This e-document is a longer version of a much briefer companion document produced by ORBCoN. To view or print the companion version visit the ORBCoN website at: www.transfusionontario.org

**General Disclaimer:**

The information in this pamphlet is understood to be accurate and appropriate at the time of publication. However, patient care decisions must be balanced with the clinical judgment of the attending physician on assessment of the status of the individual patient. Neither the authors nor the publishers accept any legal responsibility for liability for any errors or omissions in the information provided.

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Third edition: 2019
Blood Basics

Blood is important to your health. Blood is made up of three types of cells: red blood cells, white blood cells and platelets. These cells are in a salty protein solution called plasma. Plasma is a yellowish coloured liquid. Blood carries nutrients and oxygen to your tissues and takes waste products and carbon dioxide away from them. Blood is also responsible for your clotting system and helps to fight infection.

- Red blood cells make up 40-45% of your blood. They carry oxygen from your lungs to your tissues and remove carbon dioxide from the tissues to be released by your lungs. If you do not have enough red blood cells, this problem is called anemia.
- White blood cells and platelets make up about 1% of your blood.
- White blood cells protect you by fighting infection and removing germs from your body.
- Platelets are your first line of defense to stop bleeding. They make up only a small portion of your blood.
- Plasma makes up about 55% of your blood and contains water (70%), salts, proteins, sugars, fats, hormones, antibodies to fight infection, blood clotting factors and other substances.
Other Blood Facts

- Each blood drop contains 250 million red blood cells, 400,000 white blood cells, and 15 million platelets
- Blood is made in the bone marrow
- Each adult has between 5-7 litres of blood
- Newborns have about 1/4 litre (1 cup) of blood in their bodies
- Blood is always on the move and it takes about one minute for blood to make a complete round trip
- Red blood cells live for about 120 days, white blood cells for 3-4 days and platelets for 5-9 days
- Blood makes up about 7% of your body weight
- There is no substitute for human blood
Why You May Need a Blood Transfusion

You might need a blood transfusion because:
- You bleed during surgery
- You are badly hurt in an accident
- Your blood cells don’t work the way they should
- You don’t have enough red blood cells or platelets
- You are taking medicine that affects your blood like drugs to treat cancer
- Your body doesn’t make antibodies to fight infection
- Your blood won’t clot
Blood Collection

There are two blood collection agencies in Canada: Canadian Blood Services in all of Canada except Quebec, and Héma-Québec in Quebec. Both organizations must meet strict regulations for patient and donor safety as laid out by Health Canada. Both organizations will help each other in times of blood shortages. All blood donations collected from Canadian Blood Services and Héma-Québec are from volunteer, unpaid blood donors.

Donating blood does not make you weak or sick. The most common types of blood donation are:

1. **Whole Blood**: this is the most common type of donation. One bag of blood is collected from the donor and processed into components.

2. **Apheresis**: one specific portion of whole blood is collected with the use of an apheresis machine. Usually platelets and plasma are collected this way.

Blood Donor Screening

Donors go through a thorough, pre-donation screening process to protect their health and the health of patients. Donors must be at least 17 years of age, 110 pounds and in good health. The donors answer a series of questions pertaining to their health and medical background on the blood donation questionnaire. These questions must be answered at the time of each donation. Temperature, hemoglobin level (usually by a finger prick to determine if the donor has enough red blood cells to donate), pulse and blood pressure are also checked. If any answers to the questions affect the donor’s suitability, the donation does not take place. Donor identification is confirmed by personal identification information (e.g., driver’s license) and/or a previously issued blood donor card. For more information, go to www.blood.ca.
Blood Donor Testing
Each blood donation is tested for diseases that may be spread by blood transfusion. These tests detect the presence of hepatitis viruses (both B and C) and human immunodeficiency virus (HIV) as well as several other diseases that can be transmitted through blood that could potentially harm a recipient. In addition, each donation is tested for the ABO and Rhesus (Rh) group and the presence of any other blood group antibodies.

Other Blood Facts
- Canadian Blood Services collects about 850,000 donations per year and Héma-Québec collects about 102,000 donations
- One whole blood donation can help up to 3 patients
- Only 3.5% of eligible Canadians donate blood
- Whole blood donors can donate every 56 days for males and every 84 days for females, apheresis platelet donors can donate every 14 days and apheresis plasma donors can donate every 7 days

Blood donors are generous people who selflessly give to help Canadians in need. Canadian Blood Services and Héma-Québec are always actively searching for blood donors to ensure there are enough blood products to meet the needs of Canadians. Have you, members of your family or your friends ever considered blood donation?

For information on clinic locations, or to book an appointment at Canadian Blood Services visit their website at: www.blood.ca/
Whole blood is processed into components: red blood cells, platelets and plasma.

- Red blood cells are used to carry oxygen to your tissues and organs
- Platelets are used to prevent or stop bleeding
- Plasma is used when your blood will not clot

Plasma may be sent to special manufacturing plants where the proteins in the plasma are separated and made into products like Clotting Factors to treat Hemophilia, Immune Globulin (IG) products to treat patients who are not able to make antibodies to fight infections or, in the case of Rh Immune Globulin (RhIG) to prevent the formation of harmful antibodies in some pregnant women.

Albumin is another product made from plasma that may be used to treat patients with liver or kidney failure, or to replace fluids to help remove harmful proteins from plasma.

**Life Span of Stored Blood Components**

Red blood cells can be stored for up to 42 days, platelets are only stored for 7 days, and frozen plasma can be stored for up to a year. Manufactured Plasma Protein Products often have a shelf life of 2 years or more.
Blood Groups and Compatibility

Both red blood cells and plasma play very important roles in blood group compatibility (matching). The major blood groups of the ABO system and Rh (Rhesus) system are determined by antigens (proteins) on the surface of the red blood cells. A person may be group A, B, AB or O. You have “naturally occurring” antibodies to the ABO antigens you do not have on your red blood cells.

Compatibility

Compatibility of a blood product is determined not only by the antigens on the red blood cells but also by antibodies in the plasma. We have naturally occurring ABO antibodies to the red blood cell antigens we don’t have. These antibodies are found in the plasma. For example, group A people will have A antigen on their red blood cell surface and will produce anti-B which is found in their plasma. People must receive blood products that are ABO compatible but not necessarily identical to their own blood type as demonstrated in the chart below:

<table>
<thead>
<tr>
<th>Group</th>
<th>Antigen on red blood cell</th>
<th>Frequency</th>
<th>Antibody in plasma</th>
<th>Compatible group for red blood cell transfusion</th>
<th>Compatible group for plasma transfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>40%</td>
<td>B</td>
<td>A or O</td>
<td>A or AB</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>11%</td>
<td>A</td>
<td>B or O</td>
<td>B or AB</td>
</tr>
<tr>
<td>AB**</td>
<td>A and B</td>
<td>4%</td>
<td>None</td>
<td>A, B, AB, or O</td>
<td>AB</td>
</tr>
<tr>
<td>O*</td>
<td>None</td>
<td>45%</td>
<td>A and B</td>
<td>O</td>
<td>A, B, AB, or O</td>
</tr>
</tbody>
</table>

*Group O is considered the universal red blood cell donor. This blood can be given to patients of all other blood groups.

**Group AB is considered the universal plasma donor and can be given to patients of all other blood groups.

As you can see from this chart, group O red blood cells and group AB plasma can be given to all patients regardless of their ABO group. These products may be given in emergency situations when there is not enough time to determine the patient’s blood group.
Blood Groups and Compatibility (cont’d)

In the Rhesus system, the presence or absence of the D antigen determines if the blood is Rh positive or negative. If the D antigen is present, you are Rh positive and if it is absent, you are Rh negative. In Canada, approximately 85% of the population is Rh positive and 15% of the population is Rh negative.

▲ Rh positive patients can safely receive either Rh positive or Rh negative blood

▲ Rh negative patients are sometimes given Rh positive blood in emergency situations when Rh negative blood is not available

▲ Rh negative females under the age of 45, should receive Rh negative blood

▲ Rh negative women may receive Rh Immune Globulin (RhIG) during pregnancy and after delivery to avoid the production of Rh antibodies that may cause harm to their babies

For more information, see our Resources for Midwives here.

Be Involved

As a patient, you should be involved in your blood transfusion and the identification process. You may be asked to confirm your name and date of birth or another piece of information that identifies you. This is for your own safety. If you have any doubts about the blood product or the reason you are receiving it, tell your nurse or doctor before the transfusion begins. Do not proceed with the transfusion until you are satisfied that your questions have been answered.
The Risks of Blood Transfusion

Blood transfusion, like all other medical procedures, is not without risk. As a patient, you should know: how a transfusion will help you, what your choices are, and the risks of a transfusion.

### Non-Infectious Complications

<table>
<thead>
<tr>
<th>Non-Infectious Complications</th>
<th>Estimated Risk of Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor allergic reaction (hives or rash)</td>
<td>1 in 100</td>
</tr>
<tr>
<td>Fluid overload</td>
<td>1 in 100</td>
</tr>
<tr>
<td>Fever or chills</td>
<td>1 in 300</td>
</tr>
<tr>
<td>Lung injury</td>
<td>1 in 10,000</td>
</tr>
<tr>
<td>Incompatible blood reaction</td>
<td>1 in 40,000</td>
</tr>
<tr>
<td>Serious allergic reaction</td>
<td>1 in 40,000</td>
</tr>
</tbody>
</table>

### Infectious Complications

<table>
<thead>
<tr>
<th>Infectious Complications</th>
<th>Estimated Risk of Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>1 in 10,000 platelet pools</td>
</tr>
<tr>
<td></td>
<td>1 in 250,000 red blood cells</td>
</tr>
<tr>
<td>West Nile Virus</td>
<td>Less than 1 in 1 million</td>
</tr>
<tr>
<td>Chagas Disease</td>
<td>1 in 4 million</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>1 in 7.5 million</td>
</tr>
<tr>
<td>Human T-lymphotropic virus (HTLV)</td>
<td>1 in 7.6 million</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>1 in 13 million</td>
</tr>
<tr>
<td>Human Immunodeficiency Virus (HIV)</td>
<td>1 in 21 million</td>
</tr>
</tbody>
</table>

### Non-Transfusion Risk Event

<table>
<thead>
<tr>
<th>Non-Transfusion Risk Event</th>
<th>Estimated Risk of Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death from motor vehicle accident</td>
<td>1 in 10,000</td>
</tr>
<tr>
<td>Death from being struck by lightning</td>
<td>1 in 5 million</td>
</tr>
</tbody>
</table>
The Risks of Blood Transfusion (cont’d)

Infectious Complications
Blood donors are tested and screened to lower the risk of infection. It may take weeks or months after a transfusion to find out if you have been infected with a virus, bacteria, or parasite.

Testing of donor blood for infectious diseases is very sensitive. The risk of transmission is now extremely small.

Hepatitis
At least two forms of hepatitis can be transmitted through blood transfusion: hepatitis B and hepatitis C. All blood and components are tested for both the hepatitis B and C viruses.

Human Immunodeficiency Virus (HIV)
The human immunodeficiency virus may cause acquired immunodeficiency syndrome (AIDS), a condition that results in damage to the immune system.

Bacterial Infection
This type of reaction is not common and happens when germs enter the blood component either from the donor’s skin, the donor’s bloodstream or during processing. Symptoms may include a high fever, chills (shaking) a drop in blood pressure, or vomiting.

Others
Other infectious agents that are routinely checked for in all donations include syphilis, West Nile virus, and human T-cell lymphotropic virus (HTLV).
The Risks of Blood Transfusion (cont’d)

Non-Infectious Complications

Allergic Reaction and Hives
Allergic reactions to donor plasma may occur. Signs and symptoms may include hives and itching. These reactions are not often serious.

Sometimes a more serious allergic reaction may occur. There may be problems with breathing, low blood pressure, feeling anxious, fast heart beat, and feeling like you are going to throw up. The transfusion will be stopped and the doctor will decide if it should continue or not.

Fever
Fever occurs in about 1 in 300 transfusions and may sometimes develop shortly after the transfusion has started. You may also feel chills (shaking). The transfusion will be stopped and the doctor will decide if it should continue or not. They may give you medicine to help lower your fever.

Hemolytic Reactions
Hemolytic reactions are not common. Hemolytic means that the red blood cells burst. If this happens, you may get a fever, chills (shaking), back pain, and pass red or dark urine. The transfusion will be stopped and your symptoms will be treated right away.
Fluid Overload (Transfusion Associated Circulatory Overload)  
Fluid overload occurs in about 1 in 100 transfusions. Fluid overload happens when the rate of blood transfusion is more than the heart can handle and fluid backs up into the lungs and causes difficulty breathing. It may be caused by heart problems or transfusing too fast.

If this happens, you may be short of breath and have increased blood pressure, increased heart rate, and bluish-purple skin tone. The doctor will be notified and you may be given medicine to relieve the symptoms.

Graft versus Host Disease  
This can happen in patients with low immunity from disease or cancer treatment drugs. It is not a common reaction. Sometimes it can happen in patients with normal immunity if they receive blood from a donor with similar but a slightly different type, usually a close relative.

Transfusion Related Acute Lung Injury  
This happens in about 1 in 10,000 transfusions and the reason is not clearly known. If it happens, you may be short of breath, have low blood pressure and low oxygen.

It is very important to tell your nurse if you have any of the signs and symptoms of a transfusion reaction at any time during, or after your transfusion.
What to Look for During and After a Transfusion

Although problems (reactions) during a blood transfusion are rare, it is important for you to understand what could happen. During a blood transfusion, you will be carefully monitored for any signs of a transfusion reaction. Your nurse will check your vital signs, temperature, pulse, respirations, and blood pressure and also observe you for symptoms that you may be having a reaction. If you have any of the symptoms that are listed below, let your nurse know.

The following is a list of signs and symptoms that can be a result of a reaction to your transfusion:

- Fever
- Chills (shaking)
- Pain in head, chest or back
- Anxiety or agitation
- Rash, hives and/or itching
- Nausea and/or vomiting
- Difficulty breathing and or shortness of breath
- High or low blood pressure
- Red or dark urine

If you have any of these signs or symptoms, report them to your nurse or doctor right away. If you have a reaction during the transfusion, the transfusion will be stopped, you may be given some medicine to help you feel better and your doctor will decide if your transfusion should continue or not.

If you are going home after your transfusion, ask your nurse or doctor for information about what to look for and what to do if you develop any of these symptoms.

Reactions can occur during the transfusion, soon after (within 6 hours), or days or weeks later. Most reactions are mild and easily treated. Because of this, you will be watched closely for the first 15 minutes of your transfusion and at different times during the transfusion.
Alternatives (Options) to Transfusion

Surgical Transfusion Needs
There may be other options that can be used to avoid or reduce the need for blood transfusion. Since some of these take time to work, they need to be planned ahead of time.

For patients having surgery, discuss these steps with your nurse or doctor:

- A thorough medical exam before surgery to address any treatable conditions
- Iron and vitamins to maintain “healthy” blood levels
- Blood tests to determine hemoglobin (red blood cell), iron levels and any risk for transfusion
- When to stop drugs and supplements (e.g., aspirin) that thin your blood and may increase bleeding during surgery
- In some patients, it may be appropriate to use a drug which is the synthetic form of the hormone erythropoietin (EPO) to boost hemoglobin production
- Use of other drugs that may lessen blood loss before, during and after the surgery

Your surgeon and anesthetist will discuss the best treatment for your particular condition.

For more information on your preoperative options, speak to your nurse or doctor. You may also visit the Ontario Nurse Blood Conservation Program at: www.ontracprogram.com
Non-Surgical Transfusion Needs
Options may also be available to reduce transfusion in patients with non-surgical transfusion issues such as kidney failure or cancer.

Discuss the following with your nurse or doctor:

▲ When possible, ensure any other conditions that may cause bleeding are treated

▲ Iron and vitamins to maintain “healthy” blood levels

▲ Review use of blood thinners (e.g., aspirin), which may cause or increase blood loss

▲ In some patients, it may be appropriate to use a drug which is the synthetic form of the hormone erythropoietin (EPO) to boost hemoglobin production

▲ Importance of a balanced diet
Informed Consent

Informed consent for transfusion is a requirement of blood and safety standards in Canada. When consenting to transfusion you should be making an informed choice. You must be able to understand the information presented to you.

Consent has several elements:

- Consent must be voluntary
- You must be mentally competent to give consent
- Consent must be specific to the treatment proposed
- Consent must be “informed”—the patient must understand the risks, benefits and alternatives

The following information should be explained to you:

- Information about the blood product, how it is given and what the expected outcome is
- The reason for the transfusion
- The transfusion-associated risks
- The alternatives to transfusion
- The benefits of the transfusion
- What could happen if you do not have the transfusion

A competent person is allowed to refuse or stop a transfusion or any medical treatment. If you do not want a transfusion for any reason, including religious beliefs, you must inform your doctor. However, there are risks associated with refusal. Your doctor will be able to give you more information about these choices.
You should be able to ask questions about your transfusion and bring up any concerns. You should be given answers to your questions and concerns before you give consent.

You can withdraw your consent at any time. If you are unable to give consent, your legal representative or substitute decision maker can act in your place, keeping your best interest and wishes in mind.

For additional information please go to:
https://www.transfusionontario.org/en/ and/or
https://www.choosingwiselycanada.org/patient-pamphlets/