegm) or dry [cough](/wiki/Cough), [chest pain](/wiki/Chest_pain), [fever](/wiki/Fever), and [trouble breathing](/wiki/Dyspnea), depending on the underlying cause.<ref name=Ash2007>[Template:Cite book](/wiki/Template:Cite_book)</ref>

Pneumonia is usually caused by infection with [viruses](/wiki/Virus) or [bacteria](/wiki/Bacteria) and less commonly by other [microorganisms](/wiki/Microorganism), certain [medications](/wiki/Pharmaceutical_drug) and conditions such as [autoimmune diseases](/wiki/Autoimmune_disease).<ref name=RespText09/><ref name=Jeff2010>[Template:Cite book](/wiki/Template:Cite_book)</ref> Risk factors include other lung diseases such as [cystic fibrosis](/wiki/Cystic_fibrosis), [COPD](/wiki/COPD), and [asthma](/wiki/Asthma), [diabetes](/wiki/Diabetes_mellitus), [heart failure](/wiki/Heart_failure), a history of [smoking](/wiki/Smoking), a poor ability to cough such as following a [stroke](/wiki/Stroke), or a [weak immune system](/wiki/Immunosupressed).[[1]](#cite_note-1) Diagnosis is often based on the symptoms and [physical examination](/wiki/Physical_examination). [Chest X-ray](/wiki/Chest_X-ray), blood tests, and [culture](/wiki/Microbial_culture) of the [sputum](/wiki/Sputum) may help confirm the diagnosis.<ref name=NIH2011Diag>[Template:Cite web](/wiki/Template:Cite_web)</ref> The disease may be classified by where it was acquired with community, hospital, or health care associated pneumonia.[[2]](#cite_note-2) [Vaccines](/wiki/Vaccine) to prevent certain types of pneumonia are available. Other methods of prevention include [handwashing](/wiki/Handwashing) and not smoking.<ref name=NIH2011Pre>[Template:Cite web](/wiki/Template:Cite_web)</ref> Treatment depends on the underlying cause.<ref name=NIH2011>[Template:Cite web](/wiki/Template:Cite_web)</ref> Pneumonia believed to be due to bacteria is treated with [antibiotics](/wiki/Antibiotic).<ref name=NIH2011Tx>[Template:Cite web](/wiki/Template:Cite_web)</ref> If the pneumonia is severe, the affected person is generally hospitalized.<ref name=NIH2011/> [Oxygen therapy](/wiki/Oxygen_therapy) may be used if oxygen levels are low.<ref name=NIH2011Tx/>

Pneumonia affects approximately 450 million people globally (7% of the population) and results in about 4 million deaths per year.<ref name=Lancet11>[Template:Cite journal](/wiki/Template:Cite_journal)</ref><ref name=CochraneTx13>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Pneumonia was regarded by [William Osler](/wiki/William_Osler) in the 19th century as "the captain of the men of death".[[3]](#cite_note-3) With the introduction of antibiotics and vaccines in the 20th century survival improved.<ref name=Lancet11/> Nevertheless, in developing countries, and among the very old, the very young, and the [chronically ill](/wiki/Chronic_(medicine)), pneumonia remains a [leading cause of death](/wiki/Leading_cause_of_death).<ref name=Lancet11/>[[4]](#cite_note-4) Pneumonia often shortens suffering among those already close to death and has thus been called "the old man's friend".<ref name=EBMED05>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> [thumb|upright=1.4|A video explanation of pneumonia](/wiki/File:Pneumonia.webm) [Template:TOC limit](/wiki/Template:TOC_limit)

## Contents

* 1 Signs and symptoms[[edit](/index.php?title=(none)&action=edit&section=1)]
* 2 Cause[[edit](/index.php?title=(none)&action=edit&section=2)]
  + 2.1 Bacteria[[edit](/index.php?title=(none)&action=edit&section=3)]
  + 2.2 Viruses[[edit](/index.php?title=(none)&action=edit&section=4)]
  + 2.3 Fungi[[edit](/index.php?title=(none)&action=edit&section=5)]
  + 2.4 Parasites[[edit](/index.php?title=(none)&action=edit&section=6)]
  + 2.5 Noninfectious[[edit](/index.php?title=(none)&action=edit&section=7)]
* 3 Mechanisms[[edit](/index.php?title=(none)&action=edit&section=8)]
  + 3.1 Viral[[edit](/index.php?title=(none)&action=edit&section=9)]
  + 3.2 Bacterial[[edit](/index.php?title=(none)&action=edit&section=10)]
* 4 Diagnosis[[edit](/index.php?title=(none)&action=edit&section=11)]
  + 4.1 Physical exam[[edit](/index.php?title=(none)&action=edit&section=12)]
  + 4.2 Imaging[[edit](/index.php?title=(none)&action=edit&section=13)]
  + 4.3 Microbiology[[edit](/index.php?title=(none)&action=edit&section=14)]
  + 4.4 Classification[[edit](/index.php?title=(none)&action=edit&section=15)]
    - 4.4.1 Community[[edit](/index.php?title=(none)&action=edit&section=16)]
    - 4.4.2 Healthcare[[edit](/index.php?title=(none)&action=edit&section=17)]
      * 4.4.2.1 Hospital[[edit](/index.php?title=(none)&action=edit&section=18)]
      * 4.4.2.2 Ventilator[[edit](/index.php?title=(none)&action=edit&section=19)]
  + 4.5 Differential diagnosis[[edit](/index.php?title=(none)&action=edit&section=20)]
* 5 Prevention[[edit](/index.php?title=(none)&action=edit&section=21)]
  + 5.1 Vaccination[[edit](/index.php?title=(none)&action=edit&section=22)]
  + 5.2 Medications[[edit](/index.php?title=(none)&action=edit&section=23)]
  + 5.3 Other[[edit](/index.php?title=(none)&action=edit&section=24)]
* 6 Management[[edit](/index.php?title=(none)&action=edit&section=25)]
  + 6.1 Bacterial[[edit](/index.php?title=(none)&action=edit&section=26)]
  + 6.2 Viral[[edit](/index.php?title=(none)&action=edit&section=27)]
  + 6.3 Aspiration[[edit](/index.php?title=(none)&action=edit&section=28)]
* 7 Prognosis[[edit](/index.php?title=(none)&action=edit&section=29)]
  + 7.1 Clinical prediction rules[[edit](/index.php?title=(none)&action=edit&section=30)]
  + 7.2 Pleural effusion, empyema, and abscess[[edit](/index.php?title=(none)&action=edit&section=31)]
  + 7.3 Respiratory and circulatory failure[[edit](/index.php?title=(none)&action=edit&section=32)]
* 8 Epidemiology[[edit](/index.php?title=(none)&action=edit&section=33)]
  + 8.1 Children[[edit](/index.php?title=(none)&action=edit&section=34)]
* 9 History[[edit](/index.php?title=(none)&action=edit&section=35)]
* 10 Society and culture[[edit](/index.php?title=(none)&action=edit&section=36)]
  + 10.1 Awareness[[edit](/index.php?title=(none)&action=edit&section=37)]
  + 10.2 Costs[[edit](/index.php?title=(none)&action=edit&section=38)]
* 11 References[[edit](/index.php?title=(none)&action=edit&section=39)]
* 12 External links[[edit](/index.php?title=(none)&action=edit&section=40)]

## Signs and symptoms[[edit](/index.php?title=(none)&action=edit&section=1)]

|  |
| --- |
| **colspan=2| Symptoms frequency<ref name=Tint10/>** |
| **Symptom** | **Frequency** |
| Cough | 79–91% |
| Fatigue | 90% |
| Fever | 71–75% |
| Shortness of breath | 67–75% |
| Sputum | 60–65% |
| Chest pain | 39–49% |
|  |  |

[thumb|left|upright=1.3|alt=A diagram of the human body outlining the key symptoms of pneumonia|Main symptoms of infectious pneumonia](/wiki/File:Symptoms_of_pneumonia.svg) People with infectious pneumonia often have a [productive cough](/wiki/Cough), [fever](/wiki/Fever) accompanied by [shaking chills](/wiki/Rigors), [shortness of breath](/wiki/Shortness_of_breath), sharp or stabbing [chest pain](/wiki/Chest_pain) during deep breaths, and an increased [rate of breathing](/wiki/Respiratory_rate).<ref name=BMJ06/> In the elderly, confusion may be the most prominent sign.<ref name=BMJ06>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>

The typical signs and symptoms in children under five are fever, cough, and fast or difficult breathing.<ref name=Develop11/> Fever is not very specific, as it occurs in many other common illnesses, may be absent in those with severe disease, [malnutrition](/wiki/Malnutrition) or in the elderly. In addition, a cough is frequently absent in children less than 2 months old.<ref name=Develop11/> More severe signs and symptoms in children may include [blue-tinged skin](/wiki/Central_cyanosis), unwillingness to drink, convulsions, ongoing vomiting, extremes of temperature, or a [decreased level of consciousness](/wiki/Decreased_level_of_consciousness).<ref name=Develop11/><ref name=Clinic2011/>

Bacterial and viral cases of pneumonia usually present with similar symptoms.<ref name=WHOPrevent2012/> Some causes are associated with classic, but non-specific, clinical characteristics. Pneumonia caused by [*Legionella*](/wiki/Legionella) may occur with abdominal pain, [diarrhea](/wiki/Diarrhea), or confusion,[[5]](#cite_note-5) while pneumonia caused by [*Streptococcus pneumoniae*](/wiki/Streptococcus_pneumoniae) is associated with rusty colored sputum,[[6]](#cite_note-6) and pneumonia caused by [*Klebsiella*](/wiki/Klebsiella) may have bloody sputum often described as "currant jelly".<ref name=Tint10>[Template:Cite book](/wiki/Template:Cite_book)</ref> Bloody sputum (known as [hemoptysis](/wiki/Hemoptysis)) may also occur with [tuberculosis](/wiki/Tuberculosis), Gram-negative pneumonia, and [lung abscesses](/wiki/Lung_abscess) as well as more commonly with [acute bronchitis](/wiki/Acute_bronchitis).<ref name=Clinic2011/> *Mycoplasma* pneumonia may occur in association with [swelling of the lymph nodes in the neck](/wiki/Cervical_lymphadenopathy), [joint pain](/wiki/Arthralgia), or a [middle ear infection](/wiki/Otitis_media).<ref name=Clinic2011/> Viral pneumonia presents more commonly with [wheezing](/wiki/Wheezing) than does bacterial pneumonia.<ref name=WHOPrevent2012/> Pneumonia was historically divided into "typical" and "atypical" based on the belief that the presentation predicted the underlying cause.<ref name=M32/> However, evidence has not supported this distinction, thus it is no longer emphasized.<ref name=M32/>

## Cause[[edit](/index.php?title=(none)&action=edit&section=2)]

[thumb|alt=Three one round objects in a black background|The bacterium](/wiki/File:Streptococcus_pneumoniae.jpg) [*Streptococcus pneumoniae*](/wiki/Streptococcus_pneumoniae), a common cause of pneumonia, imaged by an [electron microscope](/wiki/Electron_microscope) Pneumonia is due to infections caused primarily by [bacteria](/wiki/Bacteria) or [viruses](/wiki/Virus) and less commonly by [fungi](/wiki/Fungi) and [parasites](/wiki/Parasites). Although there are more than 100 strains of infectious agents identified, only a few are responsible for the majority of the cases. Mixed infections with both viruses and bacteria may occur in up to 45% of infections in children and 15% of infections in adults.<ref name=Lancet11/> A causative agent may not be isolated in approximately half of cases despite careful testing.<ref name=EBMED05/>

The term *pneumonia* is sometimes more broadly applied to any condition resulting in [inflammation](/wiki/Inflammation) of the lungs (caused for example by [autoimmune diseases](/wiki/Autoimmune_disease), chemical burns or drug reactions); however, this inflammation is more accurately referred to as [pneumonitis](/wiki/Pneumonitis).[[7]](#cite_note-7)[[8]](#cite_note-8) Conditions and risk factors that predispose to pneumonia include [smoking](/wiki/Smoking), [immunodeficiency](/wiki/Immunodeficiency), [alcoholism](/wiki/Alcoholism), [chronic obstructive pulmonary disease](/wiki/Chronic_obstructive_pulmonary_disease), [asthma](/wiki/Asthma), [chronic kidney disease](/wiki/Chronic_kidney_disease), and [liver disease](/wiki/Liver_disease).<ref name=Clinic2011/>[[9]](#cite_note-9) The use of acid-suppressing medications—such as [proton-pump inhibitors](/wiki/Proton-pump_inhibitors) or [H2 blockers](/wiki/H2_blockers)—is associated with an increased risk of pneumonia.[[10]](#cite_note-10) The risk is also increased in old age.<ref name=Clinic2011/>

### Bacteria[[edit](/index.php?title=(none)&action=edit&section=3)]

[Template:Main](/wiki/Template:Main) [thumb|Cavitating pneumonia as seen on CT. Pneumonia due to MRSA](/wiki/File:MRSAPneumoCT.png) Bacteria are the most common cause of [community-acquired pneumonia](/wiki/Community-acquired_pneumonia) (CAP), with [*Streptococcus pneumoniae*](/wiki/Streptococcus_pneumoniae) isolated in nearly 50% of cases.<ref name=Rad07/><ref name=EOP10>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Other commonly isolated bacteria include [*Haemophilus influenzae*](/wiki/Haemophilus_influenzae) in 20%, [*Chlamydophila pneumoniae*](/wiki/Chlamydophila_pneumoniae) in 13%, and [*Mycoplasma pneumoniae*](/wiki/Mycoplasma_pneumoniae) in 3% of cases;<ref name=Rad07/> [*Staphylococcus aureus*](/wiki/Staphylococcus_aureus); [*Moraxella catarrhalis*](/wiki/Moraxella_catarrhalis); [*Legionella pneumophila*](/wiki/Legionella_pneumophila) and [Gram-negative bacilli](/wiki/Gram-negative_bacilli).<ref name=EBMED05/> A number of [drug-resistant](/wiki/Drug_resistance) versions of the above infections are becoming more common, including drug-resistant *Streptococcus pneumoniae* (DRSP) and [methicillin-resistant Staphylococcus aureus](/wiki/Methicillin-resistant_Staphylococcus_aureus) (MRSA).<ref name=Clinic2011/>

The spreading of organisms is facilitated when risk factors are present.<ref name=EBMED05/> [Alcoholism](/wiki/Alcoholism) is associated with *Streptococcus pneumoniae*, [anaerobic organisms](/wiki/Anaerobic_organism), and *Mycobacterium tuberculosis*; smoking facilitates the effects of *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, and *Legionella pneumophila*. Exposure to birds is associated with [*Chlamydia psittaci*](/wiki/Chlamydia_psittaci); farm animals with [*Coxiella burnetti*](/wiki/Coxiella_burnetti); aspiration of stomach contents with [anaerobic organisms](/wiki/Anaerobic_organism); and [cystic fibrosis](/wiki/Cystic_fibrosis) with [*Pseudomonas aeruginosa*](/wiki/Pseudomonas_aeruginosa) and *Staphylococcus aureus*.<ref name=EBMED05/> *Streptococcus pneumoniae* is more common in the winter,<ref name=EBMED05/> and should be suspected in persons aspirating a large amount [anaerobic organisms](/wiki/Anaerobic_organisms).<ref name=Clinic2011/>

### Viruses[[edit](/index.php?title=(none)&action=edit&section=4)]

[Template:Main](/wiki/Template:Main) In adults, [viruses](/wiki/Virus) account for approximately a third<ref name=Lancet11/> and in children for about 15% of pneumonia cases.<ref name=M31/> Commonly implicated agents include [rhinoviruses](/wiki/Rhinovirus), [coronaviruses](/wiki/Coronavirus), [influenza virus](/wiki/Influenza_virus), [respiratory syncytial virus](/wiki/Respiratory_syncytial_virus) (RSV), [adenovirus](/wiki/Adenovirus), and [parainfluenza](/wiki/Parainfluenza).<ref name=Lancet11/><ref name=Viral09/> [Herpes simplex virus](/wiki/Herpes_simplex_virus) rarely causes pneumonia, except in groups such as: newborns, persons with cancer, transplant recipients, and people with significant burns.<ref name=Text2010>[Template:Cite book](/wiki/Template:Cite_book)</ref> People following [organ transplantation](/wiki/Organ_transplantation) or those otherwise-[immunocompromised](/wiki/Immunocompromised) present high rates of [cytomegalovirus](/wiki/Cytomegalovirus) pneumonia.<ref name=M31/><ref name=Text2010/> Those with viral infections may be secondarily infected with the bacteria *Streptococcus pneumoniae*, *Staphylococcus aureus*, or *Haemophilus influenzae*, particularly when other health problems are present.<ref name=Clinic2011/><ref name=M31/> Different viruses predominate at different periods of the year; during influenza season, for example, influenza may account for over half of all viral cases.<ref name=M31/> Outbreaks of other viruses also occasionally occur, including [*hantaviruses*](/wiki/Hantaviruses) and [*coronavirus*](/wiki/Coronavirus).<ref name=M31/>

### Fungi[[edit](/index.php?title=(none)&action=edit&section=5)]

[Template:Main](/wiki/Template:Main)

Fungal pneumonia is uncommon, but occurs more commonly in individuals with [weakened immune systems](/wiki/Immunodeficiency) due to [AIDS](/wiki/AIDS), [immunosuppressive drugs](/wiki/Immunosuppressive_drug), or other medical problems.<ref name=EBMED05/><ref name=Fungus2009>[Template:Cite book](/wiki/Template:Cite_book)</ref> It is most often caused by [*Histoplasma capsulatum*](/wiki/Histoplasmosis), blastomyces, [*Cryptococcus neoformans*](/wiki/Cryptococcus_neoformans), [*Pneumocystis jiroveci*](/wiki/Pneumocystis_jiroveci) ([pneumocystis pneumonia](/wiki/Pneumocystis_pneumonia)), and [*Coccidioides immitis*](/wiki/Coccidioides_immitis). [Histoplasmosis](/wiki/Histoplasmosis) is most common in the [Mississippi River basin](/wiki/Mississippi_embayment), and [coccidioidomycosis](/wiki/Coccidioidomycosis) is most common in the [Southwestern United States](/wiki/Southwestern_United_States).<ref name=EBMED05/> The number of cases has been increasing in the later half of the 20th century due to increasing travel and rates of immunosuppression in the population.<ref name=Fungus2009/>

### Parasites[[edit](/index.php?title=(none)&action=edit&section=6)]

[Template:Main](/wiki/Template:Main) A variety of [parasites](/wiki/Parasite) can affect the lungs, including [*Toxoplasma gondii*](/wiki/Toxoplasma_gondii), [*Strongyloides stercoralis*](/wiki/Strongyloides_stercoralis), [*Ascaris lumbricoides*](/wiki/Ascaris_lumbricoides), and [*Plasmodium malariae*](/wiki/Plasmodium_malariae).<ref name=M37>Murray and Nadel (2010). Chapter 37.</ref> These organisms typically enter the body through direct contact with the skin, ingestion, or via an insect vector.<ref name=M37/> Except for [*Paragonimus westermani*](/wiki/Paragonimus_westermani), most parasites do not affect specifically the lungs but involve the lungs secondarily to other sites.<ref name=M37/> Some parasites, in particular those belonging to the *Ascaris* and *Strongyloides* genera, stimulate a strong [eosinophilic](/wiki/Eosinophilic) reaction, which may result in [eosinophilic pneumonia](/wiki/Eosinophilic_pneumonia).<ref name=M37/> In other infections, such as malaria, lung involvement is due primarily to cytokine-induced systemic inflammation.<ref name=M37/> In the [developed world](/wiki/Developed_world) these infections are most common in people returning from travel or in immigrants.<ref name=M37/> Around the world, these infections are most common in the immunodeficient.[[11]](#cite_note-11)

### Noninfectious[[edit](/index.php?title=(none)&action=edit&section=7)]

[Template:Main](/wiki/Template:Main)

Idiopathic interstitial pneumonia or noninfectious pneumonia[[12]](#cite_note-12) is a class of [diffuse lung diseases](/wiki/Diffuse_lung_disease). They include [diffuse alveolar damage](/wiki/Diffuse_alveolar_damage), [organizing pneumonia](/wiki/Organizing_pneumonia), [nonspecific interstitial pneumonia](/wiki/Nonspecific_interstitial_pneumonia), [lymphocytic interstitial pneumonia](/wiki/Lymphocytic_interstitial_pneumonia), [desquamative interstitial pneumonia](/wiki/Desquamative_interstitial_pneumonia), [respiratory bronchiolitis interstitial lung disease](/wiki/Respiratory_bronchiolitis_interstitial_lung_disease), and [usual interstitial pneumonia](/wiki/Usual_interstitial_pneumonia).[[13]](#cite_note-13)

## Mechanisms[[edit](/index.php?title=(none)&action=edit&section=8)]

[thumb|upright=1.3|alt=A schematic diagram of the human lungs with an empty circle on the left representing a normal alveola and one on the right showing an alveola full of fluid as in pneumonia|Pneumonia fills the lung's](/wiki/File:New_Pneumonia_cartoon.jpg) [alveoli](/wiki/Alveolus) with fluid, hindering oxygenation. The alveolus on the left is normal, whereas the one on the right is full of fluid from pneumonia. Pneumonia frequently starts as an [upper respiratory tract infection](/wiki/Upper_respiratory_tract_infection) that moves into the lower respiratory tract.<ref name=PedNA09>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> It is [pneumonitis](/wiki/Pneumonitis) (lung inflammation) combined with [consolidation](/wiki/Pulmonary_consolidation) (liquid in spaces normally inflated with air).[[14]](#cite_note-14)

### Viral[[edit](/index.php?title=(none)&action=edit&section=9)]

Viruses may reach the lung by a number of different routes. Respiratory syncytial virus is typically contracted when people touch contaminated objects and then they touch their eyes or nose.<ref name=M31>Murray and Nadel (2010). Chapter 31.</ref> Other viral infections occur when contaminated airborne droplets are inhaled through the mouth or nose.<ref name=Clinic2011/> Once in the upper airway, the viruses may make their way in the lungs, where they invade the cells lining the airways, alveoli, or [lung parenchyma](/wiki/Lung_parenchyma).<ref name=M31/> Some viruses such as measles and herpes simplex may reach the lungs via the blood.<ref name=Gary2010>[Template:Cite book](/wiki/Template:Cite_book)</ref> The invasion of the lungs may lead to varying degrees of cell death.<ref name=M31/> When the immune system responds to the infection, even more lung damage may occur.<ref name=M31/> Primarily [white blood cells](/wiki/White_blood_cell), mainly [mononuclear cells](/wiki/Mononuclear_cell), generate the inflammation.<ref name=Gary2010/> As well as damaging the lungs, many viruses simultaneously affect other [organs](/wiki/Organ_(anatomy)) and thus disrupt other body functions. Viruses also make the body more susceptible to bacterial infections; in this way, bacterial pneumonia can arise as a [co-morbid](/wiki/Co-morbid) condition.<ref name=Viral09>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>

### Bacterial[[edit](/index.php?title=(none)&action=edit&section=10)]

Most bacteria enter the lungs via small [aspirations](/wiki/Pulmonary_aspiration) of organisms residing in the throat or nose.<ref name=Clinic2011/> Half of normal people have these small aspirations during sleep.<ref name=M32/> While the throat always contains bacteria, [potentially infectious](/wiki/Virulent) ones reside there only at certain times and under certain conditions.<ref name=M32/> A minority of types of bacteria such as [*Mycobacterium tuberculosis*](/wiki/Mycobacterium_tuberculosis) and [*Legionella pneumophila*](/wiki/Legionella_pneumophila) reach the lungs via contaminated airborne droplets.<ref name=Clinic2011/> Bacteria can spread also via the blood.<ref name=WHOPrevent2012/> Once in the lungs, bacteria may invade the spaces between cells and between alveoli, where the [macrophages](/wiki/Macrophage) and [neutrophils](/wiki/Neutrophil) (defensive [white blood cells](/wiki/White_blood_cell)) attempt to inactivate the bacteria.[[15]](#cite_note-15) The neutrophils also release [cytokines](/wiki/Cytokine), causing a general activation of the immune system.<ref name=Fein2006>[Template:Cite book](/wiki/Template:Cite_book)</ref> This leads to the fever, chills, and fatigue common in bacterial pneumonia.<ref name=Fein2006/> The neutrophils, bacteria, and fluid from surrounding blood vessels fill the alveoli, resulting in the consolidation seen on chest X-ray.[[16]](#cite_note-16)

## Diagnosis[[edit](/index.php?title=(none)&action=edit&section=11)]

[Template:Listen](/wiki/Template:Listen) Pneumonia is typically diagnosed based on a combination of physical signs and a [chest X-ray](/wiki/Chest_X-ray).<ref name=Diag10>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> However, the underlying cause can be difficult to confirm, as there is no definitive test able to distinguish between bacterial and non-bacterial origin.<ref name=Lancet11/><ref name=Diag10/> [The World Health Organization](/wiki/The_World_Health_Organization) has defined pneumonia in children clinically based on either a [cough](/wiki/Cough) or difficulty breathing and a rapid respiratory rate, chest indrawing, or a decreased level of consciousness.<ref name=WHOBook/> A rapid respiratory rate is defined as greater than 60 breaths per minute in children under 2 months old, 50 breaths per minute in children 2 months to 1 year old, or greater than 40 breaths per minute in children 1 to 5 years old.<ref name=WHOBook>[Template:Cite book](/wiki/Template:Cite_book)</ref> In children, increased respiratory rate and lower chest indrawing are more [sensitive](/wiki/Sensitivity_and_specificity) than hearing chest [crackles](/wiki/Crackles) with a [stethoscope](/wiki/Stethoscope).<ref name=Develop11/> Grunting and nasal flaring may be other useful signs in children less than five.[[17]](#cite_note-17) In general, in adults, investigations are not needed in mild cases.<ref name=BTS09/> There is a very low risk of pneumonia if all [vital signs](/wiki/Vital_sign) and [auscultation](/wiki/Chest_auscultation) are normal.[[18]](#cite_note-18) In persons requiring hospitalization, [pulse oximetry](/wiki/Pulse_oximetry), [chest radiography](/wiki/Chest_radiography) and [blood tests](/wiki/Blood_test)—including a [complete blood count](/wiki/Complete_blood_count), [serum electrolytes](/wiki/Serum_electrolytes), [C-reactive protein](/wiki/C-reactive_protein) level, and possibly [liver function tests](/wiki/Liver_function_tests)—are recommended.<ref name=BTS09/> The diagnosis of [influenza-like illness](/wiki/Influenza-like_illness) can be made based on the signs and symptoms; however, confirmation of an influenza infection requires testing.<ref name=ILI05>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Thus, treatment is frequently based on the presence of influenza in the community or a [rapid influenza test](/wiki/Rapid_influenza_diagnostic_test).<ref name=ILI05/>

### Physical exam[[edit](/index.php?title=(none)&action=edit&section=12)]

[Physical examination](/wiki/Physical_examination) may sometimes reveal [low blood pressure](/wiki/Hypotension), [high heart rate](/wiki/Tachycardia), or low [oxygen saturation](/wiki/Oxygenation_(medical)).<ref name=Clinic2011/> The respiratory rate may be faster than normal, and this may occur a day or two before other signs.<ref name=Clinic2011/><ref name=M32/> Examination of the chest may be normal, but it may show decreased chest expansion on the affected side. Harsh breath sounds from the larger airways that are transmitted through the inflamed lung are termed [bronchial](/wiki/Bronchus) breathing and are heard on [auscultation](/wiki/Auscultation) with a [stethoscope](/wiki/Stethoscope).<ref name=Clinic2011/> [Crackles](/wiki/Crackles) (rales) may be heard over the affected area during [inspiration](/wiki/Inhalation).<ref name=Clinic2011/> [Percussion](/wiki/Percussion_(medicine)) may be dulled over the affected lung, and increased, rather than decreased, [vocal resonance](/wiki/Vocal_resonation) distinguishes pneumonia from a [pleural effusion](/wiki/Pleural_effusion).<ref name=BMJ06/>

### Imaging[[edit](/index.php?title=(none)&action=edit&section=13)]

[thumb|Right middle lobe pneumonia in a child as seen on plain X ray](/wiki/File:RtPneuKidMark.png) [thumb|alt=A black-and-white image shows the internal organs in cross-section as generated by CT. Where one would expect black on the left, one sees a whiter area with black sticks through it.|CT of the chest demonstrating right-side pneumonia (left side of the image)](/wiki/File:CT_scan_of_the_chest,_demonstrating_right-sided_pneumonia.jpg) A [chest radiograph](/wiki/Chest_radiograph) is frequently used in diagnosis.<ref name=Develop11/> In people with mild disease, imaging is needed only in those with potential complications, those not having improved with treatment, or those in which the cause is uncertain.<ref name=Develop11/><ref name=BTS09>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> If a person is sufficiently sick to require hospitalization, a chest radiograph is recommended.<ref name=BTS09/> Findings do not always match the severity of disease and do not reliably separate between bacterial infection and viral infection.<ref name=Develop11/>

X-ray presentations of pneumonia may be classified as [lobar pneumonia](/wiki/Lobar_pneumonia), [bronchopneumonia](/wiki/Bronchopneumonia) (also known as lobular pneumonia), and [interstitial pneumonia](/wiki/Interstitial_pneumonia).[[19]](#cite_note-19) Bacterial, community-acquired pneumonia classically show [lung consolidation](/wiki/Lung_consolidation) of one [lung segmental lobe](/wiki/Bronchopulmonary_segment), which is known as lobar pneumonia.<ref name=Rad07/> However, findings may vary, and other patterns are common in other types of pneumonia.<ref name=Rad07/> Aspiration pneumonia may present with bilateral opacities primarily in the bases of the lungs and on the right side.<ref name=Rad07/> Radiographs of viral pneumonia may appear normal, appear hyper-inflated, have bilateral patchy areas, or present similar to bacterial pneumonia with lobar consolidation.<ref name=Rad07/> Radiologic findings may not be present in the early stages of the disease, especially in the presence of dehydration, or may be difficult to be interpreted in the [obese](/wiki/Obesity) or those with a history of lung disease.<ref name=Clinic2011/> A [CT scan](/wiki/CT_scan) can give additional information in indeterminate cases.<ref name=Rad07/>

### Microbiology[[edit](/index.php?title=(none)&action=edit&section=14)]

In patients managed in the community, determining the causative agent is not cost-effective and typically does not alter management.<ref name=Develop11/> For people that do not respond to treatment, [sputum culture](/wiki/Sputum_culture) should be considered, and culture for [*Mycobacterium tuberculosis*](/wiki/Mycobacterium_tuberculosis) should be carried out in persons with a chronic productive cough.<ref name=BTS09/> Testing for other specific organisms may be recommended during outbreaks, for public health reasons.<ref name=BTS09/> In those hospitalized for severe disease, both sputum and [blood cultures](/wiki/Blood_cultures) are recommended,<ref name=BTS09/> as well as testing the urine for [antigens](/wiki/Antigen) to *Legionella* and *Streptococcus*.<ref name=IDSA2007/> Viral infections can be confirmed via detection of either the virus or its antigens with [culture](/wiki/Viral_culture) or [polymerase chain reaction](/wiki/Polymerase_chain_reaction) (PCR), among other techniques.<ref name=Lancet11/> The causative agent is determined in only 15% of cases with routine microbiological tests.<ref name=BMJ06/>

### Classification[[edit](/index.php?title=(none)&action=edit&section=15)]

[Template:Main](/wiki/Template:Main) [Pneumonitis](/wiki/Pneumonitis) refers to lung [inflammation](/wiki/Inflammation); pneumonia refers to pneumonitis, usually due to infection but sometimes non-infectious, that has the additional feature of [pulmonary consolidation](/wiki/Pulmonary_consolidation).[[20]](#cite_note-20) Pneumonia is most commonly classified by where or how it was acquired: [community-acquired](/wiki/Community-acquired_pneumonia), [aspiration](/wiki/Aspiration_pneumonia), [healthcare-associated](/wiki/Healthcare-associated_pneumonia), [hospital-acquired](/wiki/Hospital-acquired_pneumonia), and [ventilator-associated pneumonia](/wiki/Ventilator-associated_pneumonia).<ref name=Rad07>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> It may also be classified by the area of lung affected: [lobar pneumonia](/wiki/Lobar_pneumonia), [bronchial pneumonia](/wiki/Bronchial_pneumonia) and [acute interstitial pneumonia](/wiki/Acute_interstitial_pneumonia);<ref name=Rad07/> or by the causative organism.[[21]](#cite_note-21) Pneumonia in children may additionally be classified based on signs and symptoms as non-severe, severe, or very severe.[[22]](#cite_note-22) The setting in which pneumonia develops is important to treatment,[[23]](#cite_note-23)[[24]](#cite_note-24) as it correlates to which pathogens are likely suspects,[[23]](#cite_note-23) which mechanisms are likely, which antibiotics are likely to work or fail,[[23]](#cite_note-23) and which complications can be expected based on the person's health status.

#### Community[[edit](/index.php?title=(none)&action=edit&section=16)]

[Template:Main](/wiki/Template:Main) [Community-acquired pneumonia](/wiki/Community-acquired_pneumonia) (CAP) is acquired in the community,[[23]](#cite_note-23)[[24]](#cite_note-24) outside of health care facilities. Compared with health care–associated pneumonia, it is less likely to involve [multidrug-resistant](/wiki/Multiple_drug_resistance) bacteria. Although the latter are no longer rare in CAP,[[23]](#cite_note-23) they are still less likely.

#### Healthcare[[edit](/index.php?title=(none)&action=edit&section=17)]

Health care–associated pneumonia (HCAP) is an infection associated with recent exposure to the [health care](/wiki/Health_care) system,[[23]](#cite_note-23) including hospital, outpatient clinic, [nursing home](/wiki/Nursing_home), [dialysis](/wiki/Dialysis) center, [chemotherapy](/wiki/Chemotherapy) treatment, or [home care](/wiki/Home_care).[[24]](#cite_note-24) HCAP is sometimes called MCAP (medical care–associated pneumonia).

##### Hospital[[edit](/index.php?title=(none)&action=edit&section=18)]

[Hospital-acquired pneumonia](/wiki/Hospital-acquired_pneumonia) is acquired in a [hospital](/wiki/Hospital)[[23]](#cite_note-23) (specifically, pneumonia that occurs 48 hours or more after admission, which was not incubating at the time of admission[[24]](#cite_note-24)), and as such is likely to involve [hospital-acquired infections](/wiki/Hospital-acquired_infection), with higher risk of [multidrug-resistant](/wiki/Multidrug-resistant) pathogens. Also, because hospital patients are often ill (which is why they are present in the hospital), [comorbidities](/wiki/Comorbidity) are an issue.

##### Ventilator[[edit](/index.php?title=(none)&action=edit&section=19)]

[Ventilator-associated pneumonia](/wiki/Ventilator-associated_pneumonia) occurs in people breathing with the help of [mechanical ventilation](/wiki/Mechanical_ventilation)[[23]](#cite_note-23) (specifically, it is pneumonia that arises more than 48 to 72 hours after endotracheal intubation[[24]](#cite_note-24)). Like any medical device, ventilators involve some risk of infection because of how difficult it is to prevent bacteria from colonizing the internal parts and surfaces, even with diligent cleaning. People who need ventilators typically are rather ill, to begin with, so a superimposed pneumonia is not always easily managed. [Immunodeficiency](/wiki/Immunodeficiency) may be involved because of poor nutritional status and whichever disorders are comorbid.

### Differential diagnosis[[edit](/index.php?title=(none)&action=edit&section=20)]

Several diseases can present with similar signs and symptoms to pneumonia, such as: [chronic obstructive pulmonary disease](/wiki/Chronic_obstructive_pulmonary_disease) (COPD), [asthma](/wiki/Asthma), [pulmonary edema](/wiki/Pulmonary_edema), [bronchiectasis](/wiki/Bronchiectasis), [lung cancer](/wiki/Lung_cancer), and [pulmonary emboli](/wiki/Pulmonary_emboli).<ref name=BMJ06/> Unlike pneumonia, asthma and COPD typically present with [wheezing](/wiki/Wheezing), pulmonary edema presents with an abnormal [electrocardiogram](/wiki/Electrocardiogram), cancer and bronchiectasis present with a cough of longer duration, and pulmonary emboli presents with acute onset sharp chest pain and [shortness of breath](/wiki/Shortness_of_breath).<ref name=BMJ06/>

## Prevention[[edit](/index.php?title=(none)&action=edit&section=21)]

Prevention includes [vaccination](/wiki/Vaccination), environmental measures and appropriate treatment of other health problems.<ref name=Develop11/> It is believed that, if appropriate preventive measures were instituted globally, mortality among children could be reduced by 400,000; and, if proper treatment were universally available, childhood deaths could be decreased by another 600,000.<ref name=WHOPrevent2012/>

### Vaccination[[edit](/index.php?title=(none)&action=edit&section=22)]

[Vaccination](/wiki/Vaccination) prevents against certain bacterial and viral pneumonias both in children and adults. [Influenza vaccines](/wiki/Influenza_vaccine) are modestly effective at preventing symptoms of influenza.<ref name=Lancet11/>[[25]](#cite_note-25) The [Center for Disease Control and Prevention](/wiki/Center_for_Disease_Control_and_Prevention) (CDC) recommends yearly vaccination for every person 6 months and older.[[26]](#cite_note-26) Immunizing health care workers decreases the risk of viral pneumonia among their patients.<ref name=IDSA2007>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>

Vaccinations against [*Haemophilus influenzae*](/wiki/Haemophilus_influenzae) and [*Streptococcus pneumoniae*](/wiki/Streptococcus_pneumoniae) have good evidence to support their use.<ref name=PedNA09/> Vaccinating children against *Streptococcus pneumoniae* has led to a decreased incidence of these infections in adults, because many adults acquire infections from children. A [*Streptococcus pneumoniae* vaccine](/wiki/Pneumococcal_polysaccharide_vaccine) is available for adults, and has been found to decrease the risk of [invasive pneumococcal disease](/wiki/Invasive_pneumococcal_disease).[[27]](#cite_note-27) Other vaccines for which there is support for a protective effect against pneumonia include [pertussis](/wiki/Pertussis_vaccine), [varicella](/wiki/Varicella_vaccine), and [measles](/wiki/Measles_vaccine).<ref name=CDCPrev2012/>

### Medications[[edit](/index.php?title=(none)&action=edit&section=23)]

When influenza outbreaks occur, medications such as [amantadine](/wiki/Amantadine) or [rimantadine](/wiki/Rimantadine) may help prevent the condition; however are associated with side effects.<ref name=jefferson>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> [Zanamivir](/wiki/Zanamivir) or [oseltamivir](/wiki/Oseltamivir) decrease the chance that those exposed will develop symptoms; however, it is recommended that potential side effects are taken into account.[[28]](#cite_note-28)

### Other[[edit](/index.php?title=(none)&action=edit&section=24)]

[Smoking cessation](/wiki/Smoking_cessation)<ref name=BTS09/> and reducing indoor [air pollution](/wiki/Air_pollution), such as that from cooking indoors with wood or [dung](/wiki/Feces), are both recommended.<ref name=Develop11/><ref name=WHOPrevent2012/> Smoking appears to be the single biggest risk factor for [pneumococcal pneumonia](/wiki/Pneumococcal_pneumonia) in otherwise-healthy adults.<ref name=IDSA2007/> Hand hygiene and coughing into one's sleeve may also be effective preventative measures.<ref name=CDCPrev2012/> Wearing [surgical masks](/wiki/Surgical_masks) by the sick may also prevent illness.<ref name=IDSA2007/>

Appropriately treating underlying illnesses (such as [HIV/AIDS](/wiki/HIV/AIDS), [diabetes mellitus](/wiki/Diabetes_mellitus), and [malnutrition](/wiki/Malnutrition)) can decrease the risk of pneumonia.<ref name=WHOPrevent2012>[Template:Cite web](/wiki/Template:Cite_web)</ref><ref name=CDCPrev2012>[Template:Cite web](/wiki/Template:Cite_web)</ref>[[29]](#cite_note-29) In children less than 6 months of age, exclusive breast feeding reduces both the risk and severity of disease.<ref name=WHOPrevent2012/> In those with HIV/AIDS and a CD4 count of less than 200 cells/uL the antibiotic [trimethoprim/sulfamethoxazole](/wiki/Trimethoprim/sulfamethoxazole) decreases the risk of [*Pneumocystis pneumonia*](/wiki/Pneumocystis_pneumonia)[[30]](#cite_note-30) and is also useful for prevention in those that are immunocomprised but do not have HIV.[[31]](#cite_note-31) Testing pregnant women for [Group B Streptococcus](/wiki/Group_B_Streptococcus) and [*Chlamydia trachomatis*](/wiki/Chlamydia_trachomatis), and administering [antibiotic](/wiki/Antibiotic) treatment, if needed, reduces rates of pneumonia in infants;[[32]](#cite_note-32)[[33]](#cite_note-33) preventive measures for HIV transmission from mother to child may also be efficient.[[34]](#cite_note-34) Suctioning the mouth and throat of infants with [meconium](/wiki/Meconium)-stained [amniotic fluid](/wiki/Amniotic_fluid) has not been found to reduce the rate of [aspiration pneumonia](/wiki/Aspiration_pneumonia) and may cause potential harm,<ref name=Rog2009>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> thus this practice is not recommended in the majority of situations.<ref name=Rog2009/> In the frail elderly good oral health care may lower the risk of aspiration pneumonia.[[35]](#cite_note-35) [Zinc](/wiki/Zinc) supplementation in children 2 months to five years old appears to reduce rates of pneumonia.[[36]](#cite_note-36)

## Management[[edit](/index.php?title=(none)&action=edit&section=25)]

|  |
| --- |
| **colspan=2|** [**CURB-65**](/wiki/CURB-65) |
| **Symptom** | **Points** |
| **C**onfusion | 1 |
| **U**rea>7 mmol/l | 1 |
| **R**espiratory rate>30 | 1 |
| [S**B**P](/wiki/Blood_pressure)<90mmHg, D**B**P<60mmHg | 1 |
| Age>=**65** | 1 |
|  |  |

Oral [antibiotics](/wiki/Antibiotics), rest, simple [analgesics](/wiki/Analgesics), and fluids usually suffice for complete resolution.<ref name=BTS09/> However, those with other medical conditions, the elderly, or those with significant trouble breathing may require more advanced care. If the symptoms worsen, the pneumonia does not improve with home treatment, or complications occur, hospitalization may be required.<ref name=BTS09/> Worldwide, approximately 7–13% of cases in children result in hospitalization,<ref name=Develop11/> whereas in the developed world between 22 and 42% of adults with community-acquired pneumonia are admitted.<ref name=BTS09/> The [CURB-65](/wiki/CURB-65) score is useful for determining the need for admission in adults.<ref name=BTS09/> If the score is 0 or 1, people can typically be managed at home; if it is 2, a short hospital stay or close follow-up is needed; if it is 3–5, hospitalization is recommended.<ref name=BTS09/> In children those with [respiratory distress](/wiki/Dyspnea) or oxygen saturations of less than 90% should be hospitalized.<ref name=PIDS11>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> The utility of [chest physiotherapy](/wiki/Chest_physiotherapy) in pneumonia has not yet been determined.[[37]](#cite_note-37) [Non-invasive ventilation](/wiki/Mechanical_ventilation) may be beneficial in those admitted to the [intensive care unit](/wiki/Intensive_care_unit).[[38]](#cite_note-38) Over-the-counter [cough medicine](/wiki/Cough_medicine) has not been found to be effective<ref name=Chang2014>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> nor has the use of [zinc](/wiki/Zinc) in children.[[39]](#cite_note-39) There is insufficient evidence for [mucolytics](/wiki/Mucolytics).<ref name=Chang2014/>

### Bacterial[[edit](/index.php?title=(none)&action=edit&section=26)]

[Antibiotics](/wiki/Antibiotic) improve outcomes in those with bacterial pneumonia.<ref name=CochraneTx13/> Antibiotic choice depends initially on the characteristics of the person affected, such as age, underlying health, and the location the infection was acquired. In the UK, [treatment before culture results](/wiki/Empiric_therapy) with [amoxicillin](/wiki/Amoxicillin) is recommended as the first line for [community-acquired pneumonia](/wiki/Community-acquired_pneumonia), with [doxycycline](/wiki/Doxycycline) or [clarithromycin](/wiki/Clarithromycin) as alternatives.<ref name=BTS09/> In [North America](/wiki/North_America), where the "atypical" forms of community-acquired pneumonia are more common, [macrolides](/wiki/Macrolide) (such as [azithromycin](/wiki/Azithromycin) or [erythromycin](/wiki/Erythromycin)), and doxycycline have displaced amoxicillin as first-line outpatient treatment in adults.<ref name=EOP10/><ref name=Lutfiyya>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> In children with mild or moderate symptoms, amoxicillin remains the first line.<ref name=PIDS11/> The use of [fluoroquinolones](/wiki/Fluoroquinolones) in uncomplicated cases is discouraged due to concerns about side-effects and generating resistance in light of there being no greater clinical benefit.<ref name=EOP10/>[[40]](#cite_note-40) For those who require hospitalization and caught their pneumonia in the community the use of a β-lactam such as [cephazolin](/wiki/Cephazolin) plus [macrolide](/wiki/Macrolide) such as [azithromycin](/wiki/Azithromycin) or a fluoroquinolones is recommended.[[41]](#cite_note-41) The addition of [corticosteroids](/wiki/Corticosteroid) also appears to improve outcomes.[[42]](#cite_note-42)[[43]](#cite_note-43) The duration of treatment has traditionally been seven to ten days, but increasing evidence suggests that shorter courses (three to five days) are similarly effective.[[44]](#cite_note-44) Recommended for [hospital-acquired pneumonia](/wiki/Hospital-acquired_pneumonia) include third- and fourth-generation [cephalosporins](/wiki/Cephalosporins), [carbapenems](/wiki/Carbapenem), [fluoroquinolones](/wiki/Fluoroquinolone), [aminoglycosides](/wiki/Aminoglycoside), and [vancomycin](/wiki/Vancomycin).<ref name=HAPGuideline>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> These antibiotics are often given [intravenously](/wiki/Intravenous_therapy) and used in combination.<ref name=HAPGuideline/> In those treated in hospital, more than 90% improve with the initial antibiotics.<ref name=M32/>

### Viral[[edit](/index.php?title=(none)&action=edit&section=27)]

[Neuraminidase inhibitors](/wiki/Neuraminidase_inhibitors) may be used to treat [viral pneumonia](/wiki/Viral_pneumonia) caused by influenza viruses ([influenza A](/wiki/Influenza_A) and [influenza B](/wiki/Influenza_B)).<ref name=Lancet11/> No specific [antiviral](/wiki/Antiviral_drug) medications are recommended for other types of community acquired viral pneumonias including [SARS coronavirus](/wiki/SARS), [adenovirus](/wiki/Adenovirus), [hantavirus](/wiki/Hantavirus), and [parainfluenza](/wiki/Parainfluenza) virus.<ref name=Lancet11/> Influenza A may be treated with [rimantadine](/wiki/Rimantadine) or [amantadine](/wiki/Amantadine), while influenza A or B may be treated with [oseltamivir](/wiki/Oseltamivir), [zanamivir](/wiki/Zanamivir) or [peramivir](/wiki/Peramivir).<ref name=Lancet11/> These are of most benefit if they are started within 48 hours of the onset of symptoms.<ref name=Lancet11/> Many strains of [H5N1](/wiki/H5N1) influenza A, also known as [avian influenza](/wiki/Avian_influenza) or "bird flu", have shown resistance to rimantadine and amantadine.<ref name=Lancet11/> The use of antibiotics in viral pneumonia is recommended by some experts, as it is impossible to rule out a complicating bacterial infection.<ref name=Lancet11/> The [British Thoracic Society](/wiki/British_Thoracic_Society) recommends that antibiotics be withheld in those with mild disease.<ref name=Lancet11/> The use of [corticosteroids](/wiki/Corticosteroid) is controversial.<ref name=Lancet11/>

### Aspiration[[edit](/index.php?title=(none)&action=edit&section=28)]

In general, [aspiration pneumonitis](/wiki/Chemical_pneumonitis) is treated conservatively with antibiotics indicated only for [aspiration pneumonia](/wiki/Aspiration_pneumonia).<ref name=PA2011>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> The choice of antibiotic will depend on several factors, including the suspected causative organism and whether pneumonia was acquired in the community or developed in a hospital setting. Common options include [clindamycin](/wiki/Clindamycin), a combination of a [beta-lactam antibiotic](/wiki/Beta-lactam_antibiotic) and [metronidazole](/wiki/Metronidazole), or an [aminoglycoside](/wiki/Aminoglycoside).<ref name=OConnor> [Template:Cite journal](/wiki/Template:Cite_journal)</ref> [Corticosteroids](/wiki/Corticosteroid) are sometimes used in aspiration pneumonia, but there is limited evidence to support their effectiveness.<ref name=PA2011/>

## Prognosis[[edit](/index.php?title=(none)&action=edit&section=29)]

With treatment, most types of bacterial pneumonia will stabilize in 3–6 days.<ref name=Behera2010>[Template:Cite book](/wiki/Template:Cite_book)</ref> It often takes a few weeks before most symptoms resolve.<ref name=Behera2010/> X-ray finding typically clear within four weeks and mortality is low (less than 1%).<ref name=Clinic2011/><ref name=C6/> In the elderly or people with other lung problems, recovery may take more than 12 weeks. In persons requiring hospitalization, mortality may be as high as 10%, and in those requiring intensive care it may reach 30–50%.<ref name=Clinic2011/> Pneumonia is the most common [hospital-acquired infection](/wiki/Nosocomial_infection) that causes death.<ref name=M32>Murray and Nadel (2010). Chapter 32.</ref> Before the advent of antibiotics, mortality was typically 30% in those that were hospitalized.<ref name=EBMED05/>

Complications may occur in particular in the elderly and those with underlying health problems.<ref name=C6/> This may include, among others: [empyema](/wiki/Empyema), [lung abscess](/wiki/Lung_abscess), [bronchiolitis obliterans](/wiki/Bronchiolitis_obliterans), [acute respiratory distress syndrome](/wiki/Acute_respiratory_distress_syndrome), [sepsis](/wiki/Sepsis), and worsening of underlying health problems.<ref name=C6>Cunha (2010). Pages6-18.</ref>

### Clinical prediction rules[[edit](/index.php?title=(none)&action=edit&section=30)]

Clinical prediction rules have been developed to more objectively predict outcomes of pneumonia.<ref name=M32/> These rules are often used in deciding whether or not to hospitalize the person.<ref name=M32/>

* [Pneumonia severity index](/wiki/Pneumonia_severity_index) (or *PSI Score*)<ref name=M32/>
* [CURB-65](/wiki/CURB-65) score, which takes into account the severity of symptoms, any underlying diseases, and age[[45]](#cite_note-45)

### Pleural effusion, empyema, and abscess[[edit](/index.php?title=(none)&action=edit&section=31)]

[thumb|alt=An X-ray showing a chest lying horizontal. The lower black area, which is the right lung, is smaller with a whiter area below it of a pulmonary effusion. There are red arrows marking the size of these.|A](/wiki/File:Pleural_effusion.jpg) [pleural effusion](/wiki/Pleural_effusion): as seen on chest X-ray. The A arrow indicates fluid layering in the right chest. The B arrow indicates the width of the right lung. The volume of the lung is reduced because of the collection of fluid around the lung.

In pneumonia, a [collection of fluid](/wiki/Pleural_effusion) may form in the [space that surrounds the lung](/wiki/Pleural_cavity).<ref name=Yu2011>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Occasionally, microorganisms will infect this fluid, causing an [empyema](/wiki/Pleural_empyema).<ref name=Yu2011/> To distinguish an empyema from the more common simple [parapneumonic effusion](/wiki/Parapneumonic_effusion), the fluid may be collected with a needle ([thoracentesis](/wiki/Thoracentesis)), and examined.<ref name=Yu2011/> If this shows evidence of empyema, complete drainage of the fluid is necessary, often requiring a [drainage catheter](/wiki/Chest_tube).<ref name=Yu2011/> In severe cases of empyema, [surgery](/wiki/Decortication) may be needed.<ref name=Yu2011/> If the infected fluid is not drained, the infection may persist, because antibiotics do not penetrate well into the pleural cavity. If the fluid is sterile, it must be drained only if it is causing symptoms or remains unresolved.<ref name=Yu2011/>

In rare circumstances, bacteria in the lung will form a pocket of infected fluid called a [lung abscess](/wiki/Lung_abscess).<ref name=Yu2011/> Lung abscesses can usually be seen with a chest X-ray but frequently require a chest CT scan to confirm the diagnosis.<ref name=Yu2011/> Abscesses typically occur in [aspiration pneumonia](/wiki/Aspiration_pneumonia), and often contain several types of bacteria. Long-term antibiotics are usually adequate to treat a lung abscess, but sometimes the abscess must be drained by a [surgeon](/wiki/Surgery) or [radiologist](/wiki/Interventional_radiology).<ref name=Yu2011/>

### Respiratory and circulatory failure[[edit](/index.php?title=(none)&action=edit&section=32)]

Pneumonia can cause respiratory failure by triggering [acute respiratory distress syndrome](/wiki/Acute_respiratory_distress_syndrome) (ARDS), which results from a combination of infection and inflammatory response. The lungs quickly fill with fluid and become stiff. This stiffness, combined with severe difficulties extracting oxygen due to the alveolar fluid, may require long periods of [mechanical ventilation](/wiki/Mechanical_ventilation) for survival.<ref name=M31/>

[Sepsis](/wiki/Sepsis) is a potential complication of pneumonia but occurs usually in people with poor immunity or [hyposplenism](/wiki/Hyposplenism). The organisms most commonly involved are *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Klebsiella pneumoniae*. Other causes of the symptoms should be considered such as a [myocardial infarction](/wiki/Myocardial_infarction) or a [pulmonary embolism](/wiki/Pulmonary_embolism).<ref name=C250>Cunha (2010). Pages 250–251.</ref>

## Epidemiology[[edit](/index.php?title=(none)&action=edit&section=33)]

[Template:Main](/wiki/Template:Main) [thumb|upright=1.6|alt=A map of the world with a far bit of dark-red in Africa, orange colors in parts of Asia and South America, and yellow in Europe and North America|](/wiki/File:Lower_respiratory_infections_world_map_-_DALY_-_WHO2004.svg)[Age-standardized](/wiki/Age_adjustment) death rate: [lower respiratory tract infections](/wiki/Lower_respiratory_tract_infection) per 100,000 inhabitants in 2004[[46]](#cite_note-46)[Template:Multicol](/wiki/Template:Multicol) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Multicol-break](/wiki/Template:Multicol-break) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Legend](/wiki/Template:Legend) [Template:Multicol-end](/wiki/Template:Multicol-end)

Pneumonia is a common illness affecting approximately 450 million people a year and occurring in all parts of the world.<ref name=Lancet11/> It is a major cause of death among all age groups resulting in 4 million deaths (7% of the world's total death) yearly.<ref name=Lancet11/><ref name=CochraneTx13/> Rates are greatest in children less than five, and adults older than 75 years.<ref name=Lancet11/> It occurs about five times more frequently in the [developing world](/wiki/Developing_world) than in the [developed world](/wiki/Developed_world).<ref name=Lancet11/> Viral pneumonia accounts for about 200 million cases.<ref name=Lancet11/> In the United States, as of 2009, pneumonia is the 8th leading cause of death.<ref name=Clinic2011>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>

### Children[[edit](/index.php?title=(none)&action=edit&section=34)]

In 2008, pneumonia occurred in approximately 156 million children (151 million in the developing world and 5 million in the developed world).<ref name=Lancet11/> In 2010, it resulted in 1.3 million deaths, or 18% of all deaths in those under five years, of which 95% occurred in the developing world.<ref name=Lancet11/><ref name=Develop11>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>[[47]](#cite_note-47) Countries with the greatest burden of disease include India (43 million), China (21 million) and Pakistan (10 million).[[48]](#cite_note-48) It is the leading cause of death among children in [low income countries](/wiki/Low_income_countries).<ref name=Lancet11/><ref name=CochraneTx13/> Many of these deaths occur in the [newborn](/wiki/Neonatal) period. The [World Health Organization](/wiki/World_Health_Organization) estimates that one in three newborn infant deaths is due to pneumonia.<ref name=garenne>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Approximately half of these deaths can be prevented, as they are caused by the bacteria for which an effective vaccine is available.[[49]](#cite_note-49) In 2011, pneumonia was the most common reason for admission to the hospital after an emergency department visit in the U.S. for infants and children.[[50]](#cite_note-50)

## History[[edit](/index.php?title=(none)&action=edit&section=35)]

[thumb|upright|alt=A poster with a shark in the middle of it, which reads "Pneumonia Strikes Like a Man Eating Shark Led by its Pilot Fish the Common Cold"|left|](/wiki/File:WPA_Pneumonia_Poster.jpg)[WPA](/wiki/Works_Progress_Administration) poster, 1936/1937

Pneumonia has been a common disease throughout human history.<ref name=History03>[Template:Cite book](/wiki/Template:Cite_book)</ref> The symptoms were described by [Hippocrates](/wiki/Hippocrates) (c. 460 BC – 370 BC):<ref name=History03/> "Peripneumonia, and pleuritic affections, are to be thus observed: If the fever be acute, and if there be pains on either side, or in both, and if expiration be if cough be present, and the sputa expectorated be of a blond or livid color, or likewise thin, frothy, and florid, or having any other character different from the common... When pneumonia is at its height, the case is beyond remedy if he is not purged, and it is bad if he has dyspnoea, and urine that is thin and acrid, and if sweats come out about the neck and head, for such sweats are bad, as proceeding from the suffocation, rales, and the violence of the disease which is obtaining the upper hand."<ref name=hippo>Hippocrates *On Acute Diseases* [wikisource link](/wiki/S:On_Regimen_in_Acute_Diseases)</ref> However, Hippocrates referred to pneumonia as a disease "named by the ancients". He also reported the results of surgical drainage of empyemas. [Maimonides](/wiki/Maimonides) (1135–1204 AD) observed: "The basic symptoms that occur in pneumonia and that are never lacking are as follows: acute fever, sticking [pleuritic](/wiki/Pleuritic) pain in the side, short rapid breaths, serrated [pulse](/wiki/Pulse) and cough."<ref name=maimo>Maimonides, *Fusul Musa* ("*Pirkei Moshe*").</ref> This clinical description is quite similar to those found in modern textbooks, and it reflected the extent of medical knowledge through the [Middle Ages](/wiki/Middle_Ages) into the 19th century.

[Edwin Klebs](/wiki/Edwin_Klebs) was the first to observe bacteria in the airways of persons having died of pneumonia in 1875.<ref name=klebs>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Initial work identifying the two common bacterial causes, *Streptococcus pneumoniae* and *Klebsiella pneumoniae*, was performed by [Carl Friedländer](/wiki/Carl_Friedländer)<ref name=fried>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> and [Albert Fränkel](/wiki/Albert_Fränkel_(1848-1916))<ref name=fraenkel>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> in 1882 and 1884, respectively. Friedländer's initial work introduced the [Gram stain](/wiki/Gram_staining), a fundamental laboratory test still used today to identify and categorize bacteria. [Christian Gram's](/wiki/Christian_Gram) paper describing the procedure in 1884 helped to differentiate the two bacteria, and showed that pneumonia could be caused by more than one microorganism.<ref name=gram>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>

Sir [William Osler](/wiki/William_Osler), known as "the father of modern medicine", appreciated the death and disability caused by pneumonia, describing it as the "captain of the men of death" in 1918, as it had overtaken [tuberculosis](/wiki/Tuberculosis) as one of the leading causes of death in this time. This phrase was originally coined by [John Bunyan](/wiki/John_Bunyan) in reference to "consumption" (tuberculosis).[[51]](#cite_note-51)[[52]](#cite_note-52) Osler also described pneumonia as "the old man's friend" as death was often quick and painless when there were much slower and more painful ways to die.<ref name=EBMED05/>

Several developments in the 1900s improved the outcome for those with pneumonia. With the advent of [penicillin](/wiki/Penicillin) and other antibiotics, modern surgical techniques, and intensive care in the 20th century, mortality from pneumonia, which had approached 30%, dropped precipitously in the developed world. Vaccination of infants against [*Haemophilus influenzae*](/wiki/Haemophilus_influenzae) type B began in 1988 and led to a dramatic decline in cases shortly thereafter.<ref name=adams>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> Vaccination against *Streptococcus pneumoniae* in adults began in 1977, and in children in 2000, resulting in a similar decline.<ref name=whit>[Template:Cite journal](/wiki/Template:Cite_journal)</ref>

## Society and culture[[edit](/index.php?title=(none)&action=edit&section=36)]

[Template:See also](/wiki/Template:See_also)

### Awareness[[edit](/index.php?title=(none)&action=edit&section=37)]

Due to the relatively low awareness of the disease, 12 November was declared as the annual [World Pneumonia Day](/wiki/World_Pneumonia_Day), a day for concerned citizens and policy makers to take action against the disease, in 2009.[[53]](#cite_note-53)[[54]](#cite_note-54)

### Costs[[edit](/index.php?title=(none)&action=edit&section=38)]

The global economic cost of community-acquired pneumonia has been estimated at $17 billion annually.<ref name=Clinic2011/> Other estimates are considerably higher. In 2012 the estimated aggregate costs of treating pneumonia in the United States were $20 billion;[[55]](#cite_note-55) the median cost of a single pneumonia-related hospitalization is over $15,000.[[56]](#cite_note-56) According to data released by the [Centers for Medicare and Medicaid Services](/wiki/Centers_for_Medicare_and_Medicaid_Services), average 2012 hospital charges for inpatient treatment of uncomplicated pneumonia in the U.S. were $24,549 and ranged as high as $124,000. The average cost of an emergency room consult for pneumonia was $943 and the average cost for medication was $66.[[57]](#cite_note-57) Aggregate annual costs of treating pneumonia in Europe have been estimated at €10 billion.[[58]](#cite_note-58)

## References[[edit](/index.php?title=(none)&action=edit&section=39)]

[Template:Research help](/wiki/Template:Research_help) [Template:Reflist](/wiki/Template:Reflist) **Bibliography** [Template:Refbegin](/wiki/Template:Refbegin)

* [Template:Cite book](/wiki/Template:Cite_book)
* [Template:Cite book](/wiki/Template:Cite_book)

[Template:Refend](/wiki/Template:Refend)

## External links[[edit](/index.php?title=(none)&action=edit&section=40)]

* [Template:Dmoz](/wiki/Template:Dmoz)

[Template:Pneumonia](/wiki/Template:Pneumonia) [Template:Good article](/wiki/Template:Good_article) [Template:Authority control](/wiki/Template:Authority_control)

[Category:Pneumonia](/wiki/Category:Pneumonia) [Category:Infectious diseases](/wiki/Category:Infectious_diseases) [Category:Respiratory and cardiovascular disorders specific to the perinatal period](/wiki/Category:Respiratory_and_cardiovascular_disorders_specific_to_the_perinatal_period) [Category:Articles containing video clips](/wiki/Category:Articles_containing_video_clips) [Category:RTT(full)](/wiki/Category:RTT(full))