Blood Transfusion and Donation

What are transfusions?

A transfusion (trans-few-zhun) is putting blood or some part of it in a vein through an intravenous (IV) line.

Transfusions of blood and blood products temporarily replace parts of the blood when a person has been bleeding, or when their body can’t make enough blood. The blood usually comes from another person, called a donor. Blood transfusions save millions of lives in the United States every year.

People usually donate whole blood – blood taken right out of a vein through a needle. This whole blood may be called a unit or pint of blood, and equals about 450 milliliters or 16.7 ounces. But whole blood is rarely given as a transfusion. Blood has many parts (components), such as red blood cells, white blood cells, platelets (plate-lets), plasma, clotting factors, and small proteins. Each component does a different job. After it’s donated, whole blood is usually separated into components. This lets doctors give patients only the part they need. It also helps to get the most out of the donated blood.

Why people with cancer might need blood transfusions

People with cancer might need blood transfusions because of the cancer itself. For example:

- Some cancers (especially digestive system cancers) cause internal bleeding, which can lead to anemia (luh-nee-me-uh) from too few red blood cells; see “Red blood cell transfusions” in the next section.

- Blood cells are made in the bone marrow, the spongy center of certain bones. Cancers that start in the bone marrow (such as leukemias) or cancers that spread there from other places may crowd out normal blood-making cells, leading to low blood counts.

- People who have had cancer for some time may develop something called anemia of chronic disease. This anemia results from certain long-term medical conditions that affect the production and lifespan of red blood cells.

- Cancer can also lower blood counts by affecting organs such as the kidneys and spleen, which help keep enough cells in the blood.
Cancer treatments may also lead to the need for blood transfusions:

- Surgery to treat cancer may lead to blood loss and a need for red blood cell or platelet transfusions. (See “Red blood cell transfusions” and “Platelet transfusions” in the next section.)

- Most chemotherapy drugs affect cells in the bone marrow. This commonly leads to low blood cell counts, and can sometimes put a person at risk for life-threatening infections or bleeding.

- When radiation is used to treat a large area of the bones, it can affect the bone marrow and lead to low blood cell counts.

- Bone marrow transplant (BMT) or peripheral blood stem cell transplant (PBSCT) patients get large doses of chemotherapy and/or radiation therapy. This destroys the blood-making cells in the bone marrow. These patients often have very low blood cell counts after the procedure and need transfusions.

**Types of transfusions**

**Red blood cell transfusions**

**Red blood cell basics**

Red blood cells (RBCs) give blood its color. Their job is to carry oxygen from the lungs through the bloodstream to every part of the body. A substance in red blood cells called hemoglobin (HE-muh-glo-bin) does this. Then, the red cells bring carbon dioxide (CO$_2$) back to the lungs, where it’s removed from the body when we exhale.

Red blood cells (and all other blood cells) are normally made in the bone marrow, the soft inner part of certain bones. The production of RBCs is controlled by the kidneys. When the kidneys sense that there aren’t enough RBCs in the blood, they release a hormone called erythropoietin (eh-rith-ro-POY-uh-tin) that causes the bone marrow to make more.

**When red blood cell transfusions are used**

**Anemia**

People who have low numbers of red blood cells (RBCs) are said to have anemia (uh-nee-me-uh) or they are anemic (uh-nee-mik). People who have anemia may need RBC transfusions because they don’t have enough RBCs to carry oxygen to all of the cells in the body. (Low iron or B$_{12}$ levels are less common causes of anemia in cancer patients.)

A normal hemoglobin level is 12 to 18 g/dL; a red blood cell transfusion may be suggested if it drops below 8 g/dL. Whether you need a transfusion for anemia depends on many factors, such as how long it took for the anemia to develop and how well your body is able to cope with it. Anemia due to a sudden loss of blood will probably need to be corrected right away. Anemia that develops slowly is less likely to cause problems, because the body has time to adjust to it to some extent. If your hemoglobin level is lower than normal but you’re not dizzy, pale, or short of breath, you may not need a transfusion.
Patients who have certain heart or lung diseases may be more affected by anemia and may need transfusions even if their hemoglobin level is not very low. Other conditions that increase the need for oxygen may also require transfusions.

There are drugs that can treat anemia instead of a transfusion in some patients, but they carry different risks, work slowly, and cost a lot. For more information about anemia and how it’s treated, see our document called *Anemia in People With Cancer*.

**Surgery**

Transfusions may be given during or after surgery to make up for blood loss. Some studies have suggested patients with certain cancers, like colorectal, prostate, lung (small cell or non-small cell), and breast cancer, have worse outcomes if transfusions are given before or during surgery. The reasons for this are not clear, but transfused blood may affect the immune system in ways that may cause problems later. The information can be hard to make sense of because many of the studies only looked at people who had and hadn’t been transfused, so the groups may have started with major differences. For instance, patients who need transfusions are often sicker to start with, and they may be treated in different ways afterward. These studies need to be confirmed by careful research.

Keep in mind, too, that while it might be possible to reduce the number of transfusions, totally avoiding them can cause serious risks or even death in some people. The decision to transfuse should be made in the context of other factors as well, such as the patient’s symptoms and overall health.

**Plasma transfusions**

**Plasma basics**

Plasma is the clear, pale-yellow liquid part of blood. It contains proteins (called *clotting factors*) that help make blood clot. This is important when the body is injured because clots are needed to help seal blood vessels and stop bleeding. Plasma also contains other proteins, such as antibodies (AN-tih-bah-dees), which help fight infection.

Once plasma is separated from the red blood cells, it can be frozen and kept for up to a year. Once thawed, it’s called *fresh frozen plasma*.

Plasma can be donated in a process called *apheresis* (a-fur-REE-sis), or sometimes called *plasmapheresis* (plaz-muh-fur-REE-sis). The donor is hooked up to a machine that removes blood, separates the plasma, and puts it into a special container. The machine returns the red cells and other parts of the blood to the donor’s bloodstream.

**When plasma transfusions are used**

Plasma is commonly given to patients who are bleeding because their blood is not clotting the way it should. Cancer patients might also be given fresh frozen plasma if they have a problem called *DIC (disseminated intravascular coagulation)*. In this rare condition, all of the clotting factors in the body are used up or broken down. Signs and symptoms (such as excessive bleeding and bruising) and blood tests help the doctor identify DIC.
Platelet transfusions

Platelet basics

Platelets are fragments of cells in blood and are another important part of the clotting process. They work with the clotting factors in plasma to help prevent bleeding. Platelets come from special cells in the bone marrow called megakaryocytes. (meg-uh-KAIR-ee-oh-sites)

Platelets are usually found in the plasma, and like red blood cells, they can be separated from it. A unit of whole blood has only a small volume of platelets. It takes platelets from several units of whole blood (from different donors) to help keep a person from bleeding. A unit of platelets is defined as the amount that can be separated from a unit of whole blood.

Unlike red blood cells, platelets do not have a blood type (see “Blood types” in the section called “How blood transfusions are done”), so patients can usually get platelets from any qualified donor. For platelet transfusions, 6 to 10 units from different donors (called random donor platelets) are combined and given to adult patients at one time (they are called pooled platelets).

Platelets can also be collected by apheresis (a-fur-REE-sis). This is sometimes called plateletheresis (plate-lef-er-REE-sis). In this procedure, the donor is hooked up to a machine that removes blood, and keeps just the platelets. The rest of the blood cells and plasma are returned to the donor. Apheresis can collect enough platelets so that they don’t have to be combined with platelets from other donors. Platelets collected in this way are called single donor platelets. (You can find more information about this is in the section called “Donating blood.”)

When platelet transfusions are used

Cancer patients may need platelet transfusions if their bone marrow is not making enough. This happens when platelet-producing bone marrow cells are damaged by chemo or radiation therapy or when they are crowded out of the bone marrow by cancer cells.

A normal platelet count is about 150,000 to 400,000 platelets per cubic millimeter (mm³), depending on the lab. When platelet counts drop below a certain level (often 20,000/mm³), a patient is at risk for dangerous bleeding. Doctors may think about giving a platelet transfusion when the platelet count drops to this level or even at higher levels if a patient needs surgery or may be at risk of bleeding. If there are no signs of bleeding, a platelet transfusion may not be needed even if the platelet count is low.

Currently there is one drug, called interleukin-11 (oprelvekin or Neumega®), that doctors can give to help raise a person’s platelet counts without transfusions. Like other medicines to help blood counts, it takes time for this drug to raise the platelet counts, anywhere from 10 to 21 days.

Cryoprecipitate transfusions

Cryoprecipitate basics

Cryoprecipitate (cry-o-pre-SIP-ih-tate) is the name given to the small fraction of plasma that separates out (precipitates) when plasma is frozen and then thawed in the refrigerator. It has several of the clotting factors found in plasma, but they are concentrated in a smaller amount of
liquid. A unit of whole blood has only a small amount of cryoprecipitate, so about 8 to 10 units of cryoprecipitate (from different donors) are pooled together for one transfusion.

**When cryoprecipitate transfusions are used**

Cryoprecipitate may be given to replace several blood clotting factors such as:

- Factor VIII (missing in patients with hemophilia A)
- Von Willebrand factor (needed to help platelets work)
- Fibrinogen (a substance that can solidify into a clot)

Unless they are bleeding, people with cancer rarely need cryoprecipitate.

**White blood cell (granulocyte) transfusions**

**White blood cell basics**

Chemotherapy can damage cells in the bone marrow, and patients getting chemo often have low white blood cell (WBC) counts (the normal range is 4,000 to 10,000 per cubic millimeter [mm$^3$]).

White blood cells, especially the type called neutrophils (new-trow-fills), are very important in fighting infections. When patients have low WBC counts, doctors carefully watch the number of neutrophils or the absolute neutrophil count (ANC). People with neutropenia ([new-trow-PEEN-ee-uh] an ANC below 1,000/mm$^3$) are at risk for serious infections, even more so if the count stays low for more than a week.

**When white blood cell transfusions are used**

At one time, white blood cell transfusions were commonly given to cancer patients who could not make enough of these cells on their own or whose WBCs had been destroyed by disease or medicines. But for many reasons, such transfusions now are given rarely. For instance, it’s not clear how well the transfusions help reduce the risk of serious infections. And WBC transfusions can also cause a fever known as a febrile transfusion reaction. They can sometimes transmit infectious diseases, such as cytomegalovirus (CMV), which can be dangerous for people who have weak immune systems.

Instead of transfusing WBCs, doctors now commonly use drugs called colony-stimulating factors or growth factors to help the body make its own neutrophils:

- Granulocyte colony-stimulating factor (G-CSF), such as filgrastim (Neupogen®) and pegfilgrastim (Neulasta®)
- Granulocyte-macrophage colony-stimulating factor (GM-CSF), such as sargramostim (Leukine®)
How blood transfusions are done

A blood transfusion is given through tubing connected to a needle or fine tube (catheter) that’s in a vein. The amount and part of the blood transfused depends on what the patient needs.

First, blood tests such as a complete blood count (CBC) are done to find out if the patient’s symptoms are likely to be helped by a transfusion. A CBC measures the levels of components within the blood such as red blood cells, white blood cells, and platelets. Coagulation (clotting) tests may also be done if abnormal bleeding is a problem.

If a transfusion is needed, more blood tests must be done to find a donated blood component that closely matches the patient.

Blood types

Blood types are important when it comes to transfusions. If you get a transfusion that does not work with your blood type, your body’s immune system could fight the donated blood. This can cause a serious or even life-threatening transfusion reaction (described in the section called “Possible risks of blood transfusion”).

To be sure no mistakes are made, donated blood is carefully tested to find out what type it is. This is done when it’s taken from the donor and again once it’s received by the hospital lab. The blood bag is labeled with the type of blood it contains. When a person needs a blood transfusion, a blood sample is drawn from them and tested the same way.

All blood has the same components, but not all blood is the same. People have different blood types, which are based on substances called antigens (an-tuh-jens) on a person’s blood cells. The 2 most important antigens in blood typing are called A, B, O, and Rh.

Each person is an ABO blood type – either A, B, AB, or O – which means antigen A, antigen B, both antigens, or neither antigen is found on their blood cells. Each person also is either Rh-positive or Rh-negative (you either have Rh or you don’t). These 2 factors can be combined into 8 possible blood types:

<table>
<thead>
<tr>
<th>A positive</th>
<th>B positive</th>
<th>AB positive</th>
<th>O positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>A negative</td>
<td>B negative</td>
<td>AB negative</td>
<td>O negative</td>
</tr>
</tbody>
</table>

ABO blood types

Two antigens on blood cells (A and B) determine a person’s ABO blood type (A, B, AB, or O). In the United States, the most common blood type is O, followed closely by type A.

- If you have type O blood, you can only get type O red blood cell transfusions. But you can give your red blood cells to people with type A, B, AB, or O blood, which is why you are sometimes called a universal donor. (Universal donor blood is only used in extreme emergencies. For example, if a person is bleeding severely and nearing death, there may no time for testing. In everyday practice, people in the US are always given the exact same type of red blood cells that they have.)
• If you have type A blood, you cannot get either type B or AB red blood cells.
• If you have type B blood, you cannot get type A or AB red blood cells.
• If you have type AB blood, you can get transfusions of O, A, B, or AB red blood cells.

Rh factor

Blood is either Rh-positive or Rh-negative, depending on whether the red blood cells have Rh antigens on their surface. A person who has type A, Rh-positive blood is called A positive, whereas a person with type A, Rh-negative blood is A negative.

If you have Rh-positive blood, you can get Rh-positive or Rh-negative red blood cell transfusions. But people with Rh-negative blood should only get Rh-negative red blood cells except in extreme emergencies. This is because an Rh-positive blood transfusion can cause a person with Rh negative blood to make antibodies against the Rh factor. If an Rh-negative woman makes antibodies like this, it can harm any Rh-positive babies she may have in the future. Her anti-Rh antibodies can attack Rh-positive blood cells in the fetus.

Other antigens

There are other antigens on red blood cells that can lead to transfusion reactions. These are rare because people do not make antibodies against them unless they have had transfusions before. Still, these antigens may become a factor in matching blood for a person who has had many transfusions in the past, as is the case for some people with cancer.

Plasma, platelets, and blood type

For platelet and cryoprecipitate transfusions, matching the blood type of the donor to the recipient is usually not critical, but labs still try to match them. This may become important for patients who have already had many transfusions or who have reacted to transfusions in the past.

Antibodies and cross-matching

After blood is typed, a test called an antibody screen is done to see if a patient’s plasma contains other antibodies (AN-tih-bah-dees) besides those against A, B, and Rh. (Antibodies are made by the body in response to antigens.) If there are extra antibodies, the cross-matching may take longer. This is because some units of donor blood may not fully match the recipient’s, even though they have the same ABO and Rh types.

Before a person can get a transfusion of red blood cells, another lab test called a cross-match must be done to make sure that the donor blood is compatible with the recipient’s.

A unit of the right ABO and Rh type blood is selected, and a drop of donor red cells from the unit is mixed with a drop of plasma from the patient. The mixture is watched to see if the patient’s plasma causes the donor blood cells to clump. This may happen if the patient has extra antibodies to a protein in the donor unit. If there are no problems (no clumping), a cross-match takes about 30 minutes.

A cross-match is usually not needed for a platelet or plasma transfusion unless the platelets look like they could contain some red blood cells.
The transfusion process

Most blood transfusions are given in the hospital or in outpatient clinics. Acetaminophen (Tylenol®) and diphenhydramine (Benadryl®) are often given before a transfusion to help reduce the symptoms of minor transfusion reactions.

Red blood cell transfusions are usually started at a slow rate while the patient is watched closely for the signs and symptoms of a transfusion reaction.

The patient’s vital signs (such as temperature, heart rate, and blood pressure) are checked often. Each unit of red blood cells is usually transfused over a couple of hours, and should be completed within 4 hours. Other components, like plasma and platelets, go in much faster – smaller volumes take much less time.

A visiting nurse can give transfusions in the home if precautions are taken to be sure the patient is kept safe. Patients who get home transfusions are often very sick, not able to travel to a health care facility, and need frequent transfusions for a long time.

The same standards that apply to hospital transfusions must be followed in the home. A doctor must be sure that a patient’s heart and lung function are stable before they can be transfused at home. Emergency medical care must be available close by in case it is needed. Also, the blood must be kept at a certain temperature while being taken to the home.

Possible risks of blood transfusions

Although blood transfusions can be life-saving, they are not without risks. Infections were once the main risk, but they have become extremely rare with careful testing and donor screening. Transfusion reactions and other non-infectious problems are now more common.

When you are getting a transfusion of any kind, it’s very important that you let your nurse know right away if you notice any changes in how you feel, such as itching, shivering, headache, chest or back pain, throat tightness, nausea, dizziness, trouble breathing, or other problems. You should report any that happen in the next few days, too.

Transfusion reactions

Blood transfusions sometimes cause transfusion reactions. There are several types of reactions and some are worse than others. Some reactions happen as soon as the transfusion is started, while others take several days or even longer to develop.

Many precautions are taken before a transfusion is started to keep reactions from happening. The blood type of the unit is checked many times, and the unit is cross-matched to be sure that it matches the blood type of the person who will get it. After that, both a nurse and blood bank lab technician look at the information about the patient and the information on the unit of blood (or blood component) before it’s released. The information is double-checked once more in the patient’s presence before the transfusion is started.
**Allergic reaction**

This is the most common reaction. It happens during the transfusion when the body reacts to plasma proteins or other substances in the donated blood. Usually the only symptoms are hives and itching, which can be treated with antihistamines like diphenhydramine (Benadryl). In rare cases these reactions can be more serious.

**Febrile reaction**

The person gets a sudden fever during or within 24 hours of the transfusion. Headache, nausea, chills, or a general feeling of discomfort may come with the fever. Acetaminophen (Tylenol) may help these symptoms.

These reactions are often the body’s response to white blood cells in the donated blood. They are more common in people who have had transfusions before and in women who have been pregnant several times. Other types of reaction can also cause fever, and further testing may be needed to be sure that the reaction is only febrile.

Patients who have had febrile reactions or who are at risk for them are usually given blood products that are leukoreduced (loo-ko-re-DUCED). This means that the white blood cells have been removed by filters or other means.

**Transfusion-related acute lung injury**

Transfusion-related acute lung injury (TRALI) is a rare, but very serious transfusion reaction. It can happen with any type of transfusion, but those that contain more plasma, such as fresh frozen plasma or platelets, seem more likely to cause it. It often starts within 1 to 2 hours of starting the transfusion, but can happen anytime up to 6 hours after a transfusion. There’s also a delayed TRALI syndrome, which can begin up to 72 hours after the transfusion is given.

The main symptom of TRALI is trouble breathing, which can become life-threatening. If TRALI is suspected during the transfusion, the transfusion should be stopped right away.

Doctors now believe that several factors are involved in this illness, and medicines don’t seem to help. Many of the patients who get TRALI have had recent surgery, trauma, cancer treatment, transfusions, or have an active infection. Most of the time, TRALI goes away within 2 or 3 days if breathing and blood pressure are supported, but even with support it is deadly in 5% to 10% of cases. TRALI is more likely to be fatal if the patient was already very ill before the transfusion. Most often a patient will need oxygen, fluids, and sometimes support with a breathing machine.

Delayed TRALI has a higher risk of death, with one expert finding a death rate as high as 40%. If a patient who has had TRALI needs red blood cells, doctors may try to prevent future problems by removing most of the plasma from the red blood cells using a diluted salt water solution. Researchers are working on other ways to reduce this risk with careful donor selection and testing.

**Acute immune hemolytic reaction**

An acute hemolytic (he-mo-LIT-ik) reaction is the most serious type of transfusion reaction, but it’s very rare. It happens when donor and patient blood types do not match. The patient’s antibodies attack the transfused red blood cells, causing them to break open (hemolyze) and release harmful substances into the bloodstream.
Patients may have chills, fever, chest and lower back pain, and nausea. The kidneys may be badly damaged, and dialysis may be needed. A hemolytic reaction can be deadly if the transfusion is not stopped as soon as the reaction starts.

**Delayed hemolytic reaction**

This type of reaction happens when the body slowly attacks antigens (other than ABO antigens) on the transfused blood cells. The blood cells are broken down days or weeks after the transfusion. There are usually no symptoms, but the transfused red blood cells are destroyed and the patient’s red blood cell count falls. In rare cases, the kidneys may be affected, and treatment may be needed.

People don’t usually have this type of reaction unless they have had transfusions in the past. Those who do have this reaction need special blood tests before any more blood can be transfused. Units of blood that do not have the antigen that the body is attacking must be used.

**Graft-versus-host disease**

Graft-versus-host disease (GVHD) occurs when a person with a very weak immune system gets white blood cells in a transfused blood product. The white cells in the transfusion attack the tissues of the patient who got the blood.

This is more likely if the blood comes from a relative or someone who has the same tissue type (this is different from blood type) as the patient. The patient’s immune system doesn’t recognize the white blood cells in the transfused blood as foreign. This allows the white blood cells to survive and attack the patient’s body tissues.

Within a month of the transfusion, the patient may have fever, liver problems, rash, and diarrhea.

To prevent white blood cells from causing GVHD, donated blood can be treated with radiation before transfusion. (Radiation stops white blood cells from working but does not affect red blood cells.) These are called *irradiated blood products*. They are often used for people with cancer who might have weakened immune systems.

**Infections**

Blood transfusions can transmit infections caused by bacteria, viruses, and parasites. The chance of getting an infection from blood in the United States is extremely low, but the exact risk for each type of infection varies. Testing units of blood for germs that can cause infection has made the blood supply very safe, but no test is 100% accurate.

**Bacterial contamination**

Rarely, blood gets contaminated with tiny amounts of skin bacteria during donation. Platelets are the most likely blood component to have this problem. Because platelets must be stored at room temperature, these bacteria can grow quickly. (Other components are refrigerated or frozen.) Patients who get these platelets may develop a serious illness minutes or hours after the transfusion starts.

Blood banks routinely test platelets and destroy units of blood that are likely to cause harm. The tests are still being refined, but today fewer cases of illness are caused by platelets. Also, more
hospitals use single donor platelets, which have a lower risk of bacterial contamination than pooled platelets.

**Hepatitis B and C**

Viruses that attack the liver cause these forms of hepatitis. Hepatitis is the most common disease transmitted by blood transfusions. A 2009 study on hepatitis B in donated blood suggested that the risk is about 1 in every 800,000 units or less. About 1 blood transfusion in 1.6 million may transmit hepatitis C.

Work continues to be done to reduce the risk of these infections even further. In most cases there are no symptoms, but hepatitis can sometimes lead to liver failure and other problems.

Several steps are routinely taken to reduce the risk of hepatitis from blood transfusion. People who are getting ready to donate blood are asked questions about hepatitis risk factors and symptoms of hepatitis. Donated blood is also tested to find hepatitis B virus, hepatitis C virus, and liver problems that could be signs of other types of hepatitis.

**Human immunodeficiency virus**

Human immunodeficiency virus (HIV) causes acquired immune deficiency syndrome (AIDS). Testing each unit of donated blood for HIV began in 1985, and all donated blood is now tested for HIV.

With improved testing for HIV, the number of transfusion-related AIDS cases continues to drop. The risk of HIV transmission from a transfusion is about 1 in 2 million. Along with testing, the risk is reduced by asking donors questions about HIV risk factors and symptoms.

**Other infections**

Along with the tests noted above, all blood for transfusion is tested for syphilis, as well as HTLV-I and HTLV-II (viruses linked to human T-cell leukemia/lymphoma). Since 2003, donated blood has been tested for the West Nile virus, too. In 2007, blood banks also began testing for Chagas disease (common in South and Central America).

Diseases caused by certain bacteria, viruses, and parasites, such as babesiosis, malaria, Lyme disease, and others can also be spread by blood product transfusions. But because potential donors are screened with questions about their health status and travel, such cases are very rare.

**Alternatives to blood transfusions**

Because transfusions carry risks and because the blood supply is limited, doctors try not to transfuse if they can avoid it. In some cases, options other than blood product transfusions may be available.

**Volume expanders**

When a patient has lost a lot of fluids but does not need blood, shock may be treated or prevented by giving solutions to keep the circulation going. The most common solutions are normal saline
(sterile water with a precise amount of salt) and lactated Ringer’s solution (saline plus other chemicals). Other such solutions (called volume expanders) include albumin, hydroxyethyl starch (HES), dextrans, and purified protein fractions. All of these increase fluid volume, but do not change the number of blood cells.

Growth factors

The body naturally makes hormone-like substances called hematopoietic (he-muh-toe-poi-ET-ick) growth factors that cause the bone marrow to make more blood cells. Scientists have learned how to make some of these growth factors in the lab to help people with low blood cell counts. Growth factors can be used to boost red blood cell, white blood cell, or platelet counts.

Growth factors may help patients who would otherwise need transfusions. But they have some drawbacks that may limit their use in some cases:

- Unlike transfusions, growth factors often take many days or weeks to raise blood counts, so they may not be useful in people who need their blood cell levels raised quickly, such as those who are actively bleeding.

- People who have severe bone marrow disease may not respond to the growth factors because they do not have enough blood-producing cells in their bone marrow.

- Some growth factors might cause certain types of cancer cells (such as lymphocytic leukemia, multiple myeloma, head and neck cancer, breast cancer, cervical cancer, and some kinds of lung cancer cells) to grow more quickly.

- Growth factors generally cost a lot more than transfusions.

Because of these drawbacks, certain growth factors are not used in people whose treatment is expected to cure their cancer. And when they are used, they are given for as short a time as possible.

Intra-operative or post-operative blood salvage

Patients getting surgery sometimes need transfusions to replace blood lost during or after the operation. Sometimes this lost blood can be “salvaged” or saved by collecting it with a special machine and giving it back into the patient.

Giving a person back his or her own blood is called an autologous (aw-tahl-uh-gus) transfusion. It cuts down on the need for transfusions from other donors. But some studies have found tumor cells in blood salvaged during cancer operations, and this is not something that can be done for all patients. (Another type of autologous transfusion is described in the “Donating blood” section.)

Blood substitutes

So far, there is no real substitute for human blood. But researchers are working to develop a liquid that can carry oxygen and replace blood, at least for a short time, in certain situations.

Some products being tested can do some of the work of red blood cells, such as carrying oxygen to tissues, but cannot replace the many functions of human blood. No blood substitute has been approved by the FDA as of 2013.
Donating blood

Despite all our medical advances, there is no good man-made substitute for human blood – this is why blood donations are so important. People donate blood for different reasons – some do it for friends, family members, or even themselves. Others donate to help people they don’t even know.

Blood is usually donated at special collection centers. Some centers use vans (often called bloodmobiles) that travel to different areas to collect blood. Some larger hospitals have their own centers to collect and process donated blood. After blood is tested for safety and processed into components, it’s stored in blood banks until needed.

Keeping the blood supply safe

The US Food and Drug Administration (FDA) closely regulates blood to keep the blood supply safe. The American Association of Blood Banks also publishes guidelines for safe transfusions, which its members must follow.

In the United States, all blood centers follow careful procedures to keep the blood supply safe. Everyone who comes in to donate is asked many questions and has a chance to say whether their blood may be unsafe for any reason. Also, previous donation records and lists of ineligible donors are checked. Lab tests are done to look for blood that might transmit diseases (described in “Infections” under the section called “Possible risks of blood transfusions”). People are not allowed to donate blood if their lab tests or questionnaires show that they may be at high risk for certain diseases.

Only sterile equipment is used to collect blood. The needle used to draw blood from your vein has never been used before, and it’s thrown away right after it’s used. Donors cannot get hepatitis, HIV, or any other infections or diseases from giving blood.

Reactions from donating are rare and are almost always minor when they do happen. If you are healthy, you can donate a unit (about a pint) of blood without harm because one unit is a small part of your total blood volume. Your body will replace the lost fluid within a day, and your bone marrow will replace all of the blood cells, usually within 4 to 6 weeks. You must wait at least 8 weeks between whole blood donations. Some blood components can be donated more often.

Rules protect the donor as well as the recipient

Aside from protecting those who receive donated blood, rules are also in place to protect people who want to donate. Although guidelines can vary slightly by state and facility, for the most part donors must:

- Be healthy

- Be at least 17 years old (or 16 with parental consent)

- Weigh at least 110 pounds

- Not have donated blood within the past 8 weeks (this can be shorter for most apheresis donations)

- Not be taking antibiotics
People who are taking “blood thinners” or certain drugs that are used to treat acne, baldness, or an enlarged prostate may not be able to donate unless they’ve stopped the drug for a few days or weeks. People who have taken certain drugs for psoriasis or taken products made from human plasma or tissues may be kept from donating blood even longer. Other health and travel questions are reviewed with each donor in detail. (For a complete listing of eligibility of criteria, check the Red Cross website at www.redcrossblood.org/donating-blood/eligibility-requirements/eligibility-criteria-alphabetical-listing.)

If you are interested in donating blood, contact the American Association of Blood Banks (AABB) for a list of member institutions, or visit their online blood bank locator. You can also contact America’s Blood Centers or the American Red Cross for donation centers near you. (See the “To learn more” section for contact information.)

The donation process

Before giving blood, get a good night’s sleep, eat a well-balanced meal, and drink extra caffeine-free fluids. Many donor centers ask that you bring in a list of all the medicines you are taking and your donor card or other identification.

FDA guidelines require that before giving blood, you must register; have your blood pressure, temperature, and heart rate checked; answer health questions; and get a blood test (usually by sticking the finger for a few drops of blood). The center will have you fill out a questionnaire, asking about certain behaviors or travel that might put you at increased risk for some diseases. You must also be told details about what donating blood will be like before you decide to actually give blood.

You will sit in a reclining chair or lie on a table. An area on your arm will be cleaned, and a sterile needle put into a vein (usually where your elbow bends). Removing a unit of whole blood usually takes about 10 to 15 minutes. Apheresis donation (described in the next section called “Types of donation”) may take 2 hours or longer.

Once your blood is taken, you will be asked to stay for a short time to make sure you are feeling well. During this time you are encouraged to drink fluids (such as fruit juice) and eat a light snack before leaving.

Although you can resume normal activities soon after giving blood, some centers recommend that you have someone else drive home after you donate. You might feel tired, but this will usually only last a few hours.

Types of donations

There are several types of blood donation.

Volunteer whole blood donation

Most blood donations come as units of whole blood from volunteers who have no connection to the person who will get the blood. Once donated, the units are usually separated into components.
**Apheresis donation**

Apheresis (a-fur-REE-sis) allows volunteers to donate just one blood component. Blood is drawn out through a vein in the arm, and a machine separates the needed component (usually platelets, although red blood cells, white blood cells, and plasma can also be collected this way). The rest of the blood is then returned to the donor, usually through a vein in the other arm. This procedure takes 2 or more hours.

The advantage of this type of donation is that, since most of the blood is returned, a large amount of a needed component can be collected. Patients who need many platelet transfusions, such as some cancer patients, are exposed to fewer donors in this way than they would be from platelets pooled from many donors. This cuts down on the risk of both transfusion reactions and infections.

As with whole blood donation, apheresis donors should:

- Get a good night’s sleep.
- Eat a well-balanced meal.
- Drink extra caffeine-free fluids before donating.

Since aspirin makes platelets less useful to a transfusion recipient, donors are usually asked not take aspirin for 36 hours before donation. The same FDA guidelines as those for whole blood donation must be followed. Unlike whole blood donors, those who give platelets or plasma via apheresis usually can give again in a week or so. Different blood centers may have different rules about this.

During the apheresis procedure, donors may feel cold, or they may feel a tingling sensation around the lips and nose, but this goes away once the procedure is completed. (It’s caused by the drug that is used to keep the blood from clotting in the machine.) Other side effects, such as feeling tired, are much like those from whole blood donation.

**Autologous blood donation**

Donating your own blood for later use is called autologous (aw-tahl-uh-gus) donation. Autologous donation is most often done in the weeks before you have a scheduled surgery that will likely require blood transfusion. Your own blood can then be used during or after the operation to replace any blood you may have lost.

This is generally thought to be the safest form of blood transfusion because you’re getting your own blood back. Still, it’s not totally without risk. There’s always the very small chance that bacterial contamination or clerical errors can happen.

People who aren’t able to donate blood for others may still be able to donate blood for themselves.

There is a processing fee for collecting, testing, storing, and delivering each unit of autologous blood. Be aware that your health insurance may not fully pay for this. There’s also a need to plan ahead so that you have enough time before surgery to have your blood cell counts go back to normal after your blood has been collected.
Directed donation

Donating blood for a family member, friend, or other specified patient is called directed donation. This can be done at any blood donation center, but you should call ahead to check requirements and schedule the donation. The donor must meet the same requirements as for regular blood donation, and the donor’s blood must match the blood type of the recipient.

Blood from directed donors has not been shown to be safer than blood from volunteer donors and, in some cases, may actually be more likely to cause problems. (For example, see “Graft-versus-host disease” under “Transfusion reactions” in the section, “Possible risks of blood transfusions.”)

The same types of testing are done on blood from directed donors. As with autologous donation, there is a processing fee for collecting, testing, and delivering each unit of directed donor blood. This fee might not be covered by health insurance. If the person the blood was intended for doesn’t need it, some blood banks will use it for someone else. In others, it may be thrown out.

Paid donation

Blood from paid donors cannot be used in the United States for transfusion purposes. Plasma is the only component for which donors are sometimes paid, and it’s taken by the apheresis method. Plasma can be treated for safety in ways that blood cells cannot.

Plasma taken from paid donors is generally treated and processed by pharmaceutical companies into drugs. It cannot be transfused in the form of cryoprecipitate or fresh frozen plasma.

Blood donation by cancer survivors

Some people who have had cancer are not allowed to donate blood for a certain length of time after treatment. This is done partly to protect the donor, but it may also add an extra margin of safety for the person who receives the blood. If you aren’t sure if you are well enough to give blood, talk with your doctor before you try to donate.

While cancer has very rarely been transmitted through transplants of solid organs such as kidneys, there have been no reports of cancer transmission by blood transfusion. To check this, a group of researchers looked back in time at people who had received blood from donors who had developed cancer within 5 years of giving the blood. They found no increased cancer risk in those who got blood from those who were found to have cancer soon after donating.

This would suggest that the chance of getting cancer from a blood donor with cancer is extremely small, if it exists at all. Even if cancer cells were present in donated blood, the immune system of the person getting the blood would destroy the cells. A possible exception might be in transfusion recipients with weakened immune systems, who might not be able to fight off the cancer cells. Because of this slight possibility, people whose cancer is thought to be growing or spreading are not allowed to donate blood for other people.

You cannot donate blood for other people if:

- You are being treated for cancer
- Your cancer is spreading or has come back
• You have had leukemia or lymphoma as an adult
• You have ever had Kaposi’s sarcoma

Different blood collection centers may have slightly different standards for allowing cancer survivors to donate. For example, the American Red Cross allows most people who have had cancer to donate if the cancer was treated at least 1 to 5 years ago and the cancer has not come back. (The time can vary at different blood centers.)

Potential donors whose cancers had not spread and required no further treatment besides surgery to remove the cancer have little chance of cancer cells getting into the bloodstream. These low-risk donors may need to wait only until they’ve healed from their surgery and feel well again to donate blood.

People who had leukemia or lymphoma as children are often allowed to donate after 10 years of being cancer-free.

The final decision about whether a person is allowed to donate is up to the doctor in charge of the donor center. If you have questions about whether you can donate, please contact the blood collecting center in your community.

Some cancer survivors may find these precautions frustrating. They may be eager to donate blood to help others with cancer, just as they were helped by transfusions during their treatment. Everyone should remember, though, that the most important goal in blood banking is to ensure the safety of the blood supply and to protect those who get the transfusions.

Many cancer survivors also want to help others by donating their body organs after death. For more on this, see our document called *Can I Donate My Organs If I’ve Had Cancer?*

**To learn more**

**More information from your American Cancer Society**

Here is more information you might find helpful. You also can order free copies of our documents from our toll-free number, 1-800-227-2345, or read them on our website, www.cancer.org.

Understanding Your Lab Test Results

Anemia in People With Cancer

Can I Donate My Organs If I’ve Had Cancer?

Your American Cancer Society also has books that you might find helpful. Call us at 1-800-227-2345 or visit our bookstore online at cancer.org/bookstore to find out about costs or to place an order.

**National organizations and websites***

**American Red Cross**
Toll-free number: 1-800-RED CROSS (1-800-733-2767)
Website: www.redcross.org
Provides a locator service to find the Red Cross chapter or Blood Services region that
serves you. A direct website for information on blood donation is www.redcrossblood.org.

**America’s Blood Centers**
Toll-free number: 1-888-US-BLOOD (1-888-872-5663)
Website: www.americasblood.org

Has a listing of local ABC centers for donating blood; the website also offers general information about blood, blood donation, and blood use.

**AABB (American Association of Blood Banks)**
Telephone: 301-907-6977
Web site: www.aabb.org

Sets standards, inspects, and accredits blood collection and transfusion facilities. The AABB website has a blood bank locator, and general information on blood, blood product donation, and transfusions.

*Inclusion on this list does not imply endorsement by the American Cancer Society.*

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at **1-800-227-2345** or visit www.cancer.org.

**References**


*Last Medical Review: 10/7/2013*

*Last Revised: 10/7/2013*

*2013 Copyright American Cancer Society*