



Aviation Medical Examinations May Not Be Adequate to Ensure All-around Good Health

Although some civil aviation authority requirements for medical examinations are so thorough that they provide almost all the medical attention that an individual requires, visits to private physicians often are necessary for pilots to obtain the additional medical attention required for good health.

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FSF Editorial Staff

Aviation medical examinations are conducted to ensure that pilots are fit to perform flight duties and are unlikely to become incapacitated during flight. They are not always adequate to ensure that pilots are fit for all non-flight activities or to detect all ailments that present risks to pilots' health. In those instances, pilots may require additional examination and/or testing by private physicians.

Claus Curdt-Christiansen, M.D., chief of aviation medicine for the International Civil Aviation Organization (ICAO), said that, in countries that follow ICAO's guidelines for aviation medical examinations, "the regulatory health examination contains almost all that is needed for a good preventive health examination."¹

The scope of a preventive medical examination varies, depending on a number of factors. Medical specialists consider a person's age, personal health history and family health history before recommending what should be included in routine examinations and how frequently a medical examination and specific medical tests should be conducted.

Medical specialists no longer routinely recommend that patients undergo health examinations annually. Instead, many — including the U.S. Preventive Services Task Force — say that "the content and frequency of the periodic health exam



need to be tailored to the age, health risks and preferences of each patient."²

The task force — an independent, 10-member panel of medical specialists that was convened in 1984 to assess the most effective methods of preventing disease and promoting good health — and other medical specialists recommend that physicians counsel their patients about personal health and safety habits and that they be selective in conducting tests that once were routinely included in standardized annual medical examinations, such as chest X-rays, electrocardiograms (ECGs, also known as EKGs), urine tests and blood tests.

Typically, medical specialists recommend that, in addition to providing counseling on health matters and ensuring that immunizations are provided, routine medical examinations should include a blood pressure test, to be administered at least every two years.³

A blood pressure test is conducted after the patient sits still or lies still for about five minutes. An inflatable cuff is wrapped around the upper arm to measure systolic pressure (the highest pressure generated when the heart pumps blood through the arteries) and diastolic pressure (the lowest pressure in the arteries when the heart is at rest between heartbeats). The measurements are characterized as follows:

- Optimal measurements are those in which systolic pressure is lower than 120 millimeters of mercury (mm Hg) and diastolic pressure is less than 80 mm Hg; such a reading typically is expressed verbally as “120 over 80.” (Unusually low readings, however, should be reviewed by a physician.);
- Normal measurements are characterized by systolic pressure lower than 130 mm Hg and diastolic pressure lower than 85 mm Hg;
- High-normal measurements are those with systolic pressure from 130 mm Hg to 139 mm Hg or diastolic pressure of 85 mm Hg to 89 mm Hg. (High-normal measurements indicate an increased risk of cardiovascular disease.); and,
- High measurements are those with systolic pressure of 140 mm Hg or more or diastolic pressure of 90 mm Hg or more. (One set of measurements is not considered sufficient for a clinical diagnosis of high blood pressure. The tests are conducted on three separate days, and if the high measurements persist, high blood pressure is diagnosed.)⁴

Many medical specialists recommend that physicians conduct a cholesterol test every five years. Cholesterol is a waxy lipid substance found as one of the fats in the bloodstream (and in all cells throughout the body). The risk of heart attack and stroke increase when cholesterol is carried at elevated levels by low-density lipoprotein (LDL) in the blood and deposited in the arterial walls⁵ (see “Elevated Cholesterol Levels Present Major Risk for Cardiovascular Disease.” *Human Factors & Aviation Medicine* Volume 48 (May–June 2001).

Cholesterol tests are conducted by drawing blood and measuring the levels of total cholesterol, LDL cholesterol and high-density lipoprotein (HDL) cholesterol (known as “good” cholesterol because it lowers the risk of heart disease by removing cholesterol from the arteries and carrying it to the liver for chemical breakdown). Health authorities typically characterize the measurements as follows:

- Desirable total cholesterol levels are less than about 200 milligrams per deciliter (mg/dL; 5.17 millimoles per liter [mmol/L]) of blood;⁶
- Cholesterol levels from 200 mg/dL to 239 mg/dL (6.18 mmol/L) are borderline high; and,
- Cholesterol levels of 240 mg/dL (6.20 mmol/L) are high.⁷

For people age 50 and older, medical specialists typically recommend a colon examination to detect cancer and polyps (growths that may become cancerous) on the inside wall of the colon. For people at high risk of developing colon cancer (those with a family history of the disease), the tests may be conducted earlier. Several tests may be conducted, including:

- A fecal occult blood test, which involves laboratory examination of stool samples collected by the patient for three consecutive days. Recommendations typically are for the test to be conducted annually beginning at age 50;
- A sigmoidoscopy, in which a thin, flexible tube called a sigmoidoscope is inserted into the rectum to allow a physician to examine the lower portion of the colon. Recommendations typically are for the test to be conducted every five years for people 50 and older. The test often is conducted along with a colon X-ray, after liquid barium is introduced into the colon by enema. On X-ray photographs, the opaque barium appears white; it outlines the interior of the digestive tract and defines abnormal areas such as those containing polyps, tumors and ulcers; and,
- A colonoscopy, in which a thin flexible tube called a coloscope is inserted into the rectum to allow a physician to examine the interior of the colon. Although the procedure is similar to a sigmoidoscopy, it takes about 30 minutes (twice as long as a sigmoidoscopy) and can be uncomfortable; a mild sedative often is administered first). Recommendations are for the test to be conducted every five years to 10 years for people 50 and older.⁸ Colonoscopy has long been considered the “gold standard” in colon examination.

For men, prostate-cancer screening to detect an enlarged prostate gland or prostate cancer is recommended annually, usually beginning at age 50. Testing beginning at age 40 is recommended for those who are considered at high risk (black men and men with a family history of the disease). Men may undergo one or both of the following tests:

- A digital rectal exam (DRE), in which a physician uses a lubricated, gloved finger to feel the prostate gland and check for lumps or firmness; and,
- A prostate-specific antigen (PSA) test, in which blood is drawn to measure the amount of an antigenic protein secreted by the prostate gland. PSA levels are often elevated in men with enlarged prostate glands and in men with prostate cancer.⁹

For women, a pelvic exam is recommended to detect cysts, tumors, infections and other abnormalities in the reproductive organs. Recommendations are for the first exam to be conducted at age 18 or earlier; then, after three consecutive annual pelvic exams without abnormal findings, the exam should be conducted at least every three years. Many physicians, however, recommend that the exam be conducted more frequently, often annually.¹⁰

Typically, one element of a pelvic exam is a Pap test to detect cervical cancer and precancerous changes in the cervix. A physician inserts a cotton swab or similar device to remove cells

from the cervix for laboratory analysis. The first Pap test should be conducted no later than age 18.¹¹ After three consecutive annual Pap tests with normal results, the frequency of the test may be decreased to once every three years. Pap tests should be conducted more frequently, however, for women who have abnormal test results, who smoke or who have more than one sex partner.

Clinical breast exams to detect cancer and precancerous changes in the breasts should be conducted every three years from age 18 until age 40, when annual breast exams are recommended. Self-examination once a month also is recommended. After age 50, women should have mammograms (X-rays of breast tissue) annually to detect cancer and precancerous changes in the breasts. In some circumstances, physicians recommend mammograms for women younger than 50.¹²

Medical specialists also recommend routine dental checkups every six months or at an interval advised by a dentist for a particular patient. In addition to routine cleaning, checkups should include an exam to check for oral cancer.¹³

The following tests are among those recommended for some people, depending on their health risk factors and other circumstances:

- An ECG provides a physician with information to analyze the heart's rhythm and rate. Metal contacts are placed on the skin to measure the flow and direction of electric currents in the heart, and the information is recorded on paper. ECGs can help identify abnormal heart rhythms, inadequate blood supply to the heart muscle, inadequate oxygen supply to the heart muscle, thickening of heart muscle (which sometimes results from high blood pressure) and a thinning or absence of heart muscle (which often results from a heart attack). ECGs are conducted while the person is lying down (resting ECG) or while riding a stationary bicycle or walking on a treadmill (exercise ECGs);
- A chest X-ray provides an outline of the heart, major blood vessels and the lungs. Chest X-rays can show tuberculosis, pneumonia, lung tumors, collapsed lungs, emphysema (a disease in which the lung's air sacs become stretched and the airways are obstructed), abnormalities in the size or shape of the heart, and calcium deposits within heart tissue, which may warrant additional medical tests;
- Laboratory examination of a urine specimen to check for glucose, which may indicate the presence of diabetes mellitus (which also can be detected by blood tests). Elevated protein levels may indicate the presence of kidney disease; and,
- A test for glaucoma, a disorder involving increased pressure within the eyeball, which can lead to loss of

vision. The test typically is administered by an eye specialist, who measures intraocular pressure. The test often is recommended every three years to five years, beginning at age 39.^{14,15,16}

Pilot medical examinations include many of the recommended elements of a routine health examination.

"Small wonder, since the aim is to prevent accidents caused by health problems," Curdt-Christiansen said.¹⁷

ICAO's international standards and recommended practices (SARPs)¹⁸ for personnel licensing say that applicants for pilot medical certificates should be "physically and mentally capable" of conducting a pilot's duties, with no medical reasons that he or she would be liable to become incapacitated during flight.¹⁹

The ICAO standards, which may form the basis of medical requirements by ICAO's 188 contracting states, say that pilots shall undergo aviation medical examinations at regular intervals to assess their general physical health and mental health, vision, color perception and hearing to determine "to the extent practicable ... that no condition exists which may have a downgrading effect upon the applicant's medical fitness during the validity period of the [medical certificate]."

The ICAO standards for a Class 1 medical assessment (for a commercial pilot license, airline transport pilot license, flight engineer license or flight navigator license) include more specific requirements, including the following medical tests (see "ICAO Requirements for Class 1 Medical Assessment," page 4):

- An ECG to detect heart abnormalities before the first license is issued, at least every two years between ages 30 and 40 and at least once a year after age 40;
- A urinalysis to check for diabetes mellitus and other ailments; and,
- A chest X-ray is recommended during the initial Class 1 medical assessment and periodically during future aviation medical examinations.²⁰

The SARPs are minimum standards, and many civil aviation authorities have developed their own, more stringent requirements or alternative requirements for aviation medical examinations, based on interpretations of the SARPs.

Among them are the countries that are members of the European Joint Aviation Authorities (JAA),²¹ which requires examinations for Class 1 medical certificates to include more frequent ECGs than specified by ICAO standards, including ECGs every six months after age 50; blood tests to check cholesterol levels when a medical certificate is issued initially and again at the first examination after age 40; and blood tests at every aviation medical examination to check for anemia (a condition in which the number of red blood cells is below normal or the amount of

ICAO Requirements for Class 1 Medical Assessment

In addition to other elements of an aviation medical examination, the following are among the tests specifically required by the International Civil Aviation Organization (ICAO) for a Class 1 medical assessment of a commercial pilot:¹

- An electrocardiogram to detect abnormalities in the heart before the first issuance of a commercial pilot license, at least every two years for pilots between age 30 and age 40 and at least annually for pilots after reaching age 40;
- Blood pressure tests to ensure that blood pressure is within normal limits;
- Radiography (a chest X-ray) when necessary to determine whether an “acute disability of the lungs” or a lung disease exists. ICAO recommends that an X-ray be included in the initial chest examination and periodically in subsequent examinations;
- Urine tests to check for diabetes mellitus and any other “abnormal element considered ... to be of pathological significance”;
- Eye tests to assess the pilot’s visual acuity and perception of colors; and,
- Hearing tests using a pure-tone audiometer to detect hearing defects.♦

Note

1. International Civil Aviation Organization. *Manual of Civil Aviation Medicine*. Part I, Chapter 2: “Medical Requirements.” Second edition, 1985.

hemoglobin [the protein that carries oxygen through the blood] is below normal) and other ailments (see “JAA Requirements for Class 1 Medical Certificate,” page 5).²²

Annette Ruge, M.D., Ph.D., the JAA medical coordinator, said that the JAA’s stringent requirements for aviation medical examinations do not eliminate the need for pilots to visit private physicians.²³

After an aviation medical examination, a pilot “can assume that he is fit to fly,” Ruge said. “But there are some sicknesses that ... will not be detected [in an aviation medical examination]. ... There is a difference between regulatory medicine and health care that is the private obligation of the pilot.”

She said that the pilot should ensure that he or she visits private physicians for a number of procedures that are not included in

aviation medical examinations, such as tests for glaucoma and colorectal cancer, examinations of the prostate gland, breast exams and mammograms, and — for pilots older than 40 — tests for cholesterol.

JAA’s medical requirements in some areas are more stringent than ICAO’s because of the compromises inherent in developing a single set of standards acceptable to a number of countries with different philosophies about the purpose of an aviation medical examination, she said. When the requirements were being developed, authorities from some countries believed that the exam not only should determine whether the pilot would be fit to fly during the time period covered by his medical certification but also that the exam should help the pilot keep his medical certificate for as long as possible by including more thorough testing for early identification of risk factors that might develop into medical problems.

In the United States, the philosophy has been to ensure that the pilot is safe to fly for the period covered by the medical certification, said Warren Silberman, D.O., M.P.H., manager of the Federal Aviation Administration (FAA) Civil Aerospace Medical Institute Aerospace Medical Certification Division.²⁴

“If the [aviation medical examiner] does the exam properly, I think [the pilot] can consider himself rather healthy,” Silberman said. “But if an airman is going to not lead a good, healthy lifestyle ... they’re basically asking for trouble. The burden is on [pilots] to be taking care of [themselves].”

FAA first-class medical examinations include urinalysis to detect problems such as diabetes mellitus or kidney disease, eye tests and ear tests to detect problems with vision and hearing, blood pressure tests to detect high blood pressure; and ECGs during the first medical examination after age 35 and annually after age 40 (see “U.S. FAA Requirements for First-class Airman Medical Certificate,” page 6).²⁵ In some occurrences, if aviation medical examiners believe there is a need for further examination or testing, they can require the necessary examinations or tests; pilots with disqualifying medical conditions can request testing to provide additional information before a determination is made about their medical certification, Silberman said.

Silberman said that he consistently tells pilots that they should not expect their aviation medical exams to provide all the medical attention they require, and that they should visit private physicians for preventative testing, such as a cholesterol test; a resting ECG; a rectal exam; and a pelvic exam, a Pap test and a breast exam.

“All that [preventive medical care] is something that I think a person should do for themselves [before undergoing an aviation medical examination],” Silberman said. Other tests included in a private medical examination depend on the individual’s family medical history, personal medical history and age, he said.

In their assessment of a pilot’s health risk factors, civil aviation authorities in some countries, including members of the JAA,

use the “1 percent rule” as part of an aviation medical examination to assess the risk that a pilot will experience a sudden incapacitating event, such as a heart attack or a stroke, during the period in which the medical certification is in effect.

The concept of the 1 percent rule was developed during the 1970s and 1980s — in part during workshops convened by the U.K. Civil Aviation Authority — by specialists in aviation medicine who said that the likelihood that a pilot would suffer cardiovascular incapacitation (a heart attack or a stroke) could be determined by assessing that pilot’s risk factors, including hypertension, elevated cholesterol level and age. Theoretically, if the assessment resulted in the conclusion that a pilot had less than a 1 percent risk of experiencing cardiovascular incapacitation within the designated period, he would be issued a medical certificate — perhaps with a requirement to fly only in a multi-member crew. If the pilot had more than a 1 percent risk of experiencing cardiovascular incapacitation within the designated period, medical certification would be denied. Cases of pilots with risk factors of more than 1 percent typically have been subjected to further review by aeromedical authorities.²⁶

Curdt-Christiansen said that the 1 percent rule, which is being included in the next edition of the ICAO *Manual of Civil Aviation Medicine*, is “a good tool for flexibility” in cases in which a pilot fails to meet the requirements of the prescribed medical standards.²⁷

“I can see a point in *not* excluding someone from flying ... if it can be shown that he is not a risk to flying,” Curdt-Christiansen said.

The United States does not use the 1 percent rule. Instead, Silberman said, FAA medical personnel review the individual pilot’s case to “determine the [extent of any] risk of sudden incapacitation for this particular condition during the time the medical certificate would be active.” He said that FAA medical personnel also determine whether accident statistics contain medical information that is relevant to the pilot’s condition and decide whether tests or other medical evaluations exist that can “reliably follow an individual and give us advance warning that something bad may occur.”²⁸

JAA Requirements for Class 1 Medical Certificate

The following are among the European Joint Aviation Authorities requirements during a medical examination for a Class 1 medical certificate:¹

- A resting electrocardiogram during the examination for the first issuance of a medical certificate and again every five years until age 30, every two years until age 40, annually until age 50 and every six months thereafter;
- A cholesterol test during the examination for the first issuance of a medical certificate and again at the first examination after age 40;
- A blood pressure test to ensure that blood pressure is within normal limits;
- Radiography (a chest X-ray) during the examination for the first issuance of a medical certificate and, under some circumstances, during subsequent examinations;
- Lung function tests during the examination for the first issuance of a medical certificate and again at the first examination after age 30, every five years until age 40 and every four years thereafter;
- A blood test for anemia (a condition in which the number of red blood cells is below normal or the amount of hemoglobin [the protein that carries oxygen in the blood] is below normal);
- Electroencephalography (EEG; a procedure that measures electrical activity in the brain) during the examination for the first issuance of a medical certificate. EEGs can help identify epilepsy and other related conditions;
- A urinalysis to check for diabetes mellitus and the presence of any “abnormal element” in the urine;
- A determination that the applicant has “no medical history or clinical diagnosis of any psychiatric disease or disability, condition or disorder ... which is likely to interfere with the safe exercise of the privileges of the applicable license”;
- A comprehensive eye examination, including a measurement of intraocular pressure (which, if elevated, sometimes indicates the presence of glaucoma) during the examination for the first issuance of a medical certificate and again every five years until age 40 and every two years thereafter. Less comprehensive eye examinations are conducted during intervening examinations;
- A color-perception test;
- Ear, nose and throat examinations and a hearing test. A pure-tone audiometry test (using a device known as an audiometer, which emits sounds at specific pitches and volumes) is conducted during the examination for the first issuance of a medical certificate and again every five years until age 40 and every two years thereafter. During other examinations, hearing is tested by asking the pilot to demonstrate an understanding of conversational speech at a distance of two meters (6.6 feet) from the examiner and facing away from the examiner.♦

Note

1. Joint Aviation Authorities. *Joint Aviation Requirements (JAR-FCL 3) — Flight Crew Licensing (Medical)*. Subpart B: “Class 1 Medical Requirements.” Dec. 1, 2000.

U.S. FAA Requirements for First-class Airman Medical Certificate

The following are among U.S. Federal Aviation Administration requirements during a medical examination for a first-class airman medical certificate:¹

- An eye examination to assess the pilot's visual acuity and perception of colors and to ensure that the pilot has no condition that interferes with proper functioning of the eyes;
- A hearing examination in which the pilot demonstrates an ability to hear an average conversational voice at a distance of six feet [1.8 meters] from the examiner and facing away from the examiner or in which an audiometric speech discrimination test is administered. As an alternative, the pilot may provide acceptable results of a pure-tone audiometric test. The examination includes a determination that the pilot has no condition of the middle ear, inner ear, nose, oral cavity, pharynx, or larynx that interferes with or is aggravated by flying, interferes with clear and effective speech or is likely to result in vertigo or a disturbance of equilibrium;
- A determination that the pilot has no severe personality disorder, psychosis or bipolar (manic depressive) disorder; that the pilot has not abused alcohol or drugs for at least the preceding two years; and that the pilot has no other personality disorder, neurosis or other mental condition that could make the person unable to safely perform the duties or exercise the privileges of the airman certificate;
- A determination that the pilot does not have a history of epilepsy, a disturbance of consciousness without

medical explanation of the cause or a transient loss of control of nervous system functions without medical explanation of the cause and that the pilot has had no similar problem that would make him or her unable to safely perform the duties or exercise the privileges of the airman certificate;

- A determination that the pilot has no medical history or clinical diagnosis of heart attack, coronary heart disease that has required treatment or has been considered symptomatic or clinically significant, angina pectoris (chest pain that is a symptom of coronary heart disease), cardiac-valve replacement, permanent cardiac pacemaker or heart replacement. In addition, an electrocardiogram must be conducted to demonstrate the absence of prior heart attacks and "other clinically significant abnormality" during the first medical examination after the pilot's 35th birthday and annually after age 40; and,
- A determination that the pilot has no medical history or clinical diagnosis of diabetes mellitus requiring control by medication and no other disease, defect, limitation or medication that would make the pilot unable to safely perform the duties or exercise the privileges of the pilot certificate.♦

Note

1. U.S. Federal Aviation Administration. *Federal Aviation Regulations*. Part 67 "Medical Standards and Certification." Subpart B "First-class Airman Medical Certificate." March 19, 1996.

"If there's a 1 percent risk, we take it into consideration," Silberman said. "But FAA doesn't say, 'If there's a risk greater than 1 percent, there's no [medical] certificate.'"

Medical specialists say that pilots themselves have most of the responsibility for ensuring that they remain healthy.

Richard O. Reinhart, M.D., a senior FAA aviation medical examiner and author of several books about aviation medicine, said, "You have the best odds of staying healthy and [medically] certified if you are willing to accept the responsibility of controlling your medical status. There are many factors you alone can control for your benefit as an aviator to better the odds of maintaining satisfactory health for yourself, your employer and the [civil aviation authority.]"²⁹

Reinhart said that pilots should learn all they can about their health by scheduling a thorough medical examination — including a chest X-ray; a resting ECG; a check for blood in bowel movements; a discussion of their medical history; and tests of blood, urine, breathing, vision and hearing — with a physician who understands civil aviation authority requirements as well as medicine. Then, pilots should use the

information obtained during the medical examination to identify the factors that could increase their risk of developing serious medical problems — including hypertension (high blood pressure), elevated cholesterol levels and overweight — and work to eliminate the risk factors.

Quay Snyder, M.D., associate aeromedical adviser to the Air Line Pilots Association, International (ALPA), said that pilots — and the operators that employ them — typically "pay little attention to medical-certification needs," especially in comparison with their efforts to maintain pilot currency.³⁰

"The overall approach to medical certification by pilots and their employers is reactive, rather than the proactive approach taken toward pilot certification," Snyder said. "Pilots should take a proactive approach in optimizing their health, similar to the approach they take in maintaining their pilot certificate. Healthy lifestyle habits and preventive health examinations enhance the pilot's chances for longevity in their aviation career and maintenance of a medical certificate."

Typically, the actions required to improve health and eliminate risk factors include the following:

- Don't smoke;
- Limit consumption of alcoholic beverages;
- Maintain a healthy weight;
- Consume a healthy diet that includes a variety of foods in moderate portions — especially fruits and vegetables, whole grains and low-fat meats — and restricts consumption of fats, cholesterol, sugar and salt; and,
- Exercise. Typical recommendations are for 30 minutes of exercise on most days of the week.

“Preventive medicine and aviation medicine are intertwined and cannot be separated; nor should they be,” Curdt-Christiansen said. “In all cases, the designated medical examiner, simply because he is a doctor first and the extended arm of the licensing authority second, will always give the pilot preventive advice based on his findings at the examination.”³¹

Medical examinations conducted by civil aviation authorities may not, in themselves, ensure that pilots are in good health. Nevertheless, the examinations can provide information to help pilots — and their private doctors — evaluate their medical conditions and take action to avert future problems.♦

Notes

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