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Definition

Pneumonia is swelling (inflammation) of the tissue in one or both lungs. It is usually caused by a bacterial infection. It can also be caused by a virus, such as coronavirus (COVID-19) or a fungus.¹

Pneumonia that develops in the community is known as community-acquired pneumonia (CAP). At the time of writing, COVID-19 has become an important differential for when diagnosing CAP and has increased the incidence of pneumonia.⁹

Pneumonia that develops in a hospital setting is known as hospital-acquired pneumonia (HAP). HAP is defined as a pneumonia developing 48 hours or more after hospital admission.²

Ventilator-associated pneumonia (VAP) may occur in those being supported by mechanical ventilation.

Aspiration pneumonia can occur when the stomach's contents, food, drink or saliva are inhaled. This can occur for example when people are sedated, have an unsafe swallow, suffer from a seizure or are unconscious. For more information on dysphagia in the elderly and those with learning disabilities, and how this can lead to pneumonia, access Public Health England's **Swallowing difficulties (dysphagia)** guidance.

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Prevalence and incidence

One of the more serious respiratory tract infections, pneumonia affects 8 in 1000 adults each year.¹ Between 5 and 12 percent of the adults that present to a GP with lower respiratory tract infection (LRTI) symptoms are diagnosed with CAP; of these, 22 to 42 percent are admitted to hospital. Between 1.2 percent and 10 percent of adults admitted to hospital with community-acquired pneumonia are managed in an intensive care unit, and for these patients, the risk of dying is over 30 percent.¹²

HAP infections affect 1.5 percent of inpatients in England at any time and more than half are cases of HAP not associated with intubation.²

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Signs and symptoms

Oxygen saturation should be assessed if COVID-19 is suspected, to be able to rule it out.

Common symptoms include:

- cough – productive or unproductive
- breathing difficulties and breathlessness
- tachycardia (increased heartrate)
- fever (usually above 38.5°C)
- malaise (feeling generally unwell)
- sweating and shivering
- reduced appetite
- chest pain

Less common symptoms include:

- confusion and disorientation
- haemoptysis (coughing up blood)
- headaches
- fatigue
- nausea and vomiting
- wheeze
- joint and muscle pain

To hear a patient talking about their experience of pneumonia, watch the following video:

NHS Choices - Pneumonia: Simon's story

Pneumonia: Simon's story



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Causes/risk factors

Causes

The most common cause of pneumonia is bacterial infection.

In CAP, *Streptococcus pneumoniae* (which cause pneumococcal pneumonia) and *Haemophilus influenzae* have been reported as the most commonly identified organisms.³ *Legionella* species and *Staphylococcus aureus* are identified more frequently in patients who need intensive care unit (ICU) management.³

There are a wide range of organisms associated with HAP, and the longer a person is in hospital, the wider the spectrum of likely causative organisms and the more likely they are to be multiple-drug resistant.⁴

Risk factors

Risk factors for CAP include the following lifestyle factors:

- smoking

- alcohol abuse
- being underweight
- regular contact with children

and underlying medical conditions:

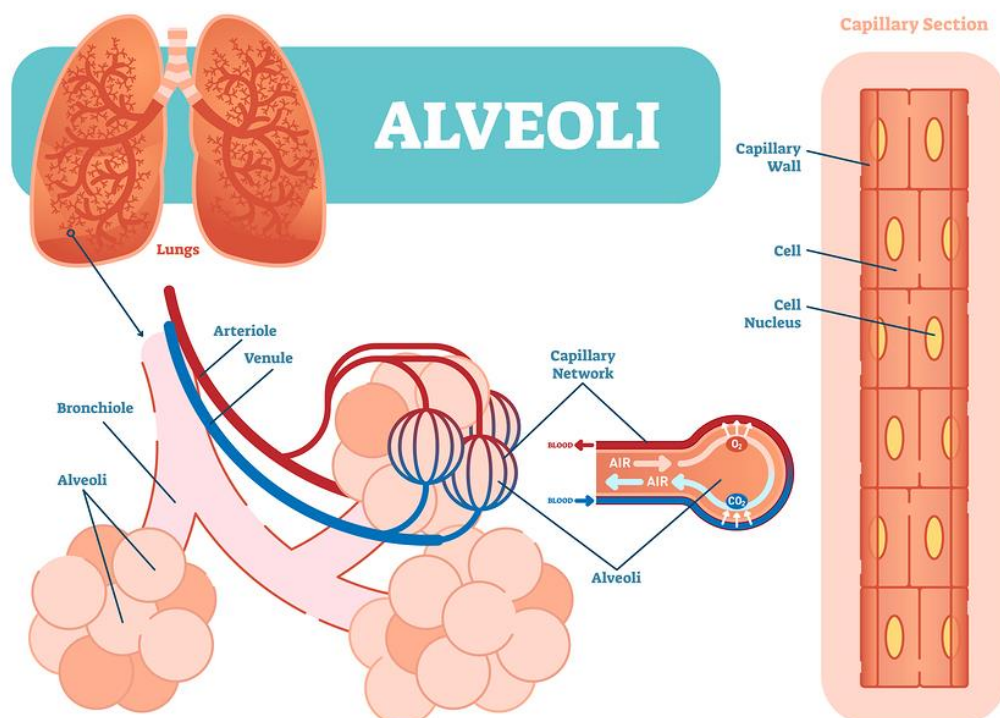
- chronic respiratory or cardiovascular diseases
- cerebrovascular disease
- epilepsy
- **dementia**
- **dysphagia**
- human immunodeficiency virus (HIV)
- **chronic kidney** or liver disease.⁵

A large risk factor for pneumonia is mechanical ventilation, which is classified as ventilator-associated pneumonia (VAP); this is considered distinct from HAP. Additionally, prior courses of antibiotics and inadequate antimicrobial therapy increase the risk of acquiring multidrug-resistant HAP. Therefore, pharmacy professionals have an important role in antimicrobial stewardship.

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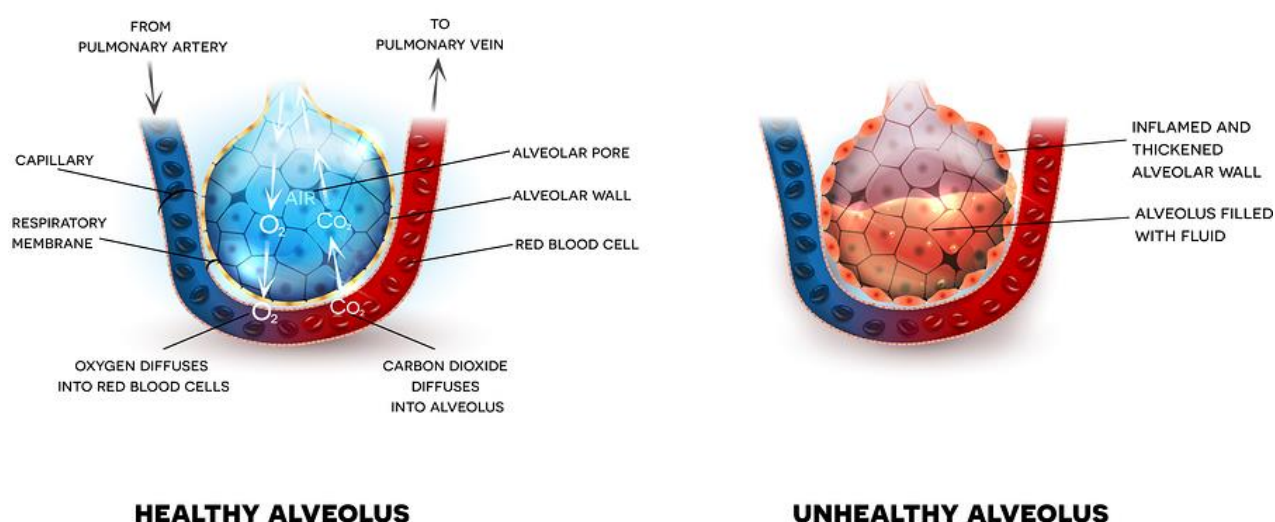
Pathophysiology (mechanism of disease)

Pneumonia affects the alveoli of the lung – the small air-filled sacs.



As with all infections, the mechanism of disease is complex. In simple terms, when pathogenic (disease causing) microorganisms enter the lungs, they stimulate a person's immune system; this is a normal process. White blood cells called macrophages detect the microorganism and release signals called cytokines. The cytokines cause the capillaries in the alveoli to become dilated, leading to inflammation of the alveolar wall and leakage of fluid and protein into the alveoli. Cytokines also attract another type of white blood cell – neutrophils – which pass into the alveolar sacs through the leaky capillaries. When a person's immune system is unable to clear the infection, this process causes pus to build up in the alveoli.

PNEUMONIA



When the alveoli fill with pus, this reduces their ability to successfully transfer oxygen from the air to the blood and carbon dioxide from the blood to the air in a process known as gas exchange. This impairment of gas exchange causes the shortness of breath.

In addition, the inflammation of the alveoli can lead to chest pain and the presence of pus can cause a cough.

For more on the aetiology and pathophysiology of CAP, visit this *BMJ Best Practice* article **Community-acquired pneumonia** (to access this article you may need to register for a seven-day free trial).

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Prognosis and complications

The National Institute for Health and Care Excellence (NICE) states that *'Between 1.2 and 10 percent of adults admitted to hospital with CAP are managed in an intensive care unit, and for these patients the risk*

*of dying is more than 30 percent. More than half of pneumonia-related deaths occur in people older than 84 years.'*²

It has been reported that clinicians who cared for patients with **sepsis** identified the respiratory tract as the top presumed source of infection accounting for 48 percent of cases, with **urinary tract infections** coming second. It should be recognised that older people are particularly vulnerable to CAP and have impaired immunity, making them more vulnerable to developing sepsis.⁶

HAP has been found to be the most common healthcare-associated infection contributing to death and in addition to an increased mortality rate, it is estimated to increase hospital stays by seven to nine days.^{4,7}

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Diagnosis/detection

The diagnosis of CAP is made based on clinical judgement after a clinical examination and history taking. If a diagnosis is made, the CAP can then be assessed for severity using the CRB-65 score which is used to assess mortality risk in primary care.⁸

CRB-65 score is calculated by giving one point if a person has any of the following:

- C confusion (note that this relates to new onset of confusion)
- R raised respiratory rate (30 breaths per minute or more)
- B low blood pressure (diastolic 60 mmHg or less, and/or systolic less than 90 mmHg)
- 65 age 65 years or more.

A score of zero indicates a low mortality risk of less than one percent.

A score of one or two indicates intermediate mortality risk of one to ten percent.

A score of three or four indicates high mortality risk of ten percent or more.²

Those who score zero may be managed at home; scores of one or more may need hospital assessment.

Note that if oxygen saturation is measured and a saturation of 94 percent or lower is observed, this may indicate the need for urgent hospital admission.⁸ If a patient has a low O₂ saturation; consider COVID-19 as a differential diagnosis (see **NICE guidance NG191**). However, a person's clinical context and normal oxygen saturation should be taken into account. An oxygen saturation of 90 percent or less may be normal for someone who suffers from a respiratory condition such as **chronic obstructive pulmonary disease (COPD)**.

If a hospital assessment is undertaken, then blood urea nitrogen can also be measured and used as part of the CURB-65 scoring system. NICE recommends blood and sputum cultures (and potentially pneumococcal and Legionella urinary antigen test) for patients with moderate or high severity CAP.²

Note that CURB-65 is used in secondary care where U stands for urea greater than 7 mmol/litre.⁷

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Pharmacological treatment

If available, a point of care C-reactive protein test can be used in those where a clear diagnosis of CAP has not been made. This result can be used to guide antibiotic prescribing and as per NICE:

- 'Do not routinely offer antibiotic therapy if the C-reactive protein concentration is less than 20 mg/litre.
- Consider a delayed antibiotic prescription (a prescription for use at a later date if symptoms worsen) if the C-reactive protein concentration is between 20 mg/litre and 100 mg/litre.
- Offer antibiotic therapy if the C-reactive protein concentration is greater than 100 mg/litre.'¹

Antibiotic duration for CAP is five days for all severities of pneumonia. Stop antibiotic treatment after five days unless microbiological results suggest a longer course is needed or the person is not clinically stable.⁷

Low-severity CAP: a five-day course of amoxicillin (or macrolide or tetracycline in penicillin allergy), extended if symptoms do not improve after three days (fluoroquinolones and dual antibiotic therapy is not recommended).

Moderate-severity CAP: a seven to ten day course of amoxicillin **and** a macrolide for five days.

High-severity CAP: a seven to ten day course of a beta-lactamase stable beta-lactam (eg, co-amoxiclav) **and** a macrolide for five days.

Local guidance should always be consulted and followed as appropriate.

Visit NICE guideline **NG138 (CAP)** and **NG139 (HAP)** for more detailed information.

Visit the following *Journal of Antimicrobial Chemotherapy* guideline for more detailed information about the management of HAP, **Guidelines for the management of hospital-acquired pneumonia in the UK: Report of the Working Party on Hospital-Acquired Pneumonia of the British Society for antimicrobial Chemotherapy.**

Vaccination against pneumococcal disease (causing pneumococcal pneumonia) is recommended for older people, especially those aged over 65 years, the very young, and people with long-term health conditions. This is usually administered as a single vaccination, although those with an impaired immune system or disorders of the spleen may require booster doses.¹⁰ For more information on pneumococcal vaccinations, visit the NICE Clinical knowledge summary **Immunizations – pneumococcal.**

Antimicrobial stewardship

When thinking about antibiotic use it's always important to remember the need for antimicrobial stewardship. For more information on this topic, access the following resources:

Antimicrobial stewardship in long term care facilities (LTCFs) by Elizabeth Beech, NHS Improvement signposts to many useful guidance documents:

Antimicrobial stewardship in long term care facilities (LTCFs)



(Please note that the first 12 minutes relate to general antimicrobial stewardship and the remaining time concentrates on UTIs).

The slides are also available and contain hyperlinks to the resources that are discussed, ***Antimicrobial stewardship in long term care facilities – room for improvement.***

e-Learning for Healthcare's ***Antimicrobial Resistance programme*** available via CPPE's website at, ***e-Learning for Healthcare learning modules.***

Royal Pharmaceutical Society's, ***The pharmacy contribution to antimicrobial stewardship.***

PresQIPP's page on ***Antimicrobial stewardship.***

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Non-pharmacological treatment

People with pneumonia should be advised to drink plenty of fluids to avoid dehydration, and get plenty of rest to help their body recover.¹¹

Smoking cessation and alcohol consumption should also be discussed as appropriate to help reduce risk of further episodes. Smoking cessation resources can be found on the CPPE ***Smoking*** gateway page.

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Patient support

The following information can be shared with patients to help them to monitor whether their symptoms are resolving as expected.

Rate of improvement can vary, but most people who have previously been fit and well can expect that after:

‘one week – fever should have gone

four weeks – chest pain and mucus production should have substantially reduced

six weeks – cough and breathlessness should have substantially reduced

three months – most symptoms should have resolved, but you may still feel very tired (fatigue)

six months – most people will feel back to normal.¹¹

Those who are living with frailty may not return to their previous level of health.

The British Lung Foundation has a page dedicated to supporting people who have **pneumonia**.

NHS also has a dedicated **Pneumonia** page.

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Further resources

For further CPPE learning on the topic of infections, visit CPPE's **Infections** gateway page.

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External websites

CPPE is not responsible for the content of any non-CPPE websites mentioned on this page or for the accuracy of any information to be found there.

All web links were accessed on 21 January 2020.

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