

Blood Pressure Near Redline

High blood pressure grounds pilots because of the risk of sudden incapacitation, but prompt treatment can return blood pressure to normal and put pilots back in cockpits.

BY LINDA WERFELMAN



Hypertension — consistently high blood pressure — affects more than 600 million people worldwide.¹ Most are unaware they have this serious condition, which is a primary risk factor for heart attack and stroke. As dangerous as hypertension is, if diagnosed and treated, it can be brought under control, sometimes by simple diet and lifestyle strategies.

Victims of high blood pressure often remain unaware of their problems because hypertension typically has no symptoms. Undetected, the condition persists, increasing the heart's workload and contributing to changes in the heart and other parts of the cardiovascular system that ultimately can lead to a major medical problem.

Pilots have the added concern that medical problems associated with untreated high blood pressure may cause sudden incapacitation, the International Civil Aviation Organization (ICAO) says in its *Manual of Civil Aviation Medicine*.

Blood pressure is the force of the blood as it pushes against the walls of the arteries — the

blood vessels that carry blood from the heart through other parts of the body — measured in millimeters of mercury.

Measurements of blood pressure contain two numbers: *Systolic* pressure is recorded when the heart beats (contracts), and *diastolic* pressure is recorded between beats, when the heart is at rest. When a blood pressure measurement is written or spoken, systolic pressure comes first; for example, the measurement for someone with systolic pressure of 120 millimeters of mercury and diastolic pressure of 80 millimeters of mercury is expressed as 120 over 80 (120/80).

What's Normal?

The ICAO manual says that a pilot's systolic and diastolic blood pressures “shall be within normal limits.” However, reaching a consensus about what “normal” means is difficult.

Many medical specialists now say that normal, healthy blood pressure for adults is lower than previously believed — that is, less than 120/80 — and that high blood pressure is indicated by consistent measurements of *either*

140 or higher systolic or 90 or higher diastolic, or both (Table 1). Specialists once believed that blood pressure naturally increased as people aged, but they now say that this typically is not true and that a blood pressure of 120/80 is a reasonable goal for adults of all ages.

Nevertheless, ICAO says that blood pressure readings from about 100/60 to 150/90 “appear to be reasonable as normal at any age, including the common appearance of labile [changeable] hypertension in middle age, but should not be considered as regulatory levels.”

Anthony Evans, M.D., chief of ICAO’s Aviation Medicine Section, said that “as a rule, the lower the blood pressure, the better — assuming it is not so low as to precipitate fainting, and the risk increases as pressure increases. The figure of 150/90 is a reasonable one for considering initiation of drug therapy — when the risk of side effects of medication might be acceptable in view of the reduction in the risk of a cardiovascular event.”

An individual’s blood pressure fluctuates throughout the day, depending on the type of activity being performed at a particular time and the level of excitement or nervousness. However, an individual’s blood pressure should be about the same any time he or she is sitting or standing still.

There are two types of high blood pressure. About 95 percent of all cases are *essential* — or *primary* — high blood pressure, cases for which there is no precise cause. Nevertheless, there are many contributing factors, including overweight, lack of exercise, stress and a family history of high blood pressure (see “Risk Factors,” page 52).

The remaining 5 percent are cases of *secondary* high blood pressure, a condition brought about by a disease, typically a disease involving the kidneys or adrenal glands; a complication of pregnancy; or an adverse reaction to legal or illegal drugs. Sometimes the drugs involved can appear harmless: Researchers reported in 2005 on a study that found that women who took daily high doses of over-the-counter pain relievers — acetaminophen and non-steroidal

anti-inflammatory drugs (NSAIDs) — for several years were more likely to develop high blood pressure than women who did not take the pain relievers.²

Although most people with high blood pressure experience no symptoms — and often realize that they have high blood pressure only after they suffer a heart attack or stroke — some symptoms may develop when high blood pressure becomes more advanced. These symptoms include headache — typically an ache in the back of the head, felt upon waking — dizziness, an irregular or very fast heartbeat, frequent nosebleeds, shortness of breath, weakness or fatigue.

Blood pressure is checked during almost all visits to a health care provider with a medical instrument called a sphygmomanometer. The sphygmomanometer functions like this: Its rubber cuff is wrapped around the upper arm and inflated, compressing a large artery in the arm and briefly stopping the flow of blood. Air in the cuff is released, and as the blood begins to pulse through the artery again, it makes a sound heard by a health care practitioner listening to the pulse through a stethoscope. The sounds continue until the pressure in the artery exceeds the pressure in the cuff. The health care practitioner records the sound’s start and stop — systolic pressure is the pressure indicated on the sphygmomanometer gauge when the first sound is heard, and diastolic pressure is the pressure indicated when the last sound is heard.

Classification of Blood Pressure Levels			
Classification	Systolic Pressure ¹		Diastolic Pressure ¹
Normal	Less than 120	and	less than 80
Pre-hypertension ²	120–139	or	80–89
Stage 1 Hypertension ²	140–159	or	90–99
Stage 2 Hypertension ²	160 or more	or	100 or more

1. Systolic pressure is recorded when the heart contracts and is higher than diastolic pressure, which is recorded when the heart relaxes. Blood pressure is expressed, in millimeters of mercury, as systolic pressure/diastolic pressure.
 2. Hypertension is consistently high blood pressure.

Source: U.S. National Heart, Lung and Blood Institute

Table 1

A single reading that indicates above-normal blood pressure is not sufficient for a diagnosis of high blood pressure. Two or more above-normal readings recorded during several weeks or several months are required before health care practitioners issue a diagnosis. Because some people have “white-coat hypertension” — an increase in blood pressure during visits to medical offices — patients sometimes are asked to monitor their blood pressure at home to provide additional information to be used in the diagnosis. Some patients also are asked to wear a monitor that records their blood pressure over a period of 24 hours or more.

If a pilot has an above-normal blood pressure reading, civil aviation authorities typically require further evaluation of his or her condition.

For example, the European Joint Aviation Authorities’ (JAA’s) *Manual of Civil Aviation Medicine* describes high blood pressure as “the most powerful and prevalent of all the coronary vascular risk factors” and says that, if a diagnosis of high blood pressure is made, the pilot should be considered temporarily unfit and issuance of a medical certificate should be delayed pending further evaluation of the pilot’s health. The evaluation should include checks of blood cholesterol, blood sugar and weight; a review of family history of high blood pressure; and a check of the patient’s history of using tobacco and alcohol, JAA says.

The U.S. Federal Aviation Administration (FAA) says that if a pilot with no known history of high blood pressure has blood pressure readings that are consistently higher than 155/95, “further investigation is required. Initially, this should consist of recording the blood pressure twice a day (morning and evening) for three consecutive days. If at least four of these six readings are 155/95 or less and the applicant is otherwise qualified, then no further action is required and the certificate can be issued.”³

However, if the three-day evaluation period confirms that the pilot has high blood pressure, treatment typically is required to stabilize his or

her blood pressure before medical certification is considered, FAA says.

Unhealthy Consequences

If high blood pressure is not controlled, a number of serious health problems can result, including the following:

- Damage to the arteries, including arteriosclerosis, the hardening and narrowing of the arteries; atherosclerosis, an accumulation of plaque — deposits of cholesterol and calcium — on the inner walls of the arteries; and aneurysm, an abnormal bulge in an artery or other blood vessel;
- Damage to the heart from the thickening of the muscle in the left ventricle, the main pumping chamber of the heart. The

Risk Factors

Many factors can contribute to high blood pressure. Some are outside an individual’s control, such as age (high blood pressure is more likely to develop as people grow older), race and ethnicity (high blood pressure is more common among blacks than people of other races) and a family history of high blood pressure.

Other risk factors are “lifestyle factors” that can be controlled. These factors include:

- Overweight;
- Lack of exercise;
- A diet containing too much fat and salt, and too many calories;
- Tobacco products;
- Excessive alcohol consumption;
- Some prescription medications (such as oral contraceptives), over-the-counter medications (such as cold medicines) and illegal drugs; and,
- Stress.

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muscle thickens as it pumps blood against the increased pressure in the arteries. In addition, because the thickened muscle may not be capable of pumping enough blood, fluid can accumulate in the lungs or the feet and legs;

- Damage to the brain from a blocked or a ruptured blood vessel in the brain, which can result in a stroke;
- Kidney damage because of weak, narrow blood vessels in the kidneys that prevent them from functioning properly; and,
- Damage to the blood vessels in the eyes, which can result in loss of vision.

In addition, people with high blood pressure often have one or more additional — and sometimes related — metabolic disorders, including high insulin levels, excess weight and abnormally high cholesterol levels. These disorders increase the likelihood of diabetes, heart disease or stroke.

Changes in Diet, Exercise May Help

High blood pressure sometimes can be reduced to normal levels with changes in diet and exercise. For many people who have only slightly elevated blood pressure, these lifestyle changes often are the only treatment required.

Reducing the amount of sodium in the diet can help to lower blood pressure, as can consumption of a low-fat, low-cholesterol diet that emphasizes fruits, vegetables, whole grains, low-fat dairy products, fish and poultry; red meat typically is considered acceptable in small amounts. In studies by the U.S. National Heart, Lung and Blood Institute (NHLBI) of more than 400 people, those who consumed this type of diet and reduced sodium intake to 1,500 milligrams a day experienced a reduction in blood pressure — in some cases, the reduction was measured within two weeks after dietary changes were implemented.^{4,5}

A program of increased physical activity typically reduces both systolic pressure and diastolic pressure by about 10 points, often

after only a few weeks. The increased activity also helps reduce weight and improve blood cholesterol levels and blood glucose levels, resulting in a reduced risk of heart attack or stroke.⁶ In fact, the American College of Sports Medicine says that people with high blood pressure who exercise and are in good physical condition have lower death rates than people with high blood pressure who are unfit. Many health care specialists recommend at least 30 minutes of exercise — walking, jogging, swimming, cycling or other aerobic activity — most days of the week.

If lifestyle changes are not sufficient to reduce blood pressure to normal levels, medication can be prescribed. Different classes of medication, in different combinations, can be used, depending on a number of factors, including other medical conditions and lifestyle issues.

In recent years, an increasing number of medications have been developed that — because of their effectiveness and relative lack of side effects — are considered acceptable for treating high blood pressure in pilots, including:

- Angiotensin-converting enzyme (ACE) inhibitors, which decrease the heart's workload by easing the flow of blood from the heart. Side effects include tiredness, flushed skin, heartburn, or swelling of the abdomen, ankles or feet;
- Angiotensin-II receptor antagonists, which act in much the same way as ACE inhibitors. Side effects are minimal;
- Calcium-channel blockers, which relax the muscles around the coronary arteries, dilate the arteries and increase the flow of blood to the heart. Side effects include a dry cough;
- Some beta blockers, which slow the heart rate and decrease blood pressure. Side effects include fatigue, cold hands and feet, weakness, dizziness and dry mouth; and,
- Thiazide diuretics and potassium-sparing diuretics, which reduce the amount of

sodium and water in the body, thus reducing blood pressure. Diuretics, which typically are less expensive than most blood pressure medications and have minimal side effects, may be more effective in lowering blood pressure.

Despite the widespread acceptability of these medications, pilots should consult an aeromedical specialist, such as a designated medical examiner, before taking the drugs and should try them first while on the ground to ensure their effectiveness and absence of side effects.

Some medications — primarily older medications initially prescribed during the 1950s and 1960s — typically are unacceptable for pilots, including centrally acting agents, which prevent the brain from sending signals to the nervous system to increase the heart rate and to narrow the blood vessels. Side effects include liver damage, some forms of hemolytic anemia (an insufficient supply of red blood cells), tiredness and dry mouth.

Before a pilot with high blood pressure can be issued a medical certificate, civil aviation authorities typically require that a cardiologist — or in some cases, a general practitioner — must confirm that the pilot's blood pressure has been stabilized for at least two weeks with an acceptable type of treatment and that the pilot has experienced no side effects. The pilot may be required to undergo subsequent examinations by a cardiologist; changes in the type or dosage of medication typically also require grounding — usually for two weeks — and reassessment. In some cases, the pilot may be restricted to flying as part of a multiple-pilot crew or with a safety pilot.

Taking anti-hypertension medicine as prescribed is important. People who stop taking the medicine or adjust dosages without a physician's approval risk an increase in blood pressure.

High blood pressure is among the most common risk factors for a number of serious medical problems, including heart attack and

stroke. With prompt treatment, either in the form of lifestyle changes or medication, blood pressure can be reduced to normal levels, and pilots can retain medical certification. ●

Notes

1. Safe Stroke Alliance for Europe (SAFE). *Stroke — A Preventable Catastrophe*. <www.safestroke.org>.
2. Brigham and Women's Hospital. *Popular Pain Killers Shown to Increase Risk of High Blood Pressure in Women*. <www.brighamandwomens.org>. The study — part of the larger Nurses Health Study — did not examine the effects of pain relievers on high blood pressure in men.
3. U.S. Federal Aviation Administration. *Hypertension*. <www.faa.gov>.
4. U.S. National Heart, Lung and Blood Institute (NHLBI). *NIH News Release: NHLBI Study Finds DASH Diet and Reduced Sodium Lowers Blood Pressure For All*. Dec. 17, 2001.
5. NHLBI. *Facts About the DASH Eating Plan*. <www.nhlbi.nih.gov>. The DASH diet also contains elements recommended as protection against other diseases, such as coronary artery disease, high cholesterol, some cancers and osteoporosis.
6. Hagberg, James M. *Exercise Your Way to Lower Blood Pressure*. <www.acsm.org>.

Further Reading From FSF Publications

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FSF Editorial Staff. "Elevated Cholesterol Levels Present Major Risk for Cardiovascular Disease." *Human Factors & Aviation Medicine* Volume 48 (May–June 2001).

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Mohler, Stanley R. "Routine Lifestyle Choices Can Reduce Performance and Increase Susceptibility to Diseases." *Human Factors & Aviation Medicine* Volume 43 (September–October 1996).