

# 150 Blood Pressure

## Blood pressure

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Blood pressure (BP) is the pressure of circulating blood against the walls of blood vessels. Most of this pressure results from the heart pumping blood through the circulatory system. When used without qualification, the term "blood pressure" refers to the pressure in a brachial artery, where it is most commonly measured. Blood pressure is usually expressed in terms of the systolic pressure (maximum pressure during one heartbeat) over diastolic pressure (minimum pressure between two heartbeats) in the cardiac cycle. It is measured in millimetres of mercury (mmHg) above the surrounding atmospheric pressure, or in kilopascals (kPa). The difference between the systolic and diastolic pressures is known as pulse pressure, while the average pressure during a cardiac cycle is known as mean arterial pressure.

Blood pressure is one of the vital signs—together with respiratory rate, heart rate, oxygen saturation, and body temperature—that healthcare professionals use in evaluating a patient's health. Normal resting blood pressure in an adult is approximately 120 millimetres of mercury (16 kPa) systolic over 80 millimetres of mercury (11 kPa) diastolic, denoted as "120/80 mmHg". Globally, the average blood pressure, age standardized, has remained about the same since 1975 to the present, at approximately 127/79 mmHg in men and 122/77 mmHg in women, although these average data mask significantly diverging regional trends.

Traditionally, a health-care worker measured blood pressure non-invasively by auscultation (listening) through a stethoscope for sounds in one arm's artery as the artery is squeezed, closer to the heart, by an aneroid gauge or a mercury-tube sphygmomanometer. Auscultation is still generally considered to be the gold standard of accuracy for non-invasive blood pressure readings in clinic. However, semi-automated methods have become common, largely due to concerns about potential mercury toxicity, although cost, ease of use and applicability to ambulatory blood pressure or home blood pressure measurements have also influenced this trend. Early automated alternatives to mercury-tube sphygmomanometers were often seriously inaccurate, but modern devices validated to international standards achieve an average difference between two standardized reading methods of 5 mm Hg or less, and a standard deviation of less than 8 mm Hg. Most of these semi-automated methods measure blood pressure using oscillometry (measurement by a pressure transducer in the cuff of the device of small oscillations of intra-cuff pressure accompanying heartbeat-induced changes in the volume of each pulse).

Blood pressure is influenced by cardiac output, systemic vascular resistance, blood volume and arterial stiffness, and varies depending on person's situation, emotional state, activity and relative health or disease state. In the short term, blood pressure is regulated by baroreceptors, which act via the brain to influence the nervous and the endocrine systems.

Blood pressure that is too low is called hypotension, pressure that is consistently too high is called hypertension, and normal pressure is called normotension. Both hypertension and hypotension have many causes and may be of sudden onset or of long duration. Long-term hypertension is a risk factor for many diseases, including stroke, heart disease, and kidney failure. Long-term hypertension is more common than long-term hypotension.

## Hypertension

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Hypertension, also known as high blood pressure, is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. High blood pressure usually does not cause symptoms itself. It is, however, a major risk factor for stroke, coronary artery disease, heart failure, atrial fibrillation, peripheral arterial disease, vision loss, chronic kidney disease, and dementia. Hypertension is a major cause of premature death worldwide.

High blood pressure is classified as primary (essential) hypertension or secondary hypertension. About 90–95% of cases are primary, defined as high blood pressure due to non-specific lifestyle and genetic factors. Lifestyle factors that increase the risk include excess salt in the diet, excess body weight, smoking, physical inactivity and alcohol use. The remaining 5–10% of cases are categorized as secondary hypertension, defined as high blood pressure due to a clearly identifiable cause, such as chronic kidney disease, narrowing of the kidney arteries, an endocrine disorder, or the use of birth control pills.

Blood pressure is classified by two measurements, the systolic (first number) and diastolic (second number) pressures. For most adults, normal blood pressure at rest is within the range of 100–140 millimeters mercury (mmHg) systolic and 60–90 mmHg diastolic. For most adults, high blood pressure is present if the resting blood pressure is persistently at or above 130/80 or 140/90 mmHg. Different numbers apply to children. Ambulatory blood pressure monitoring over a 24-hour period appears more accurate than office-based blood pressure measurement.

Lifestyle changes and medications can lower blood pressure and decrease the risk of health complications. Lifestyle changes include weight loss, physical exercise, decreased salt intake, reducing alcohol intake, and a healthy diet. If lifestyle changes are not sufficient, blood pressure medications are used. Up to three medications taken concurrently can control blood pressure in 90% of people. The treatment of moderately high arterial blood pressure (defined as >160/100 mmHg) with medications is associated with an improved life expectancy. The effect of treatment of blood pressure between 130/80 mmHg and 160/100 mmHg is less clear, with some reviews finding benefit and others finding unclear benefit. High blood pressure affects 33% of the population globally. About half of all people with high blood pressure do not know that they have it. In 2019, high blood pressure was believed to have been a factor in 19% of all deaths (10.4 million globally).

### Orthostatic hypotension

*as postural hypotension, is a medical condition wherein a person's blood pressure drops when they are standing up (orthostasis) or sitting down. Primary*

Orthostatic hypotension, also known as postural hypotension, is a medical condition wherein a person's blood pressure drops when they are standing up (orthostasis) or sitting down. Primary orthostatic hypotension is also often referred to as neurogenic orthostatic hypotension. The drop in blood pressure may be sudden (vasovagal orthostatic hypotension), within 3 minutes (classic orthostatic hypotension) or gradual (delayed orthostatic hypotension). It is defined as a fall in systolic blood pressure of at least 20 mmHg or diastolic blood pressure of at least 10 mmHg after 3 minutes of standing. It occurs predominantly by delayed (or absent) constriction of the lower body blood vessels, which is normally required to maintain adequate blood pressure when changing the position to standing. As a result, blood pools in the blood vessels of the legs for a longer period, and less is returned to the heart, thereby leading to a reduced cardiac output and inadequate blood flow to the brain.

Very mild occasional orthostatic hypotension is common and can occur briefly in anyone, although it is prevalent in particular among the elderly and those with known low blood pressure. Severe drops in blood pressure can lead to fainting, with a possibility of injury. Moderate drops in blood pressure can cause confusion/inattention, delirium, and episodes of ataxia. Chronic orthostatic hypotension is associated with cerebral hypoperfusion that may accelerate the pathophysiology of dementia. Whether it is a causative factor in dementia is unclear.

The numerous possible causes for orthostatic hypotension include certain medications (e.g. alpha blockers), autonomic neuropathy, decreased blood volume, multiple system atrophy, and age-related blood-vessel stiffness.

Apart from addressing the underlying cause, orthostatic hypotension may be treated with a recommendation to increase salt and water intake (to increase the blood volume), wearing compression stockings, and sometimes medication (fludrocortisone, midodrine, or others). Salt loading (dramatic increases in salt intake) must be supervised by a doctor, as this can cause severe neurological problems if done too aggressively.

## Partial pressure

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In a mixture of gases, each constituent gas has a partial pressure which is the notional pressure of that constituent gas as if it alone occupied the entire volume of the original mixture at the same temperature. The total pressure of an ideal gas mixture is the sum of the partial pressures of the gases in the mixture (Dalton's Law).

In respiratory physiology, the partial pressure of a dissolved gas in liquid (such as oxygen in arterial blood) is also defined as the partial pressure of that gas as it would be undissolved in gas phase yet in equilibrium with the liquid. This concept is also known as blood gas tension. In this sense, the diffusion of a gas liquid is said to be driven by differences in partial pressure (not concentration). In chemistry and thermodynamics, this concept is generalized to non-ideal gases and instead called fugacity. The partial pressure of a gas is a measure of its thermodynamic activity. Gases dissolve, diffuse, and react according to their partial pressures and not according to their concentrations in a gas mixture or as a solute in solution. This general property of gases is also true in chemical reactions of gases in biology.

## Sepsis

*reduced blood flow. The presence of low blood pressure, high blood lactate, or low urine output may suggest poor blood flow. Septic shock is low blood pressure*

Sepsis is a potentially life-threatening condition that arises when the body's response to infection causes injury to its own tissues and organs.

This initial stage of sepsis is followed by suppression of the immune system. Common signs and symptoms include fever, increased heart rate, increased breathing rate, and confusion. There may also be symptoms related to a specific infection, such as a cough with pneumonia, or painful urination with a kidney infection. The very young, old, and people with a weakened immune system may not have any symptoms specific to their infection, and their body temperature may be low or normal instead of constituting a fever. Severe sepsis may cause organ dysfunction and significantly reduced blood flow. The presence of low blood pressure, high blood lactate, or low urine output may suggest poor blood flow. Septic shock is low blood pressure due to sepsis that does not improve after fluid replacement.

Sepsis is caused by many organisms including bacteria, viruses, and fungi. Common locations for the primary infection include the lungs, brain, urinary tract, skin, and abdominal organs. Risk factors include being very young or old, a weakened immune system from conditions such as cancer or diabetes, major trauma, and burns. A shortened sequential organ failure assessment score (SOFA score), known as the quick SOFA score (qSOFA), has replaced the SIRS system of diagnosis. qSOFA criteria for sepsis include at least two of the following three: increased breathing rate, change in the level of consciousness, and low blood pressure. Sepsis guidelines recommend obtaining blood cultures before starting antibiotics; however, the diagnosis does not require the blood to be infected. Medical imaging is helpful when looking for the possible location of the infection. Other potential causes of similar signs and symptoms include anaphylaxis, adrenal

insufficiency, low blood volume, heart failure, and pulmonary embolism.

Sepsis requires immediate treatment with intravenous fluids and antimicrobial medications. Ongoing care and stabilization often continues in an intensive care unit. If an adequate trial of fluid replacement is not enough to maintain blood pressure, then the use of medications that raise blood pressure becomes necessary. Mechanical ventilation and dialysis may be needed to support the function of the lungs and kidneys, respectively. A central venous catheter and arterial line may be placed for access to the bloodstream and to guide treatment. Other helpful measurements include cardiac output and superior vena cava oxygen saturation. People with sepsis need preventive measures for deep vein thrombosis, stress ulcers, and pressure ulcers unless other conditions prevent such interventions. Some people might benefit from tight control of blood sugar levels with insulin. The use of corticosteroids is controversial, with some reviews finding benefit, others not.

Disease severity partly determines the outcome. The risk of death from sepsis is as high as 30%, while for severe sepsis it is as high as 50%, and the risk of death from septic shock is 80%. Sepsis affected about 49 million people in 2017, with 11 million deaths (1 in 5 deaths worldwide). In the developed world, approximately 0.2 to 3 people per 1000 are affected by sepsis yearly. Rates of disease have been increasing. Some data indicate that sepsis is more common among men than women, however, other data show a greater prevalence of the disease among women.

#### Comparison of international blood pressure guidelines

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Guidelines on the choice of agents and how best to step up treatment for various subgroups in hypertension (high blood pressure) have changed over time and differ between countries.

Abbreviations:

#### Vital signs

*overall health. There are four primary vital signs: body temperature, blood pressure, pulse (heart rate), and breathing rate (respiratory rate), often notated*

Vital signs (also known as vitals) are a group of the four to six most crucial medical signs that indicate the status of the body's vital (life-sustaining) functions. These measurements are taken to help assess the general physical health of a person, give clues to possible diseases, and show progress toward recovery. The normal ranges for a person's vital signs vary with age, weight, gender, and overall health.

There are four primary vital signs: body temperature, blood pressure, pulse (heart rate), and breathing rate (respiratory rate), often notated as BT, BP, HR, and RR. However, depending on the clinical setting, the vital signs may include other measurements called the "fifth vital sign" or "sixth vital sign."

Early warning scores have been proposed that combine the individual values of vital signs into a single score. This was done in recognition that deteriorating vital signs often precede cardiac arrest and/or admission to the intensive care unit. Used appropriately, a rapid response team can assess and treat a deteriorating patient and prevent adverse outcomes.

#### Cerebral perfusion pressure

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Cerebral perfusion pressure, or CPP, is the net pressure gradient causing cerebral blood flow to the brain (brain perfusion). It must be maintained within narrow limits because too little pressure could cause brain tissue to become ischemic (having inadequate blood flow), and too much could raise intracranial pressure (ICP).

## Management of hypertension

*treated to achieve a blood pressure of below 140/90 mmHg to 160/100 mmHg. According to one 2003 review, reduction of the blood pressure by 5 mmHg can decrease*

Hypertension is managed using lifestyle modification and antihypertensive medications. Hypertension is usually treated to achieve a blood pressure of below 140/90 mmHg to 160/100 mmHg. According to one 2003 review, reduction of the blood pressure by 5 mmHg can decrease the risk of stroke by 34% and of ischaemic heart disease by 21% and reduce the likelihood of dementia, heart failure, and mortality from cardiovascular disease.

## Methyldopa

*for high blood pressure. It is one of the preferred treatments for high blood pressure in pregnancy. For other types of high blood pressure including*

Methyldopa, also known as L-methyl-L-DOPA and sold under the brand name Aldomet among others, is a medication used for high blood pressure. It is one of the preferred treatments for high blood pressure in pregnancy. For other types of high blood pressure including very high blood pressure resulting in symptoms other medications are typically preferred. It can be given by mouth or injection into a vein. Onset of effects is around 5 hours and they last about a day.

Common side effects include sleepiness. More severe side effects include red blood cell breakdown, liver problems, and allergic reactions. Methyldopa is in the alpha-2 adrenergic receptor agonist family of medication. It works by stimulating the brain to decrease the activity of the sympathetic nervous system.

Methyldopa was discovered in 1960. It is on the World Health Organization's List of Essential Medicines.

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