Imperial College London

Airwave Health Monitoring Study

A guide to understanding your results

In association with:

Lab Tests Online UK

A public resource on clinical lab testing from the laboratory professionals who do the testing

www.labtestsonline.org.uk

Thank you for taking part in the Airwave Health Monitoring health screening. We greatly appreciate your participation.

This brochure has two sections; the first to outline your smoking, alcohol intake, weight, fat %, waist to hip ratio, blood pressure and ECG results.

The second section is a description of the blood tests that we performed on your samples so that you can understand and interpret these results. Some participants did not have a blood test, but they can have information about the blood tests for future reference.

All blood test results are given with a **'reference range'**, which is a way of comparing your results with that of the normal range found in a healthy population. Whether your test result is within the laboratory reference range or not, it must be considered within the context of your personal circumstances, and with the benefit of your doctor's knowledge of your past medical history and the results of any other investigations performed.

A test result outside the reference range may or may not indicate a problem—it only ensures that your doctor should investigate it further. You can have an abnormal value and have nothing wrong—but your doctor should try to determine the cause.

It's possible that you fall in that 5% of **healthy** people who fall outside the reference range. In addition, there are many things that can give an ambiguous result without indicating a major problem. For example, a high blood sugar could be diet-related rather than caused by diabetes. If your doctor is unsure about the test result they may wish to repeat it. Some abnormal results may disappear on their own, especially if they are on the border of the reference range.

We want you to be informed, but we can not pretend to take the place of communication with your doctor. We want you to understand what the test is, and how it can be used but because we can't be aware of all the factors that could affect your test results, we can't interpret the results. If you need further explanation of your results, you should talk to your doctor.

For more details, please visit the following web pages:

Lab Tests Online

http://www.labtestsonline.org.uk

British Heart Foundation

http://www.bhf.org.uk/

Contents   Page

<u>Results</u>

Smoking

Background   Smoking dramatically increases the risk of heart disease, stroke, lung disease, cancer and many other diseases. Cigarettes cut short the life of the average smoker by 10 years. There is no safe level of smoking. Even just a few cigarettes a day is a major hazard to your health and those around you.

Action   If you smoke, you should stop. There are many methods to assist people to stop smoking, and your GP will be able to give you advice. Here are a few useful numbers:

- NHS Smoking helpline (7am to 11pm) – 0 800 169 0169
- Quitline – 0 800 002200

Alcohol Intake

Background   Drinking alcohol is best when you don't overdo it. A small amount of alcohol does you no harm and may actually be good for you. Large amounts of alcohol can contribute to high blood pressure, liver disease and can also make you gain weight. Alcohol is measured in **units**. **One unit** is equivalent to 1 small glass of wine, 1 single pub measure of spirits, or half a pint of beer/lager. Recommended safe limits are up to **21 units** per week for men and up to **14 units** per week for women.

Action   If your alcohol intake is high, you should cut down your alcohol intake.

Weight

Background   Being overweight should be taken seriously. As your weight increases, the heart has to work harder and the risk of heart disease increases. Being overweight also increases the risk of other diseases such as diabetes and high blood pressure. People come in all sizes; the correct weight for a tall person is greater than for a shorter person. You therefore need to know whether you are the correct weight for your height. Your **Body Mass Index (BMI)** gives you this information. If your BMI is between 18.5 and 25 you are the correct weight for your height.

Action   If you are overweight, you may want to discuss weight reduction strategies with your GP.

Waist-Hip Ratio (WHR)

Background   WHR is the ratio of the circumference of the waist to that of the hips. The measurement determines how weight is distributed in the centre of the body. A WHR of 0.8 or less for women and 0.9 or less for men have been shown to confer health benefits, with less susceptibility to major diseases such as Diabetes and Cardiovascular disorders.

Action   If your WHR is greater than the cut-off value, you may want to discuss your results with your GP.

Fat%

Background   Body fat percentage is the proportion of total fat in a person's body. For example, if you weigh 100Kg and have a recording of 10% fat, this means that your body consists of 10 Kg fat and 90 Kg of lean body mass (including bone, muscle, organ tissue, blood and water).

                        A certain amount of fat is essential for bodily functions. Fat regulates body temperature, cushions and insulates organs and tissues and is the main form in which energy is stored in the body.

Action   If your fat percentage is more than the range indicated, you may want to discuss weight reduction activities and your dietary habits with your GP.

Blood Pressure

Background   Your blood pressure is constantly changing depending upon, for example, whether you are resting, exercised or stressed. There is, therefore, a normal range for blood pressure and not just a single value. In a healthy adult the blood pressure reading should be less than 140/90 mm Hg (but should be less than 130/80 mm Hg if you have diabetes). As your blood pressure can become high at any

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time in life, the only way of making sure that it remains within the normal range is to have it checked regularly. Many factors are known to contribute to developing high blood pressure. The most important are being overweight, unfit, or adding a lot of salt to food. High blood pressure is dangerous, and if untreated can increase the risk of heart disease and strokes.

Action   If the blood pressure we measured was over 140/90 mm Hg, you should have it re-checked by your GP.

Electrocardiogram (ECG)

Background   The electrocardiogram (ECG) is a non-invasive test that is used to reflect underlying heart conditions by measuring the electrical activity of the heart. By positioning electrodes (electrical sensing devices) on the body in standardized locations, information about many heart conditions can be learned by looking for characteristic patterns on the ECG print-out. For instance, the ECG can show the heart's rate and rhythm, detect decreased blood flow, enlargement of the heart, or the presence of either current or past heart attacks.

Action   Your feedback letter may advise you to speak to your GP about your result. A copy of your ECG will be sent to your GP if you have given consent and an accurate GP address. Your GP is best placed to advise you on the significance of any findings in the light of your own personal history.

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Blood Tests

Urea

Why get tested?	To evaluate kidney function.
What is being tested?	Urea is produced when protein is broken down by the body. Healthy kidneys eliminate more than 90% of the urea the body produces, so blood levels indicate how well your kidneys are working.
What does the test result mean?	High urea levels suggest impaired kidney function. This may be due to acute or chronic kidney disease. However, there are many things besides kidney disease that can affect urea levels such as decreased blood flow to the kidneys as in congestive heart failure, shock, stress, recent heart attack or severe burns; bleeding from the gastrointestinal tract; conditions that cause obstruction of urine flow; or dehydration.

Low urea levels are not common and are not usually a cause for concern. They can be seen in severe liver disease or malnutrition but are not used to diagnose or monitor these conditions. Low urea is also normally seen in pregnancy especially in latter months when the fetus is using large amounts of protein for growth. |
| **Is there anything else I should know?** | Urea levels increase with age and also with the amount of protein in your diet. High-protein diets may cause abnormally high urea levels. Very low-protein diets can cause abnormally low urea. |

Creatinine

Why get tested?	To determine if your kidneys work normally and to monitor treatment for kidney disease.
What is being tested?	Creatinine is produced in your muscles when a compound called creatine spontaneously breaks down. Creatine is used in a process in body cells to produce the energy needed to contract muscles and it is produced at a relatively constant rate. Almost all creatinine is excreted by the kidneys, so blood levels are a good measure of how well your kidneys are working.

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What does the test result mean?	Increased creatinine levels in the blood suggest diseases that affect kidney function. These can include:

- Glomerulonephritis (swelling of the kidney's blood vessels);
- Pyelonephritis (pus-forming infection of the kidneys);
- acute tubular necrosis (death of cells in the kidneys' small tubes);
- urinary tract obstruction; or
- Reduced blood flow to the kidney due to shock, dehydration, congestive heart failure, atherosclerosis, or complications of diabetes.

Creatinine can also increase as a result of muscle injury. Low levels of creatinine are not common and are not usually a cause for concern. As creatinine levels are related to the amount of muscle the person has, low levels may be a consequence of decreased muscle mass (such as in the elderly), but may also be occasionally found in advanced liver disease.

Total Cholesterol

Why get tested?	To screen for risk of developing heart disease. Cholesterol is different from most tests in that it is not always used to diagnose or monitor a disease but is used to estimate risk of developing a disease — specifically heart disease. Because high blood cholesterol has been associated with hardening of the arteries, heart disease and a raised risk of death from heart attacks, cholesterol testing is considered a routine part of preventive health care.
What is being tested?	Cholesterol is a substance that is essential for life. It forms the membranes for cells in all organs and tissues in your body. It is used to make hormones that are essential for development, growth and reproduction. It forms bile acids that are needed to absorb nutrients from food. A small amount of your body's cholesterol circulates in the blood in complex particles called lipoproteins. These lipoproteins include some particles that carry excess cholesterol away for disposal (see HDL, good cholesterol) and some particles that deposit cholesterol in tissues and organs (LDL, bad cholesterol). The test for cholesterol measures

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all cholesterol (good and bad) that is carried in the blood by lipoproteins. Cholesterol comes from your diet, and is also made in your liver.

What does the test result mean? The cholesterol level measured in your blood will be considered along with other risk factors (i.e. high blood pressure, smoking etc.) when assessing your overall risk of developing heart disease. This overall assessment is what will be used to decide whether or not you require further treatment in the form of dietary changes or drugs to lower your cholesterol level.

If you are taking treatment to lower your cholesterol, the target is to get your total cholesterol to a value less than 5 mmol/L, with a fall of around 20-25%.

HDL (High Density Lipoprotein)

Why get tested? To determine the risk of developing heart disease. The test of HDL cholesterol is used to determine your risk of heart disease. If a high cholesterol is due to high HDL, a person is probably at low risk and further testing or treatment for high cholesterol is not advised

What is being tested? HDL is one of the classes of lipoproteins that carry cholesterol in the blood. HDL is considered to be beneficial because it removes excess cholesterol and disposes of it, hence HDL cholesterol is often termed "good" cholesterol. The test for HDL measures the amount of HDL-cholesterol in blood.

What does the test result mean? High HDL is better than low HDL. There are two ways that HDL cholesterol values are interpreted — as a percent of total cholesterol or as a measured value.

- **Measured Value**: If HDL is less than 0.9 mmol/L, there is an increased risk of heart disease. A desirable level of HDL is greater than 0.9 mmol/L and is associated with average risk of heart disease. A good level of HDL is 1.5 mmol/L or more and is associated with a less than average risk of heart disease.

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HDL should be interpreted in the context of the overall findings from the lipid profile and in consultation with your doctor about other risk factors for heart disease.

Apolipoprotein A (Apo A)

Why get tested?

To determine whether or not you have adequate levels of Apo A-I, and to help determine your risk of developing coronary heart disease (CAD).

What is being tested?

Apolipoproteins are the protein component of lipoproteins - complexes that transport lipids throughout the bloodstream. Apolipoproteins provide structural integrity to lipoproteins and shield the hydrophobic (water repellent) lipids at their center.

Most lipoproteins are cholesterol- or triglyceride-rich and carry lipids throughout the body, for uptake by cells. High-density lipoprotein (HDL - the "good" cholesterol), however, is like an empty taxi. It goes out to the tissues and picks up excess cholesterol, then transports it back to the liver. In the liver the cholesterol is either recycled for future use or excreted into bile. HDL's reverse transport is the only way that cells can get rid of excess cholesterol. It helps protect the arteries and if there is enough HDL present, it can even reverse the build up of fatty plaques in the arteries (deposits that lead to atherosclerosis and coronary artery disease).

Deficiencies in Apo A-I appear to correlate well with an increased risk of developing coronary artery disease (CAD) and peripheral vascular disease.

What does the test result mean?

An increase of Apo A-I is usually not a problem, but decreased levels are associated with low levels of HDL and decreased clearance of excess cholesterol from the body. Decreased levels of Apo A-I, along with increased concentrations of Apo B-100 (Apo B), are associated with an increased risk of coronary artery disease.

There are some genetic disorders that lead to deficiencies in Apo A-I (and therefore to low levels of HDL). People with these disorders tend to have hyperlipidemia and higher levels of low-density lipoprotein (LDL - the "bad" cholesterol). Frequently, they have accelerated rates of

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atherosclerosis (the build up of fat plaques and hardened tissue in the arteries that can lead to heart attacks, heart disease, and strokes).

Apolipoprotein B (Apo B)

Why get tested?

To help evaluate your risk of developing atherosclerotic heart disease. Apo B levels are used, along with other lipid tests, to help determine an individual's risk of developing atherosclerotic heart disease and coronary artery disease (CAD).

What is being tested?

Apolipoproteins are an essential part of lipid metabolism. They are component parts of lipoproteins - molecules that the body uses to transport lipids from ingested food in the intestines, throughout the bloodstream, to the liver, and to the body's cells. Apolipoproteins provide structural integrity to lipoproteins and protect the hydrophobic lipids (non-water absorbing lipids) at their center. They are recognized by receptors found on the surface of many of the body's cells and help bind lipoproteins to those cells to allow the transfer (uptake) of cholesterol and triglyceride from the lipoprotein into the cells.

What does the test result mean?

Elevated levels of Apo B correspond to elevated levels of LDL and are associated with an increased risk of CAD. Elevations may be due to a high fat diet and/or decreased clearing of LDL from the blood. Increased levels of Apo B are seen with hyperlipidemia and in those patients with:

- Biliary obstruction
- Diabetes
- Drugs such as: androgens, beta blockers, diuretics, progestin
- Hypothyroidism
- Nephrotic syndrome
- Pregnancy

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Apo B levels may be decreased with any condition that affects lipoprotein production, or affects its synthesis and packaging in the liver. Lower levels are seen with:

- Chronic anaemia
- Chronic pulmonary disease
- Drugs such as: oestrogen (in post menopausal women), lovastatin, simvastatin, niacin, and thyroxine
- Hyperthyroidism
- Malnutrition
- Reye syndrome
- Weight reduction
- Severe illness

GGT (Gamma GT)

Why get tested?

To screen for liver disease or alcohol abuse; and to help your doctor tell whether a raised level of alkaline phosphatase (ALP) is due to liver or bone disease.

What is being tested?

GGT is an enzyme found mainly in the liver and is normally present in low levels in the blood. When the liver is injured or the flow of bile is obstructed, the GGT level rises. It is therefore a useful marker for detecting bile duct problems.

What does the test result mean?

Your doctor is not usually concerned with low or normal levels, but they do tell him/her that it is unlikely that you have liver disease.

Raised GGT levels indicate that something is going on with your liver but not specifically what. In general, the higher the level the greater the damage to your liver. Elevated levels may be due to liver disease, but they may also be due to congestive heart failure, drinking alcohol, and use of many prescription and non-prescription drugs including non-steroidal anti-inflammatory drugs (NSAIDs), lipid-lowering drugs, antibiotics, histamine blockers (used to treat excess stomach acid production), antifungal agents,

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anticonvulsants (seizure control medications), antidepressants and hormones such as testosterone. Oral contraceptives (birth control pills) and clofibrate can decrease GGT levels.

| **Is there anything else I should know?** | Even small amounts of alcohol within 24 hours of your GGT test may cause a temporary increase in the GGT. If this occurs, your doctor may want to repeat the test to verify that it is normal. |

Smoking can also increase GGT.

Levels of GGT increase with age in women, but not in men, and are always somewhat higher in men than in women.

GGT is about twice as high in persons of African ancestry as in those of European ancestry. Several drugs increase (induce) the concentration of GGT in the blood. The increases do not indicate damage to the liver and can be considered interference.

HBA1c

Why get tested?	To monitor a person's blood sugar levels.
What is being tested?	As glucose circulates in your blood, some of it spontaneously binds to haemoglobin (the protein that carries oxygen in your red blood cells). This combination is called haemoglobin A1c (HbA1c). The amount of HbA1c formed is directly related to the amount of glucose in your blood. HbA1c levels do not change quickly since red blood cells live for 2–3 months. Because of this, the amount of HbA1c in your blood reflects the average amount of glucose in your blood during the last few months.
What does the test result mean?	A healthy person without diabetes will have an HbA1c below 7%. If you are diabetic and your HbA1c is less than 7%, it is likely that your diabetes is in good control. If your HbA1c rises above 7%, you are at increased risk of complications such as eye disease, kidney disease or nerve damage.

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Glucose

Why get tested?	To determine whether or not your blood glucose level is within normal ranges; to screen for, diagnose, and monitor diabetes, and hypoglycaemia (low blood glucose).
What is being tested?	Glucose is a simple sugar that serves as the main source of energy for the body. The brain and nervous system cells rely on glucose for energy, and can only function when glucose levels in the blood remain within a certain range. Normally blood glucose levels rise slightly after a meal, and insulin is released to lower them, with the amount of insulin released matched up with the size and content of the meal. If blood glucose levels drop too low, such as might occur in between meals or after a strenuous workout, glucagon (another hormone from the pancreas) is produced to tell the liver to release some of its glucose stores, raising the blood glucose levels. If the glucose/insulin system is working properly the amount of glucose in the blood remains fairly stable.
What does the test result mean?	Your screening test was a non-fasting (random) plasma glucose test. The result should be below 11.1 mmol/L. If your result is above this level, please consult your GP for further tests.

C-Peptide

Why get tested?	To monitor insulin production by the beta cells in the pancreas and to help determine the cause of hypoglycaemia (low blood sugar).
What is being tested?	When a patient has newly diagnosed type 1 or type 2 diabetes, C-peptide can be used to help determine how much insulin the patient's pancreas is still producing and whether or not that insulin is being used effectively. C-peptide measurements can also be used with insulin and glucose levels to help diagnose the cause of hypoglycaemia (low blood glucose) and to monitor its treatment. Symptoms of hypoglycaemia may be caused by taking too much insulin, alcohol consumption, liver kidney disease, or insulinomas (tumours of the cells in the pancreas that can produce uncontrolled amounts of insulin and C-peptide).

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What does the test result mean?	High levels of C-peptide generally indicate high levels of insulin. This may be due to excessive insulin production by the body, a response to high levels of blood glucose caused by glucose intake or insulin resistance, when the body's cells do not respond normally to insulin and so the body makes more insulin in an attempt to compensate. Low levels of C-peptide are seen when insufficient insulin is being produced by the beta cells or when production is suppressed by injected insulin. Diuretics and alcohol can also cause low levels in some cases.

High Sensitive C-Reactive Protein (hs-CRP)

Why get tested?	hs-CRP is being proposed as a method for predicting a healthy person's risk of heart attack or other heart conditions
What is being tested?	C-reactive protein (CRP) is a protein in the blood that increases when inflammation is present. CRP has been used for many years as an indicator of infection and inflammation associated with disease. Doctors now believe that atherosclerosis (fatty build-up in artery walls, also called 'hardening of the arteries') is also an inflammatory process. However, the inflammation from atherosclerosis is a low level of long-term inflammation that produces only small amounts of CRP. Therefore, the test requires higher sensitivity than previous tests in order to detect the small increases of CRP. Thus, this test is known as high-sensitivity CRP or hs-CRP.
What does the test result mean?	The results are generally interpreted on a relative scale. People with the highest values have the highest risk of heart disease and those with the lowest values have the lowest risk. If your hs-CRP level is on the high end of the normal range (more than 3.0mg/L), it may be a sign that you are at risk for cardiovascular (heart and blood vessel) disease and other heart conditions.
Is there anything else I should know?	Because hs-CRP tests measure a marker for inflammation, doctors need to know about recent medical events that may also have increased CRP levels, such as tissue injury, infections, or general inflammation from conditions like arthritis.

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Prothrombin Time (PT)

Why get tested?

To check for a bleeding disorder, liver disease or vitamin K deficiency, or to ensure clotting ability before surgery.

What is being tested?

The test measures how long it takes for your blood to begin to form clots. Prothrombin is a plasma protein produced by the liver. Clotting is caused by a series of chemical reactions, including the conversion of prothrombin to thrombin. The test used to measure this clotting factor is called Prothrombin time, Pro time or PT.

What does the test result mean?

The test result for PT depends on the method used; results will be measured in seconds. An increased Prothrombin time means that your blood is taking longer to form a clot. If you are not taking anti-coagulant drugs and your PT is prolonged, additional testing may be necessary to determine the cause.

Fibrinogen

Why get tested?

To determine whether your fibrinogen level is adequate to allow normal blood clotting, to help determine whether you have an inherited fibrinogen deficiency or abnormality. Sometimes as a non-specific marker of inflammation in the blood.

What is being tested?

Fibrinogen is a coagulation factor, a protein that is essential for blood clot formation. It is produced by the liver and released into the circulation as needed along with over 20 other clotting factors. It helps your doctor to evaluate your body's ability to form and break down blood clots. Fibrinogen may be used as a follow-up to an abnormal Prothrombin Time (PT) or activated Partial Prothrombin Time (aPTT, or PTT) and/or an episode of prolonged or unexplained bleeding.

What does the test result mean?

Fibrinogen levels are a reflection of clotting ability and activity in the body. Reduced concentrations of fibrinogen may impair the body's ability to form a stable blood clot.

Chronically low levels may be related to decreased production due to an inherited condition such as afibrinogenemia (no production), or to an acquired

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condition such as liver disease or malnutrition that leads to hypofibrinogenemia (low levels).

Fibrinogen concentrations may rise sharply in any condition that causes inflammation or tissue damage. Elevated concentrations of fibrinogen are not specific - they do not tell the doctor the cause or location of the disturbance.

RBC (Red Blood Cells)

Why get tested?	To evaluate any change in the number of red blood cells in your blood.
What is being tested?	This test counts the number of red blood cells (RBC) in a litre of blood. Red blood cells, which are made in the bone marrow, carry oxygen from the lungs to the cells and transport carbon dioxide from the cells to the lungs. Women tend to have lower RBC counts than men, and levels tend to decrease with age. When the value decreases by more than 10% of the expected normal value, the patient is said to be anaemic.
What does the test result mean?	A high RBC count may indicate congenital heart disease, dehydration, obstructive lung disease, or bone marrow over-production. A low RBC count may indicate anaemia, bleeding, kidney disease, bone marrow failure (for instance, from radiation or a tumour), malnutrition, or other causes. A low count may also indicate nutritional deficiencies of iron, folate, vitamin B12, and vitamin B6.

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WBC (White Blood Cells)

Why get tested?	If your doctor thinks that you might have an infection or allergy and to monitor treatment.
What is being tested?	The white blood cell (WBC) count indicates the number of white blood cells in a sample of blood. This count provides a clue to the presence of illness. White blood cells are made in the bone marrow and protect the body against infection and aid in the immune response. If an infection develops, white blood cells attack and destroy the bacteria causing the infection.
What does the test result mean?	An elevated number of white blood cells is called leukocytosis. This can result from bacterial infections, inflammation, leukaemia, trauma, or stress. A WBC count of 11.0–17.0 x10^9/L cells would be considered mild to moderate leukocytosis.
	A decreased WBC count is called leukopenia. It can result from many different situations, such as chemotherapy, radiation therapy, or diseases of the immune system. A count of 3.0–4.0 x 10^9/L cells would be considered mild leukopenia.

HCT (Haematocrit)

Why get tested?	This test is used to evaluate:

- anaemia (decrease of red blood cells),
- polycythaemia (increase in red blood cells),
- dehydration

What is being tested?	Hematocrit is a measurement of the proportion of blood that is made up of red blood cells. The value is expressed as a percentage or fraction of cells in blood. For example, a hematocrit value of 40% means that there are 40 milliliters of red blood cells in 100 milliliters of blood.

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What does the test result mean?	Decreased haematocrit indicates anaemia, such as that caused by iron deficiency. Further testing may be necessary to determine the exact cause of the anaemia.
	Other conditions that can result in a low haematocrit include vitamin or mineral deficiencies, recent bleeding, cirrhosis of the liver, and malignancies.
	The most common cause of increased haematocrit is dehydration, and with adequate fluid intake, the haematocrit returns to normal. However, it may reflect a condition called *polycythemia vera*—that is, when a person has more than the normal number of red blood cells. This can be due to a problem with the bone marrow or, more commonly, as compensation for inadequate lung function (the bone marrow manufacturers more red blood cells in order to carry enough oxygen throughout your body). Anytime a haematocrit is persistently high, the cause should be determined in consultation with a doctor.

Haemoglobin

Why get tested?	If you have anaemia (too few red blood cells) or polycythaemia (too many red blood cells), to assess its severity, and to monitor response to treatment
What is being tested?	This test measures the amount of haemoglobin (a protein found in red blood cells) in your blood and is a good indication of your blood's ability to carry oxygen throughout your body. Haemoglobin carries oxygen to cells from the lungs. If your haemoglobin levels are low, you have anaemia, a condition in which your body is not getting enough oxygen, causing fatigue and weakness
What does the test result mean?	Normal values in an adult are approximately 120 to 180 grams per litre (12 to 18 g/dL) of blood but are influenced by the age, sex and ethnic origin in the person. Above-normal haemoglobin levels may be the result of:

- dehydration,
- excess production of red blood cells in the bone marrow,
- severe lung disease, or
- several other conditions.

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Below-normal haemoglobin levels may be the result of:

- iron deficiency
- inherited haemoglobin defects
- bone marrow failure
- cirrhosis of the liver (during which the liver becomes scarred),
- bleeding,
- vitamin and mineral deficiencies,
- kidney disease,
- other chronic illnesses or
- cancers that affect the bone marrow

Mean Cell Volume (MCV)

Why get tested?	MCV is a good indicator of anaemia, and can help doctors narrow down what might be causing the anaemia.
What is being tested?	The MCV is a measurement of the average size of your red blood cells (RBC).
What does the test result mean?	The MCV is elevated when your RBCs are larger than normal (macrocytic), for example in anemia caused by vitamin B12 deficiency. When the MCV is decreased, your RBCs are smaller than normal (microcytic), such as is seen in iron deficiency anemia.

Mean Cell Haemoglobin (MCH) and Mean Cell Haemoglobin Concentraion (MCHC)

What is being tested?	Mean cell haemoglobin (MCH) is a calculation of the amount of oxygen-carrying haemoglobin inside your RBCs. Mean cell haemoglobin concentration (MCHC) is a calculation of the percentage of haemoglobin in the RBCs.
What does the test result mean?	Decreased values point to hypochromasia, decreased oxygen- carrying capacity because of decreased haemoglobin inside the cell. Hypochromasia is seen in iron deficiency anaemia and in thalassemia.

Platelets

Why get tested?	To diagnose a bleeding disorder or a bone marrow disease.

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What is being tested? Platelets are tiny fragments of cells made in the bone marrow and circulate in the blood. Because they are very sticky, they are the first components to be activated when there has been an injury to a blood vessel and begin the formation of a "blood clot". The platelet count is a test that determines the number of platelets in your blood.

What does the test result mean? In an adult, a normal count is about 150,000 to 400,000 platelets per microlitre of blood.

Patients who have a bone marrow disease, such as leukaemia or other cancer in the bone marrow, often experience excessive bleeding, which is generally due to a significantly decreased number of platelets (thrombocytopenia). Low number of platelets may occur in some patients with long-term bleeding problems thus reducing the supply of platelets. Individuals with an autoimmune disorder (such as lupus, where the body's immune system attacks its own organs) can cause the destruction of platelets. Patients undergoing chemotherapy may also have a decreased platelet count.

More commonly (up to 1% of the population), easy bruising or bleeding may be due to an inherited disease called von Willibrand's disease. While the platelets may be normal in number, their ability to stick together is impaired. Many cases go undiagnosed due to the mild nature of the disease; however, the more severe form can be very harmful.

Increased platelet counts (thrombocytosis) may be seen in individuals who show no significant medical problems, while others may have a more significant blood disorder problem called myeloproliferative disorder (abnormal growth of blood cell elements). Some may have a tendency to bleed due to the lack of stickiness of the platelets, yet in others, the platelets retain their stickiness but, because they are increased in number, tend to stick to each other, forming a clump that can get stuck within a blood vessel and cause damage.

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Differential White Cell Count

Why get tested?

To diagnose an illness affecting your immune system, such as an infection.

What is being tested?

There are five types of white blood cells, each with different functions: neutrophils, lymphocytes, monocytes, eosinophils and basophils. The differential reveals if these cells are present in normal proportion to one another, if one cell type is increased or decreased, or if immature or abnormal cells are present. This information is helpful in diagnosing specific types of illnesses that affect the immune system.

White blood cells are made in your bone marrow or lymphoid system. They protect your body against infection and aid your immune system. If an infection develops, white blood cells attack and destroy the bacteria or virus causing the infection.

What does the test result mean?

The results indicate the percentage of each type of white blood cell that is present:

Neutrophils can increase in response to bacterial infection, inflammatory disease, steroid medication, or more rarely leukaemia. Decreased neutrophil levels may be the result of severe infection or other conditions, such as responses to various medications or chemotherapy.
Eosinophils can increase in response to allergic disorders, inflammation of the skin, and parasitic infections. They can also occur in response to some infections or to various bone marrow malignancies.
Basophils can increase in cases of leukaemia, long-standing inflammation, the presence of a hypersensitivity reaction to food, or radiation therapy.
Lymphocytes can increase in cases of bacterial or viral infection, leukaemia, lymphoma, or radiation therapy. Decreased lymphocyte levels are common in later life but can also indicate steroid mediation, stress and lupus.
Monocyte levels can increase in certain leukaemias, in response to infection of all kinds as well as to inflammatory disorders. Decreased monocyte levels can indicate bone marrow injury or failure and some forms of leukaemia.