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## Blood Product Transfusions

Transfusions of blood and blood products temporarily replace parts of the blood when a person's body can't make its own or has lost them from bleeding. Here, we describe blood and its components and why they are important. We also explain how blood is donated and transfused and how this relates to people with cancer.

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## Kinds of Blood Product Transfusions

In a blood transfusion, donated blood or parts of blood (also called **blood products**) are given to another person who is bleeding or who can't make enough blood cells.

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## Why do people with cancer need blood transfusions?

Some reasons people with cancer might need blood transfusions are:

- Some cancers cause bleeding inside the body (internal bleeding)
- Blood cancers (like leukemia) can crowd out healthy blood cells in the bone marrow
- People who have had cancer for a while may develop [anemia](#)<sup>1</sup> of chronic disease.
- Cancers that affect organs, like the liver and spleen

Some people with cancer might need blood transfusions because of treatment [side effects](#)<sup>2</sup>. For example:

- Chemotherapy and radiation
- Bleeding after surgery

## Types of blood products

People who give blood usually donate whole blood. Whole blood can be separated into parts called **blood products** and each part does a separate job. This way, one unit of whole blood can be used to help more than one person. And the person getting a transfusion only gets the part that they need. These blood products or components are:

- Packed red blood cells
- Platelets
- Plasma
- Cryoprecipitate

Whole blood transfusions are usually saved for emergencies such as trauma or surgery where there is severe blood loss that needs to be replaced quickly.

## Packed red blood cell transfusions

Packed red blood cells are prepared by separating the plasma from blood. Plasma makes up most of the liquid in the blood. Sometimes, white blood cells are also removed and what is left is called **leukocyte-reduced red blood cells**. Leukocyte-reduced RBCs may be used for people who have a higher risk of reacting to a transfusion.

## When are red blood cell transfusions used?

**Anemia:** Low numbers of red blood cells (RBCs) cause anemia. People with anemia may need RBC transfusions because they don't have enough hemoglobin. Hemoglobin (Hgb) is the protein on red blood cells that carries oxygen throughout the body.

Common causes of anemia in people with cancer include:

- Cancer treatments like chemotherapy or radiation kill RBCs
- Blood cancers like leukemia where cancer cells crowd out RBCs
- Some tumors can make it hard for the body to make RBCs
- Low iron or vitamin B12 levels

A normal hemoglobin level is about 12 to 18 g/dL. An RBC transfusion may be given if hemoglobin is less than 8 g/dL. It will also depend on your symptoms as well as how long it took for the anemia to develop. Anemia from 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. If your hemoglobin level is lower than normal but you're not dizzy, pale, or short of breath, you may not need a transfusion.

**Surgery:** Transfusions may be given before, during, or after surgery to make up for blood loss or if someone has low blood counts.

## Platelet transfusions

Platelets are pieces of cells in blood that help make clots and stop bleeding.

A unit of whole blood has only a small number of platelets. So, it takes platelets from several units of whole blood to help keep a person from bleeding. A unit (or pack) of platelets is the amount that can be separated from one unit of whole blood.

Platelets don't have a blood type like red blood cells do, so patients can usually get platelets from any 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 (called **pooled platelets**).

Platelets can also be collected by apheresis (sometimes called plateletpheresis). The donor is hooked up to a machine that removes their 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 multiple donors. These are called **single donor platelets**.

## When are platelet transfusions used?

People with cancer might need platelet transfusions if their bone marrow is not making enough platelets. This can happen when chemotherapy or other cancer treatments damage the bone marrow, where blood cells are made. It can also happen in certain blood cancers (like [leukemias](#)<sup>3</sup>) when cancer cells in the bone marrow crowd out normal blood cells.

A normal platelet count is about 150,000 to 400,000 platelets per microliter (mcL) of blood. When platelet counts are below a certain level (often 20,000/mcL), a person is at risk for dangerous bleeding. Doctors might suggest a platelet transfusion when the platelet count is below this level or even at higher levels if the person needs surgery or is bleeding. If there are no signs of bleeding, a platelet transfusion may not be needed even if the platelet count is low.

## Plasma transfusions

Plasma is the liquid part of blood. It has proteins called clotting factors that help blood clot. Clots help stop bleeding when we're injured. Plasma has other proteins, such as antibodies, that help fight infection.

After 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**.

## When are plasma transfusions given?

Plasma may be given to patients who are bleeding because their blood doesn't clot the way it should. People with cancer might also be given fresh frozen plasma if they have a condition called **disseminated intravascular coagulation** (DIC). In DIC, all the clotting factors in the body are used up. Signs and symptoms (such as severe bleeding and bruising) and blood tests help the doctor diagnose DIC.

## Cryoprecipitate transfusions

Cryoprecipitate (or cryo) is the part of plasma that separates out (precipitates) when plasma is frozen and then thawed. It has some 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 are pooled together for one transfusion.

## When are cryoprecipitate transfusions used?

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

- Factor VIII (missing in people with hemophilia A)
- Von Willebrand factor (needed to help platelets work)
- Fibrinogen (protein needed to form a clot)

## Donating your own blood to use later

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

This is 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 can't donate blood for others may still be able to donate blood for themselves.

There are fees for autologous donation that may not be covered by your insurance. Be aware that your health insurance may not fully pay for this. You and your doctors will need to plan so that your blood cell counts go back to normal before your surgery.

## Other treatments

Treatments other than blood product transfusions are sometimes used. These treatments don't replace blood transfusions, but they may decrease the number of transfusions a person needs.

### Volume expanders

When a person has lost a lot of fluids, the body can go into shock. This may be treated or prevented by giving fluids into a vein. This can help increase blood going to internal organs. But these fluids don't carry oxygen or raise the number of blood cells.

### Iron

Iron helps the body make **hemoglobin (Hgb)**. Hemoglobin is the protein on red blood cells that carries oxygen throughout the body. Some people with cancer and anemia (low red blood cells) have low iron levels. Giving iron supplements might help increase hemoglobin and reduce the need for blood transfusions. This can be especially helpful for people with chronic anemia.

There are possible problems with taking iron. For example, there is a risk of iron overload. Iron overload can happen when iron levels in the blood get too high. This can damage some organs.

### **Growth factors**

The body naturally makes hormone-like substances called **hematopoietic growth factors**. These substances cause the bone marrow to make more blood cells. Growth factors can be used to increase red blood cell, white blood cell, or platelet counts.

Growth factors may be used instead of transfusions. But there are some possible problems that may limit their use.

- They often take days or weeks to increase blood counts. So, they may not help people who need to have their blood cell levels raised quickly, such as those who are bleeding.
- Might not work in people with severe bone marrow disease. Growth factors can't work if there are not enough blood-producing cells in the bone marrow.
- Might cause certain types of cancer cells to grow more quickly. These types of cancer include [lymphocytic leukemia](#)<sup>4</sup>, [multiple myeloma](#)<sup>5</sup>, [head and neck cancers](#)<sup>6</sup>, [breast cancer](#)<sup>7</sup>, [cervical cancer](#),<sup>8</sup> and some kinds of [lung cancer](#)<sup>9</sup> cells.
- Usually cost a lot more than transfusions.

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

### **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.

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 other functions of human

blood.

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## Hyperlinks

1. [www.cancer.org/cancer/managing-cancer/side-effects/low-blood-counts/anemia.html](http://www.cancer.org/cancer/managing-cancer/side-effects/low-blood-counts/anemia.html)
2. [www.cancer.org/cancer/managing-cancer/side-effects/low-blood-counts.html](http://www.cancer.org/cancer/managing-cancer/side-effects/low-blood-counts.html)
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## Blood Types and Matching



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## Blood tests before the transfusion

Before you get a blood transfusion, tests must be done to make sure a donated blood product closely matches your blood type.

The main blood tests done are :

- Type
- Antibody screen
- Crossmatch

## Blood types

Testing and matching are important before someone gets a blood transfusion. If you get a transfusion with a blood type that doesn't work with yours, your immune system might attack the donated blood. This can cause a serious or even life-threatening transfusion reaction. See Possible risks of blood transfusion for more information on side effects.

Donated blood is always tested to find out what type it is. This is done when it's taken from the donor and again in the hospital lab. If you need a blood transfusion, a blood sample is taken from you and tested the same way.

All blood has the same parts, but not all blood is the same type. People have different blood types based on **antigens**. Antigens are substances that trigger the body's immune response. When typing someone's blood , two antigens are looked at:

- **ABO antigen type.** Everyone has either type A, B, AB, or O blood. This means that their blood cells have either antigen A (type A), antigen B (type B), both antigens (type AB), or neither antigen (type O).
- **Rh factor.** Everyone is **either Rh-positive or Rh-negative** (you either have Rh or

you don't).

Your ABO antigen + Rh factor = blood type. There are eight different blood types:





- A positive and A negative
- B positive and B negative
- AB positive and AB negative
- O positive and O negative

## ABO blood type matching

The A and B antigens decide a person's ABO blood type (either A, B, AB, or O). In the United States, the most common blood type is O, followed by type A.

Whatever **antigen** you have on your **blood cell** is linked with the **antibodies** in your **plasma**. Antibodies are proteins in your immune system that watch for and attack foreign substances.

- If you have type A blood with A-antigens, you also make anti-B antibodies. So, you can't get type B or AB blood, because your anti-B antibodies would attack any donor blood with B-antigens. You can only get type A or O blood.
- If you have type B blood with B-antigens, you also make anti-A antibodies. So, you can't get type A or AB blood, because your anti-A antibodies would attack any donor blood with A antigens. You can only get type B or O blood.
- If you have type AB blood with A and B antigens, you don't make anti-A or anti-B antibodies. That is why people with type AB blood can receive transfusions from any blood type. These people are sometimes called **universal receivers**.
- If you have type O blood with no A or B antigens, you make both anti-A and anti-B antibodies. So, people with type O blood can only get type O blood because their anti-A and anti-B antibodies would attack any donor blood with A or B antigens. But since type O has no antigens, anyone of any blood type can receive type O blood. This is why people with type O blood are sometimes called **universal donors**.

ABO BLOOD GROUPS	BLOOD GROUP A	BLOOD GROUP B	BLOOD GROUP AB	BLOOD GROUP O
Red blood cell type				
Antigen (on red blood cells)	A antigen	B antigen	A antigen B antigen	none
Antibodies (in plasma)	anti-B	anti-A	none	anti-A anti-B
Blood you can get	A or O	B or O	A, B, AB, or O	O only
Blood you cannot get	B or AB	A or AB	none	A, B, or AB

## Rh factor matching

In addition to matching ABO types, blood also needs to be matched by Rh (rhesus) factor . Rh factor is another protein that some people have on their red blood cells.

- If you have Rh-positive blood, you have the Rh antigen on your blood cells. Your body **doesn't** make anti-Rh antibodies. So, you can get Rh-positive or Rh-negative red blood cell transfusions.
- If you have Rh-negative blood, you don't have the Rh antigen on your red blood cells. Your body **can** make anti-Rh antibodies. So, you should only get Rh-negative red blood cells except in emergencies. An Rh-positive blood transfusion can cause a person with Rh-negative blood to make antibodies against the Rh antigen. This can cause a [transfusion reaction](#).

## Other antigens

There are other antigens on red blood cells that can lead to transfusion reactions. These are rare because people don't make antibodies against them unless they have had transfusions before. These antigens may become a problem in matching blood for a person who has had many transfusions in the past, like some people with cancer.

## Plasma, platelets, cryo, and blood type

Blood types are also important for plasma transfusions, but the rules are different from the rules for red blood cells transfusions. For example, people with type AB blood are universal plasma donors. Anyone can receive AB plasma, but someone who is AB can only receive type AB plasma.

For platelet and cryoprecipitate transfusions, matching the blood type of the donor to the recipient is not needed, but many labs still try to match them. If a person gets frequent platelet or cryo transfusions, matching may lower the risk of future transfusion reactions.

## Antibody screen and crossmatching

After blood is typed, a test called an **antibody screen** is done to see if a patient's plasma has antibodies other than those against A, B, and Rh. If there are extra antibodies, the crossmatching 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 red blood cell transfusion, another test called a **crossmatch** must be done. For a crossmatch, a small amount of donor blood is mixed with the recipient's blood to see if they react before the blood is transfused. If the two blood samples clump together, they are not a good match and that donor's blood will not be used for that recipient.

A crossmatch is usually not needed for a platelet or plasma transfusion unless the platelets look like they could have some red blood cells.

## Other testing

Other testing might be done depending on the patient. For example, some people with cancer need CMV-negative blood. CMV (cytomegalovirus) is a common infection that most people get at some point, but don't have symptoms. But if someone with a weakened immune system gets CMV-positive blood, it can cause serious problems.

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## Transfusion Steps and Possible Side Effects

Most blood transfusions are given in a clinic or hospital. Depending on where you're getting a blood transfusion, the process may be a little different.

- [Possible side effects of blood transfusions](#)

Here is a general overview of what it's like to get a blood transfusion.

- Before the doctor prescribes blood products, you will be asked to read and sign your [informed consent](#)<sup>1</sup> (permission) form. This means you understand the risks and benefits of getting a transfusion and what other options you might have. Make sure someone has explained these things to you. Informed consent may not apply if it is a life-threatening emergency.
- Lab work is done to check your blood type. Sometimes other [blood tests](#) are done, like testing for antibodies.
- The blood bank will find a donated blood product that matches your blood type.
- When the blood (or blood product) is ready, someone will check your blood pressure, heart rate, and temperature.
- You will have an intravenous line (IV) placed in your arm if you don't already have an [IV or central line](#)<sup>2</sup>.
- The nurse will do several safety checks to make sure the blood product is the right one for you. The nurse should also remind you of what to look out for during the transfusion.
- The nurse will start the blood transfusion in your vein slowly for the first 15 minutes or so. This is to make sure you don't have a reaction.

- After about 15 minutes, the nurse will increase the rate of the transfusion.

How long the transfusion takes depends on what kind of blood product you're getting and how you're doing with the transfusion.

For example, whole blood and packed red blood cells take between 2 to 4 hours to complete. But platelets and plasma can be transfused quickly, usually less than 30 minutes. If you have certain conditions like heart failure, they may run it slower so that your body isn't getting too much fluid at once.

Sometimes blood transfusions can be given at home by a visiting nurse. This happens rarely and there are certain rules on who can and can't get a transfusion at home. Home transfusions follow the same safety standards as hospital transfusions. Not all home health agencies provide this service.

## Possible side effects of blood transfusions

Most people who get a blood transfusion have no problems. But some people do, and these are called transfusion reactions.

There are several types of transfusion reactions. Some are mild and don't need treatment, and others are more serious. Most transfusion reactions happen during a transfusion, but others might not happen for several days.

### Transfusion reactions

- **Allergic reactions.** This is the most common reaction and is usually mild with itching or hives. It happens when your immune system reacts to proteins in the blood product. Antihistamine medicine is usually enough to treat the reaction. If there are no other symptoms, the transfusion is usually continued.
- **Febrile reactions.** This is a common reaction. A fever can occur during or up to 24 hours after the transfusion. This happens because the immune system reacts to white blood cells in the blood product. People may also have a headache, nausea, chills, or a general feeling of discomfort. Acetaminophen (Tylenol) can help. If the fever happens during the transfusion, is mild, and there are no other symptoms, the transfusion may be continued. People who are at risk for a febrile reaction may be given **leukoreduced** blood products. Leukoreduced blood products have the white blood cells removed and can help prevent febrile reactions.
- **Transfusion-related acute lung injury (TRALI).** This is a very rare reaction and

usually happens to people who are very sick in the hospital. The main symptom is trouble breathing.

- **Acute immune hemolytic reaction.** This is a very rare but serious reaction that develops when the donor and patient blood types don't match. It usually happens quickly, within a few minutes after the transfusion starts. This is why so many safety checks are done to make sure the right blood goes to the right patient.
- **Delayed hemolytic reaction.** This kind of reaction usually only happens if a person has had many transfusions in the past. The body slowly attacks proteins on the transfused donor cells. Extra testing can be done to match blood products for these people to prevent future reactions.
- **Graft-versus-host disease (GVHD).** This only happens in people with a very weak immune system, such as after a bone marrow or organ transplant. In this reaction, the white blood cells of the donor blood attack the tissues of the person getting the blood transfusion. To prevent GVHD, donated blood can be treated with radiation before transfusion (called **irradiated** blood products).

Some of these reactions can happen during the transfusion, but some might not happen for days after your transfusion. Tell your doctor or nurse right away if you have:

- Itching, hives, or rash
- Swelling in the face, lips, or tongue
- Headache or dizziness
- Fever or chills
- Trouble breathing or new cough
- Chest or back pain

## Infections

The chance of getting an infection from a blood transfusion in the United States is very low. All blood donors are screened, and all blood products are tested for the following infections:

- Hepatitis B virus
- Hepatitis C virus
- Human immunodeficiency virus (HIV)
- Syphilis
- HTLV-I and HTLV-II



- West Nile virus
- Chagas disease

Some states require other tests depending on common infections in that area. More tests may be ordered for certain patients. For example, some patients need cytomegalovirus (CMV)-negative blood products.

### **Bacterial contamination**

Rarely, tiny amounts of skin bacteria get into the blood during donation. Platelets have the highest risk of bacterial contamination because they are kept at room temperature. Other blood products are refrigerated or frozen, which lowers the chance of bacteria growing.

### **Hyperlinks**

1. [www.cancer.org/cancer/managing-cancer/making-treatment-decisions/informed-consent.html](http://www.cancer.org/cancer/managing-cancer/making-treatment-decisions/informed-consent.html)
2. [www.cancer.org/cancer/managing-cancer/making-treatment-decisions/tubes-lines-ports-catheters.html](http://www.cancer.org/cancer/managing-cancer/making-treatment-decisions/tubes-lines-ports-catheters.html)

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### **Written by**

The American Cancer Society medical and editorial content team  
(<https://www.cancer.org/cancer/acs-medical-content-and-news-staff.html>)

Our team is made up of doctors and oncology certified nurses with deep knowledge of cancer care as well as editors and translators with extensive experience in medical writing.

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