

*professional development*

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## **Transfusion of Blood Components and Products**



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## Introduction

Alberta Health Services (AHS) has developed a provincial Transfusion of Blood Component and Blood Products policy and procedure suite. The policy and procedures are a resource to support technical aspects, provincial and federal standards and regulations, and best practices in this field of medicine.

Transfusion Medicine is the field of medicine concerned with the administration of blood components and products. Advances in technology, evolving Standards and Regulations, and improving patient safety are all drivers of constant change in this field.

The **educational program** for Transfusion of Blood Components and Products has been standardized to ensure portability throughout the Alberta Health Services. This learning module is designed to provide clinical staff with the theory behind safe transfusion practices.

The following table breaks down the transfusion process into key activities and identifies who is able to perform these activities.

### Key Activities Matrix

	Prescriber (Physician/Nurse Practitioner)	Registered Nurse (RN)	Licensed Practical Nurse (LPN)	Medical Laboratory Technologists	Medical Laboratory Assistants
Obtaining informed, written consent	✓				
Collection of pretransfusion specimen	✓	✓	✓	✓	✓
Identification of patient for pretransfusion specimen collection	✓	✓	✓	✓	✓
Patient identification verification prior to transfusion	✓	✓	✓	✓	✓
Initiating** transfusion	✓	✓			
Transfusion rate adjustment	✓	✓			
Monitoring transfusion	✓	✓	✓		

\*Nursing students can administer blood and blood products under direct supervision. "Direct supervision" means the Instructor/Preceptor (or a RN at the discretion of the Instructor/Preceptor) is present in the practice setting at the point of care and is providing supervision at the side of the nursing student.

\*\*Initiating transfusion means spiking the blood component or product, starting the flow and monitoring the patient for first 15 minutes. Initiation includes the injection of blood products.

**Note:** In addition to the personnel listed above, health care providers (i.e. a nursing student, a health care aide, a unit clerk, EMS staff, or a porter) are permitted to receive and document the issue of blood components and products **only** during transfusion

service/laboratory hours when a laboratory technologist or laboratory assistant is available to release the required blood component or product. Issue/removal from the blood bank after transfusion service/laboratory hours requires 2 personnel, one of which must be a health care professional.

### **Purpose of the Education Program**

This learning module will familiarize the learner with principles of blood component/product administration. A post learning assessment is included to guide your learning. A pass mark of at least 85% on the post-learning assessment is recommended prior to practice. Successful demonstration of skills in the clinical area under the **direct supervision** of a Clinical Nurse Educator or designate is recommended.

Please direct any questions or concerns to the Clinical Nurse Educator(s) or designates in your area.

### **Learning Objectives**

On completion of the learning module, the learner will be able to:

1. define basic blood group systems, their antigens and associated antibodies, and explain how ABO and Rh compatibility works for blood components.
2. describe the difference between blood components and blood products (often referred to as plasma protein products or manufactured products).
3. discuss the need for informed consent in the setting of transfusion, and the process for obtaining informed consent.
4. list the steps taken prior to transfusion including: orders to transfuse, specimen collection, and patient preparation.
5. discuss the equipment used for transfusing blood components and products.
6. explain handling instructions for blood including product pick-up and transportation to the patient.
7. recognize the importance of identification of patient and blood, and the means to perform this identification.
8. outline the steps required to safely transfuse blood.
9. explain the documentation required to complete the process of transfusion.
10. recognize transfusion reaction signs and symptoms, and discuss the processes involved in management of these reactions.

### **Target Audience**

This module is to be completed by clinical staff who participate in the process of blood administration.

**Prerequisites**

- Consent to Treatment/Procedures policy and procedure suite
- Patient Identity Verification Policy
- Policy: Transfusion of Blood Components and Products - Acute
- Procedure: Transfusion of Blood Components and Products - Acute

**Learning Resources**

The on-line links for specific information regarding blood components and products referred to in this module can be found at:

<http://www.albertahealthservices.ca/lab/page10380.aspx>

**Instructions for Completion**

1. **Please do not write in this module.** Answer sheets and performance checklists can be copied or provided by your facilitator. Please do not remove any pages from this learning module.
2. To complete the learning module:
  - i. Read the objectives and the content in each Section.
  - ii. Complete each learning activity before proceeding to the next section.
  - iii. Complete the post learning assessment. Your goal is to achieve 85% on this test. If you do not achieve 85% on your post-learning assessment, you will need to review the module or seek out other learning resources.
3. Proceed with practice and demonstration of blood component/product administration as per Performance Checklist in Appendix D.
4. Perform the procedure under the direct supervision of a CNE or experienced designate. The demonstration must be performed on either a patient receiving a blood component/product transfusion or through simulation.
5. Once you demonstrate the skill with 100% accuracy as indicated by the completion of the performance checklist, you have completed the requirements for Transfusion of Blood Components and Products.

## Section One

### Blood Components

#### Learning Objectives

On completion of this section, the learner will be able to:

1. define basic blood group systems, their antigens and associated antibodies, and explain how ABO and Rh compatibility works for blood components.
2. describe the difference between blood components and blood products (often referred to as plasma protein products or manufactured products).

Blood components are the therapeutic parts of blood intended for transfusion. They are made from a whole blood unit, and include:

- red blood cells
- plasma
- platelets
- cryoprecipitate

The first three components above are made by centrifuging whole blood. Cryoprecipitate is made from fresh plasma by putting the plasma through a freeze/thaw cycle.

#### Red Blood Cells

Red blood cells have antigens on their surface. These antigens determine a patient's blood group and are capable of combining with antibodies inside the human body. This interaction can lead to serious complications. Transfusion with red cells can be considered a "liquid transplant".

#### ABO system

The ABO blood group is the most important of all the blood group systems. There are four different ABO blood groups, determined by whether or not an individual's red cells carry the A antigen, the B antigen, both A and B antigens or neither.

Early in childhood, normal healthy individuals make red cell antibodies against A or B antigens that are not on their own cells. These naturally occurring antibodies are mainly IgM antibodies. They attack and rapidly destroy red cells with the corresponding antigen. For example, anti-A attacks red cells of Group A or AB. Anti-B attacks red cells of Group B or AB.



**Blood components are made from fresh whole blood.**

Blood Group	ABO Antigens on Red Cells	ABO Antibodies in Plasma
Group O	none	anti-A and anti-B
Group A	A	anti-B
Group B	B	anti-A
Group AB	A and B	None

Table 1: ABO Blood Groups

If ABO incompatible red cells are transfused, red cell hemolysis can occur. For example, if group A red cells are infused into a group O recipient, the recipient's anti-A antibodies bind to the transfused cells. An ABO incompatible transfusion reaction may result in overwhelming complement activation and hemolysis, resulting in shock, renal failure and death.

### Rh(D) System

The Rh blood group system is what identifies a person's blood type as either positive or negative. The Rh(D) antigen is highly immunogenic. Antibodies against Rh(D) positive cells will only develop in Rh(D) negative people exposed to Rh(D) positive cells through either transfusion or pregnancy (i.e., they are not naturally occurring).

In general, O Rh(D) negative (O Negative) is the blood group of choice where emergency unmatched blood is required. However, this is not always possible due to the fact that O Negative blood is very rare. When Rh negative red cells are not available, Rh Immune Globulin (RhIG, WinRho) may be used to help prevent the patient from producing their own anti-D antibodies. Rh type is not a factor when considering compatibility for plasma components.

### Compatibility

The following chart shows the compatibility information for red blood cells and plasma between patient and donor blood groups.

Patient's ABO Group	Compatible Red Blood Cells	Compatible Plasma
O Negative	O Negative	All ABO groups
O Positive	O Positive O Negative	All ABO groups
A Negative	A Negative O Negative	A AB
A Positive	A Positive A Negative O Positive O Negative	A AB



Patient's ABO Group cont'd	Compatible Red Blood Cells cont'd	Compatible Plasma cont'd
B Negative	B Negative O Negative	B AB
B Positive	B Positive B Negative O Positive O Negative	B AB
AB Negative	AB Negative A Negative B Negative O Negative	AB
AB Positive	All ABO and Rh groups	AB

Table 2: Patient Red Cell and Plasma Compatibility

### Plasma

Fresh Frozen Plasma (FFP) and Frozen Plasma (FP) are prepared from whole blood. FFP and FP are considered the same product and are used interchangeably. For plasma compatibility, please see Table 2 above. FFP and FP are both stored in a frozen state, and require time to thaw when requested for transfusion. The size of the unit of plasma sometimes varies based on how it was collected from the donor (i.e. apheresis units are approximately 500 mL and were previously referred to as “2 doses”; normal single donor collections result in units that are approximately 250 mL in size and were previously referred to as a “single dose”).

### Platelets

Platelet concentrates are also made from whole blood using the same steps for the production of plasma.

The same ABO and Rh type as the patient is the first choice when selecting platelets for transfusion. However, any ABO type may be transfused when no other choice of product is available. When ABO identical platelets are not available for pediatric transfusion, the Transfusion Service may further concentrate the platelets. All pediatric patients and females of child-bearing potential (i.e.  $\leq 45$  yrs old) who are Rh negative should be transfused with Rh negative platelets whenever possible. When Rh negative platelets are not available, Rh Immune Globulin (RhIG, WinRho) is often used to help prevent the formation of anti-D antibodies by the patient. The decision to administer Rh Immune Globulin is assessed by the Transfusion Medicine physician and most responsible health care provider on a case by case basis.

### Cryoprecipitate

Cryoprecipitate is prepared by slowly thawing FFP and then centrifuging it to separate the insoluble precipitate from the plasma. It has high fibrinogen content.

For cryoprecipitate, the same ABO type as the patient is the first choice; however, only group O and A are usually available. Any ABO type may be safely transfused.

## Blood Products

Blood products, sometimes referred to as “plasma protein products (PPPs)” or “manufactured products”, are made from plasma pools made up of a large number of donors. The plasma is collected, pooled together, and then treated by at least one method to either destroy or remove any viruses or bacteria that may be present. Because these products do contain human proteins, they are considered a “blood” product, and do require informed written consent.

Examples of blood products include:

- Albumin
- Factor VII Concentrate
- Factor VIII Concentrate
- Factor IX Concentrate
- Antithrombin III (ATIII) Concentrate
- Intravenous Immune Globulin
- Immunoglobulins (e.g. Rh Immune Globulin (RhIG), Hepatitis B Immune Globulin (HBIG), Varicella Zoster Immune Globulin (VZIG) etc.)
- Prothrombin Complex Concentrates (PCCs)



Plasma protein products like this one are made from the plasma of multiple donors.

## Transfusion of Blood Components and Products

Listed below are the basic steps to transfuse a patient with a blood component or product. The following sections will expand on these steps and provide the details necessary to perform transfusion safely and in compliance with applicable Standards and Regulations (see References).

1. Confirm informed written (signed) consent has been obtained.
2. Gather required equipment.
3. Confirm patient is wearing a Transfusion Service Identification Number (TSIN) when required. **Note:** This is **always** required when transfusing red cells. Some facilities have additional requirements for use of TSIN. Become familiar with the practice in your hospital.
4. Obtain and verify blood component or product.
5. Have a second health care professional verify the patient identity and blood component or product.
6. Advise the patient to report any side effects where possible, and administer the blood component or product.
7. Monitor the transfusion as required.
8. Report any adverse reaction.
9. Complete the required documentation.

**Learning Activity 1**

Instructions: Answer the questions below. **Please do not write in this module.**

1. For each patient blood group in column A, match the ABO antibodies they have in their plasma from column B

**Column A**

Group A  
Group B  
Group O  
Group AB

**Column B**

Anti- A & Anti-B  
Anti-A only  
Anti-B only  
No ABO antibodies

2. For each patient's ABO and Rh blood group in column A, match the safe ABO and Rh blood groups of donor **red cells** that they may receive.

**Column A**

A Pos  
A Neg  
B Pos  
O Pos  
AB Pos

**Column B**

O Pos and O Neg  
O Neg, A Neg  
O Pos, O Neg, A Pos, A Neg  
O Pos, O Neg, B Pos, B Neg  
Any Blood Group

3. Group O Pos patient can be transfused with what ABO group of plasma?

- i. Group A
  - ii. Group B
  - iii. Group O
- a. i, ii
  - b. i, iii
  - c. ii, iii
  - d. i, ii, iii

4. Group A Neg patient can be transfused with what ABO group of plasma?

- i. Group A
  - ii. Group AB
  - iii. Group O
- a. i, ii
  - b. i, iii
  - c. ii, iii
  - d. i, ii, iii

- 
5. Choose the statements below that are true for a group A Neg woman of child bearing potential who is to receive a platelet transfusion.
- i. Group A Neg platelets are the preferred product of choice for this transfusion
  - ii. Group O Pos platelets are just fine, no further follow up required
  - iii. Group A Pos platelets are acceptable if Rh negative platelets are unavailable, but Rh immune globulin may also be required.
- a. i, ii
  - b. i, iii
  - c. ii, iii
  - d. i, ii, iii
6. Blood products contain human proteins.
- a. True
  - b. False
7. Circle each example of a blood product
- IVIG      RhIG      Cryoprecipitate      Prothrombin Complex Concentrate (PCC)

**Note:** see Appendix C for answers

## Section Two: Pretransfusion

### Informed Written (signed) Consent

#### Learning Objectives

On completion of this section, the learner will be able to:

1. discuss the need for informed written (signed) consent in the setting of transfusion, and the process for obtaining this consent.
2. understand the steps taken prior to transfusion including: the orders to transfuse, specimen collection, and patient preparation.
3. explain handling instructions for blood including product pick-up and transportation to the patient.

Informed written (signed) consent must be obtained for the transfusion of blood components and blood products. The consent must be documented in the health record, and is obtained by the Most Responsible Health Practitioner MRHP. If it is not possible to obtain consent prior to transfusion (e.g. emergencies) it must be obtained as soon as possible. For further information, and to access the forms required to record consent, refer to the AHS Consent to Treatment/Procedure(s) policy suite at <http://insite.albertahealthservices.ca/2270.asp>.

#### Duration of a Valid Consent

The AHS consent policy does **not** identify a specific time frame for how long consent is valid. A new consent should be obtained if any of the conditions below occur:

- The patient's condition has materially changed
- The medical knowledge about the patient's condition or treatment has materially changed
- There has been a refusal to a portion of the Treatment/Procedure(s) originally planned or a refusal regarding the involvement of particular individuals in the Treatment/Procedure(s) (e.g., medical trainees)

#### Order for Blood Components and Blood Products

The order to transfuse must include:

- type and amount of blood component or blood product to be transfused
- rate/duration of infusion
- any special requirements (e.g., use of a blood warmer, irradiation)
- sequence of infusion if more than one type of component or product is to be transfused.
- any pre/post transfusion medications and or laboratory testing requirements
- the recipient identification and indication for transfusion (may be documented in the medical record)
- route of administration

DATE	TIME	PHYSICIAN'S ORDERS	DATE	PROGRESS NOTES
		(P) Please transfuse 2 units of RBC each over 4 hrs. - Lapse long IV after first unit - FU CBC ures after BP		Anemia + CF  A. Coker

## Pre-transfusion Specimen

Before collecting a pretransfusion specimen and attaching the transfusion service identification number (TSIN) band, the health care professional or provider must, in the presence of the patient, confirm the patient's identity. Confirmation should include involving the patient with questions such as "How do you spell your name?" and "Please tell me your date of birth?" Avoid "yes" "no" answer type questions. If the patient is unable to identify themselves, a second health care professional or provider must verify the patient's identity. The check also includes verifying that the TSIN on the band for the patient, the sample, and the requisition (where applicable) match. Ensure the TSIN band is attached to the patient.

The pre-transfusion specimen is used to:

- determine patients blood group (ABO and Rh)
- screen for any potentially harmful antibodies
- find suitable units for transfusion

Information required on the pre-transfusion specimen and/or requisition includes:

- patient's full first and last name
- 1 other unique identifier (i.e., ULI)
- TSIN where required (i.e., BBIN, RTSIS, TMID, CCI#)
- identity of the person collecting the specimen
- identity of the witness of the collection

The image shows three items used for consistency checking: a patient armband, a specimen label, and a transfusion medicine requisition form. The armband (top) is green and white with ID D35542 and collection date 02/02/14. The specimen label (middle) is white with a barcode, patient name Patient, Anusua, and collection date 0123/15. The requisition form (bottom) is yellow and white, containing patient information and collection details that must be verified against the other two items.

Example of armband, specimen and requisition that must be checked for consistency. (Your sites resources may differ)

## Obtaining Blood Components and Blood Products

Ensure the patient is ready for transfusion prior to obtaining the blood component or product.

- Verify written informed (signed) consent has been obtained, and there is an order for transfusion
- Ensure patient has a healthy, patent IV site if required
- Administer any required premedications (recommended only on patients with a history of transfusion reactions)

The issuing of blood components and products is typically carried out by two (2) health care providers, one (1) of whom is a health care professional or an employee of the transfusion service/laboratory. Exceptions to this include: use of electronic systems such as "smart" refrigerators or where only one health care professional is available (e.g. nursing staff during off-shift hours). In these scenarios, the individual must either be authorized by the electronic system, or a health care professional trained in obtaining blood components and products from the transfusion service/laboratory by themselves. Only one blood component or product should be signed out of the blood bank at a time, unless the components or products are being rapidly infused, being issued in a cooler, or where more than one bag/vial is required for the dose (ex. cryoprecipitate, IVIG, factor products, etc.).

The request (documentation) to pick up blood components or products must include:

- patient demographics, including a second identifier
- type of blood component or product
- amount/dose of required blood component or product

Ensure the blood component or product obtained is consistent with the transfusion order.

### **Transporting Blood Components or Products within the Facility**

Blood components and products should be transported directly from the transfusion service/laboratory to the location where the transfusion is going to take place. The component or product should **not** be left unattended or placed in a location that may result in either physical or temperature damage. Transfusion should be started as soon as possible.

Occasionally, more than one blood component at a time may be required for a patient. In these instances, the blood components may be issued in a cooler designed for this purpose.

### **Patient Teaching**

Most transfusion reactions occur during the first 15 minutes of the transfusion and are often first noted by the patient.

Where possible, patients should be instructed to notify you if they experience any of the following (when patients are unable to communicate, it is recommended to remain by the patient's bedside for the first 15 minutes):

- hives or itching
- feeling feverish or chills
- difficulty in breathing
- back pain or pain at the infusion site
- any feeling different from usual

Additional information for patients receiving transfusions can be found on MyHealth.Alberta.ca at the following links:

For adults: <https://myhealth.alberta.ca/alberta/Pages/Blood-transfusions.aspx>

For children: <https://myhealth.alberta.ca/alberta/Pages/Blood-transfusions-for-children.aspx>

For babies: <https://myhealth.alberta.ca/alberta/Pages/Blood-transfusions-for-babies.aspx>

**Learning Activity 2**

**Instructions:** Questions 1 – 10 are True False questions. **Please do not write in this module.**

1. Informed written consent must be obtained for the transfusion of blood components and products.
  - a. True
  - b. False
2. The AHS consent policy stipulates consent to transfusion is valid for 1 year.
  - a. True
  - b. False
3. An order to transfuse only has to include the patient's name and the product to be transfused.
  - a. True
  - b. False
4. Active communication, avoiding "yes" "no" type questions is to be used when identifying patients for pre-transfusion specimen collections.
  - a. True
  - b. False
5. Patient's full first and last name is sufficient identification on the pre-transfusion requisition and sample.
  - a. True
  - b. False
6. A second health care provider must assist in patient identification if the patient is unable to participate.
  - a. True
  - b. False
7. The issuing of blood components and products is typically carried out by 2 individuals, one of whom is a health care professional or from the transfusion service/laboratory.
  - a. True
  - b. False



8. The request to pick up a blood component or product must include patient demographics (including a second unique identifier), and the type and amount of the component or product required.
  - a. True
  - b. False
  
9. It is acceptable to stop for coffee when transporting blood from the transfusion service/laboratory to the patient.
  - a. True
  - b. False
  
10. Most transfusion reactions will occur in the first 15 minutes of the transfusion.
  - a. True
  - b. False

**Note:** see Appendix C for answers

## Section Three: Equipment

### Equipment Used in Transfusion

#### Learning Objective

On completion of this section, the learner will be able to:

1. discuss the equipment used for transfusing blood components and products

In this section you will find specific information regarding the equipment used in the transfusion of blood components and products. Refer to the AHS Transfusion Medicine Blood Components and Products information monographs at: <http://www.albertahealthservices.ca/lab/page3319.aspx> for information on the use of specific infusion set, compatible intravenous solutions and/or reconstitution devices for blood components and products.

#### Tubing

- Maximum length of time a transfusion set can hang for is 8 hours or as per manufacturer recommendation (whichever is shorter). If it is difficult to maintain the transfusion rate, a new transfusion set may be needed.
- A new transfusion set is required when platelets are to be transfused after red cells or plasma, or when switching from one blood product to another
- Discard the set and bag on completion of the transfusion unless a transfusion reaction has occurred; then consult the transfusion service/laboratory.

#### Filters

- For blood component transfusions a blood administration infusion set/filter (170-260 micron) is used. Many of the manufactured blood products are supplied with specific ancillary devices to aid in both the reconstitution and infusion of the product.

#### Vented Sets

- Blood products contained in glass bottles (Albumin, IVIG) are transfused using vented sets. Vented sets should not be used for other blood components and products.

#### Central Venous Access Device

Central venous access device is the **preferred** venous access for blood component/product administration if the patient has both central and peripheral access available.

**Note:** Small diameter PICC lines might result in slow flow rates and/or occlusion.

## Peripheral

Use intravenous catheter of 18 to 24 gauge where possible, taking into account the condition and the size of the vein. Blood components or products may be transfused through a 14 to 24 gauge short peripheral catheter. Transfusion for neonate/pediatric/elderly populations is usually given using a 22 to 24 gauge peripheral venous access device. Smaller gauge catheters may require decreased infusion rates.

## Direct IV Administration of Blood Products (IV Push)

- Direct intravenous (IV) administration of blood products refers to the **injection** of a blood product into the systemic circulation (refer to AHS Monographs for specific product information).
- Blood product administration by direct IV is included in the specialized clinical competency of transfusion for RN/RPN.

## Pumps

- Pumps may be used for the transfusion of blood components or products depending on patient condition and/or infusion parameters.
- Pumps do not damage or destroy blood components (i.e. red cells and platelets).
- Pressure infusion devices and rapid infusers are considered a type of infusion pump. This should not be used for platelets or cryoprecipitate unless specifically validated for this use.
- Fluid warming pumps pose a risk to red blood cells if not properly maintained. The safe use of these devices depends on their regular maintenance. You **must** always ensure a warmer's preventative maintenance is up to date, and the device is currently certified for use.

## Priming Tubing

A second IV line (known as a reaction line) is to be available.

**Adults:** Pre-prime blood administration set with appropriate solution prior to attaching the blood component/ product (refer to AHS product monographs).

**Neonates/Pediatrics:** Prime the set with the blood component/product.

## Emergency Equipment *(confirm availability, awareness of location)*

- Oxygen source and oxygen tubing
- Nasal canula and or oxygen mask
- Suction
- Additional intravenous solutions

## Emergency Medications *(confirm availability, awareness of location)*

- epiNEPHrine: Adult or pediatric 1 mg/mL, neonate 0.1 mg/mL
- diphenhydrAMINE: 50 mg/mL injectable Not used in neonates
- hydrocortisone, injectable

**Learning Activity 3**

**Instructions:** Fill in the blanks by choosing the appropriate option listed. **Please do not write in this module.**

1. Unless otherwise specified by the manufacturer, the maximum time allowed for a transfusion set to hang is \_\_\_\_\_ hours.  
(4, 8, 24)
2. Blood \_\_\_\_\_ require a filtered infusion set with a 170-260 micron filter.  
(products, components)
3. Blood products contained in glass bottles require \_\_\_\_\_ sets.  
(vented, non-vented)
4. If both central and peripheral access is available for administration of blood components and products, the \_\_\_\_\_ device is the preferred mechanism.  
(central, peripheral)
5. Use of the same tubing/transfusion set when switching from a blood component to a blood product \_\_\_\_\_ considered acceptable.  
(is, is not)
6. When a transfusion has been completed, and there is evidence of a transfusion reaction, the infusion set should not be discarded until after consultation with the \_\_\_\_\_ service.  
(postal, transfusion)
7. For neonate/pediatric transfusions, lines should be primed with the \_\_\_\_\_.  
(appropriate solution, blood component/product)

**Note:** see Appendix C for answers

## Section Four: Administration/Transfusion

### Administration of Blood Components and Products

#### Learning Objective

On completion of this section, the learner will be able to:

1. recognize the importance of identification of patient and blood, and the means to perform this identification.
2. outline the steps required to safely transfuse blood.
3. explain the documentation required to complete the process of transfusion.

#### Verification of Blood Components and Products

The final checks done immediately prior to transfusion are critical in ensuring patient safety. These checks must be completed by one health care professional that is authorized to administer blood components and products, and one other health care provider trained and authorized to perform this function (usually a second health care professional or lab assistant). A second check prior to transfusion can also be done by an approved electronic device designed for this purpose. The following table outlines the checks that must be completed, and which checks must be done in the presence of the patient. All checks should be completed by the same two health care providers.

Confirm prior to or at bedside:	Confirm at bedside:
<ul style="list-style-type: none"> <li>• patient identification on transfusion order matches patient identification on component/product</li> <li>• blood component/product received is consistent with transfusion order</li> <li>• Component/product number on container matches component/ product number on the tag</li> <li>• component/product is not expired</li> <li>• no abnormalities exist (leaks, hemolysis, particulates etc.)</li> </ul> <p>For blood components:</p> <ul style="list-style-type: none"> <li>• ABO (and Rh where applicable) on the component label match the tag</li> <li>• ABO (and Rh where applicable) of the component is compatible with the patient's ABO and Rh</li> <li>• Compatibility status of the unit.</li> <li>• Any special requirements e.g. irradiated, washed, antigen negative.</li> </ul>	<ul style="list-style-type: none"> <li>• Patient's identification (refer to AHS <i>Patient Identity Verification Policy</i>)</li> <li>• patient's identification matches transfusion tag</li> <li>• transfusion service identification number on the tag matches the transfusion service identification number on the band (where applicable)</li> </ul>

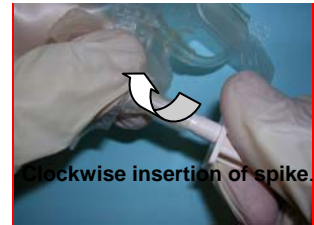


**Example of a TSIN with patient identification band**  
(Your sites TSIN band may differ)

**If there is any doubt regarding the identification check or the quality of the blood component or product STOP the process and notify the Transfusion Service/Laboratory immediately.**

### How to Spike a Blood Component

1. Separate the port cover until port is exposed.
2. Port covers that are not removable must be held away from the port to prevent contamination.
3. Hold the blood bag in one hand and exposed tubing spike in the other (do not hang unit on IV pole).
4. Insert spike into port and while gently pushing, turn spike a ¼ turn clockwise. Do **not** over spike.
5. To remove component, pull gently while turning spike counter clockwise.



### Spiking Blood Products

When entering a blood product, it is important to not “over-spike” as you may end up pushing the stopper into the vial.

## Transfusion

### Red Cells and Plasma

Transfusion should be started as soon as possible, and must be completed within 4 hours of removal from the temperature controlled environment. If the transfusion has been cancelled or cannot be completed within 4 hours, return the component to the transfusion service/laboratory immediately. Blood components should NEVER be discarded on the nursing unit without prior consultation with the transfusion service/laboratory.

Transfusion services/laboratories cannot receive units back into inventory that have been out of the refrigerator for longer than 60 minutes.

### Platelets

Transfusion should be started as soon as possible after the platelets are removed from the temperature controlled environment. Platelets require constant gentle agitation in a monitored environment kept at room temperature. Agitation and room temperature are required to prevent the platelets from clumping together. For this reason, platelets must never be placed in a refrigerator. Transfusion of a unit of platelets must **not** take longer than 4 hours after being removed from temperature controlled storage.

### Blood Products

For information on stability, routes of administration and reconstitution/mixing of the various blood products, please refer to the product information monographs found at <http://www.albertahealthservices.ca/lab/page3319.aspx>

### Initiation of Transfusion

Refer to the Key Activities Matrix in the Introduction for a listing of the personnel who may initiate the transfusion or administration of a blood component or product.

### Baseline Vital Signs

Record the following baseline vital signs within 30 minutes **prior** to starting the transfusion of blood components or blood products, and before any subsequent component or product.

- Temperature
- Blood Pressure
- Pulse
- Respiration
- Oxygen saturation if available

### Monitoring

All patients receiving blood component transfusions are monitored as per the following table. For transfusion of blood products, refer to the AHS *Blood Components and Products Information/Monographs* for monitoring requirements. Start the transfusion slowly (up to 2 mL per minute for blood components, refer to product monographs for product specific information), and for the first 5 minutes, remain with the patient. Monitoring of patient vital signs starts when the blood component reaches the IV site. Repeat vital signs as follows:

Table 3: Frequency of vital signs for patients receiving transfusion

	Pre Transfusion Vitals?	Stay At Patient Bedside?			Vital Signs During Transfusion		Post Transfusion Monitoring
		First 5 min	First 10 min	First 15 min	After 15 min	Remainder of transfusion	
ADULTS (in patients)	Yes		NO, but must be immediately available*		Yes	q1h	Set of V/S then monitor prn
ADULTS (out patients)	Yes		NO, but must be immediately available*		Yes	q1h	Set of V/S. Monitor for minimum of 15 min post**
PEDIATRICS & NEONATES	Yes	YES			Yes	1st hour → q15 min 2 <sup>nd</sup> and 3 <sup>rd</sup> hours → q30 min then q1h until complete	For 30-60 minutes following

\*Defined as performing non-dedicated tasks with the patient in view

\*\*If patient has had a previous adverse reaction to component transfusion, or this is the first transfusion patient has had for component, monitor for 30-60 minutes.

**Note:** Vital signs/patient monitoring may be conducted more frequently as determined by clinical condition of patient.

**Post Transfusion**

Flush the intravenous line to ensure the entire blood component or product has been transfused.

Maintain access by infusing an appropriate solution and rate as per prescriber order to keep vein open (TKVO).

Dispose of empty blood component and tubing as per local Infection Prevention and Control (IPC) policy and procedures, unless there has been a suspected transfusion reaction. If a reaction is suspected, consult with Transfusion Service/Laboratory regarding empty container(s) and infusion sets.

**Documentation**

The patient's health record shall contain the following information as it relates to the transfusion:

- Baseline vital signs
- The start and stop date and time of the transfusion
- Type, volume and transfusion service identification number of the blood component or product
- Identification of the person performing the transfusion
- Identification of the second person who verified the blood component or product for transfusion
- All additional vital signs and time they were captured
- Any signs and symptoms of adverse reaction and subsequent follow up
- Patient teaching performed
- Follow up testing done/patient outcome

**Transfusion Documentation/Tag**

All hospitals require the return of the transfusion documentation/tag to the laboratory (in some cases this may happen electronically). Become familiar with the practice in your hospital.

**Patient Notification**

All in-patients must be notified they have received a blood component or blood product. . Become familiar with the mechanism of notification of transfusion in your hospital.



**Learning Activity 4**

**Instructions:** Answer the questions below. **Please do not write in this module.**

1. What are the nine checks for blood components that can be done either at the bedside or prior to entering the patient's room?

_____	_____
_____	_____
_____	_____
_____	_____

2. What are the 3 checks that **MUST** be done at the patient bedside prior to starting a transfusion?

_____	_____
_____	

3. Final checks must be completed by one health care professional authorized to administer blood components and products and one other health care provider.

- a. True
- b. False

*For the following questions, unscramble the letters to reveal the answers:*

4. Time in which a red cell unit must be completely transfused after removal from storage?

\_\_\_\_\_

(rofu orhus)

5. Platelets must always be kept at \_\_\_\_\_.

(moro returaepemt)

6. Baseline vital signs are taken within \_\_\_\_\_ minutes prior to start of transfusion.

(ythtri)

7. For adult transfusions it is necessary to stay at the patient's side for the first 5 minutes and immediately available for the next 10 minutes. You should also start the transfusion

\_\_\_\_\_.

(lyswol)

8. All in-patients must be \_\_\_\_\_ they have received a transfusion.

(fitnodie)

**Note:** see Appendix C for answers

## Section Five: Transfusion Reactions

### Transfusion Reactions

#### Learning Objective

On completion of this section, the learner will be able to:

1. recognize transfusion reaction signs and symptoms, and discuss the processes involved in management of these reactions.

The AHS *Acute Transfusion Reaction Chart* can be found at:

<http://www.albertahealthservices.ca/assets/wf/lab/wf-lab-clin-tm-trxn-algrthm.pdf>

Make sure you are familiar with this chart before transfusing blood components or products.

#### Presenting Signs and Symptoms of Transfusion Reactions

Signs and symptoms of transfusion reactions can be grouped into one of 6 clusters.

Symptom/Sign Cluster\*

Cutaneous	Inflammatory	Cardiovascular	Respiratory	Gastrointestinal	Pain
- Pruritis	- Fever	- Tachycardia	- Tachypnea	- Nausea	- Headache
- Urticaria	- Chills	- Bradycardia	- Dyspnea	- Vomiting	- Chest
- Erythema	- Rigors	- Hypotension	- Wheezing	- Diarrhea	- Substernal
- Flushing		- Hypertension	- Rales		- Abdominal
- Jaundice		- Arrhythmia	- Hoarseness		- Back
- Pallor		- Shock	- Stridor		- Infusion site
- Cyanosis		- Jugular venous	- Pulmonary		- Proximal
- Petechiae		distension	edema		extremity
- Purpura			- Chest tightness		

Table 4 Signs & Symptoms of Transfusion Reactions (Taken from Mintz)

#### Steps Taken When a Transfusion Reaction is Suspected

1. Immediately stop transfusion and maintain IV site with saline. Flushing remaining amounts of remaining blood or product in original line may exacerbate the patient's symptoms. It is suggested that a new site, new IV set or a Y connector with limited extension volume be used to limit this risk.
2. Notify an authorized prescriber and transfusion service/laboratory of suspected adverse reaction.
3. Obtain physician orders for treatment / resuscitative measures.
4. Retain the remainder of the donor unit, attached tubing and IV fluids at the bedside, contact the transfusion service/laboratory to discuss documentation and next steps..

5. Perform clerical check – check that the information on the blood tag matches that on:
  - a. The blood unit label itself (ABO and Rh group, donor unit #)
  - b. The patient’s hospital identification band
  - c. The patient’s transfusion service identification number.
6. Document symptoms of reaction, vital signs and other required information on the forms provided for the transfusion service/laboratory, and in the patient’s medical chart.
7. Order a transfusion reaction investigation to be collected if required.
8. Send the completed documentation, requisition, and required samples to the transfusion service/laboratory.

It is imperative to be aware of the potential complications related to the administration of blood components and products. When a blood component or product transfusion reaction is anticipated, pre-medication may be ordered by the authorized prescriber.

Most transfusion reactions occur during the first 15 minutes of transfusion; however, the health care professional looking after the patient must continue to assess for reactions throughout the transfusion.

**Note:** Transfusion reactions may be acute or delayed in onset and vary in severity. Some transfusion reactions occur after the transfusion is complete.

Potential transfusion reactions are:

- common minor reactions
- very rare but life-threatening reactions
- problems caused by transmission of infection
- transfusion of an incompatible unit

The reporting of adverse transfusion reactions data is important for several reasons.

- It permits a rapid and thorough investigation and timely corrective action, if required, by Transfusion Services/Laboratory.
- The collection of adverse transfusion reaction data is essential for surveillance of the blood system.
- The data facilitates assessment of the quality of care provided and of blood components/products obtained.

**Learning Activity 5****Instructions:** Questions 1 – 4 are True False questions. **Please do not write in this module.**

1. The transfusion should ALWAYS be stopped in the event a transfusion reaction is suspected.
  - a. True
  - b. False
  
2. Flushing remaining amounts of blood components or products may exacerbate symptoms of a transfusion reaction.
  - a. True
  - b. False
  
3. The majority of transfusion reactions occur during the first 15 minutes of the transfusion.
  - a. True
  - b. False
  
4. Adverse transfusion reaction data is never used for surveillance of the blood system.
  - a. True
  - b. False

Note: see Appendix C for answers

---

**Transfusion of Blood Components and Products Post Learning Exam**

For each of the following questions, select the BEST answer. Answers in Appendix B.

1. Blood Components are:
  - i. Therapeutic parts of blood intended for transfusion
  - ii. Made from whole blood
  - iii. Often referred to as “manufactured products”
  - a. i, iii
  - b. i, ii
  - c. ii, iii
  - d. i, ii, iii
  
2. The two most important blood groups in Transfusion Medicine are:
  - a. ABO and Kell
  - b. Duffy and MNS
  - c. ABO and Rhesus
  - d. Kell and Rhesus
  
3. Patients who are A Negative are most compatible with red cells of the following types:
  - a. O Negative and A Positive
  - b. O Negative and B Negative
  - c. A Negative and B Negative
  - d. O Negative and A Negative
  
4. Red cells from which of the following blood group can be safely transfused to any recipient?
  - a. AB Negative
  - b. O Negative
  - c. A Positive
  - d. AB Positive
  
5. Blood products are:
  - a. Made from pools of plasma from multiple donors
  - b. Devoid of human proteins and do not require consent
  - c. Not treated in any way to prevent the spread of transfusion transmissible diseases
  - d. Produced from concentrated red cell units

- 
6. A patient's informed written consent for transfusion is valid for how long?
    - a. Two years
    - b. Until the patient's condition has materially changed
    - c. For life of the patient
    - d. Length of current visit
  
  7. In ALL health regions and facilities, the patient is required to be wearing a valid Transfusion Service Identification Number (TSIN) when receiving a transfusion of this:
    - a. Rh Immune Globulin
    - b. Intravenous Immune Globulin
    - c. Prothrombin Complex Concentrates
    - d. Red Blood Cells
  
  8. The following elements must always be on the pre-transfusion specimen label and/or requisition:
    - i. Patient's full first and last name and the identity of the collector
    - ii. The patient's address
    - iii. A second unique identifier such as the Unique Lifetime Identifier (ULI)
    - a. ii, iii
    - b. i, ii
    - c. i, iii
    - d. i, ii, iii
  
  9. You are about to collect a sample for pretransfusion testing and must identify the patient. Which of the following questions is an example of an active and appropriate way to do this?
    - a. Were you born on December 10<sup>th</sup>, 1965?
    - b. Are you Mrs. Smith?
    - c. How do you spell your first and last name?
    - d. Aren't you the guy from Global News?
  
  10. The majority of transfusion reactions occur at what point in the transfusion?
    - a. Within the first 30 seconds
    - b. Within the first 15 minutes
    - c. Transfusion reactions never occur
    - d. Just before the transfusion starts

- 
11. The request to pick up blood components or products **MUST** always include:
- i. Patient demographics, including a second identifier.
  - ii. The blood component or product to be transfused
  - iii. The amount or dose of the blood component or product required
- a. ii, iii
  - b. i, ii
  - c. i, iii
  - d. i, ii, iii
12. What is the maximum a transfusion set (i.e. blood tubing) can hang for?
- a. 8 hours
  - b. 4 units or 4 hours, whichever comes first
  - c. 12 hours
  - d. 2 units or 24 hours, whichever comes first
13. A vented infusion set must be used to transfuse which of the following?
- a. Red blood cells
  - b. Platelets
  - c. Albumin or IVIG in a glass bottle
  - d. Cryoprecipitate
14. Which of the following statements below is true regarding infusion pumps and their use in the transfusion of blood components and products?
- a. Pumps can be used to transfuse blood components or products
  - b. Pumps damage and destroy blood components
  - c. Pressure infusion devices and blood warmers are not a type of infusion device
  - d. You do not need to confirm a blood warmers preventative maintenance is up to date and it is currently certified for use to ensure safe transfusion.
15. In the list of the pre-transfusion checks below, which check **MUST** be performed at the patient bedside prior to starting the transfusion?
- a. Confirm the component/product is not expired.
  - b. ABO-Rh on the component label match the ABO-Rh on the tag
  - c. Patient's identification matches the transfusion tag
  - d. The blood component/product received is consistent with the order in the chart.

- 
16. What should you do if a discrepancy is discovered during the identification process?
- Confirm with a co-worker that it is ok to start the transfusion.
  - Start the transfusion, but go back over the paperwork to try and rectify the discrepancy
  - Make a note in the chart that a discrepancy was found and proceed with the transfusion
  - Stop the process and immediately contact the transfusion service/laboratory.
17. The transfusion of blood components must be completed within what time frame AFTER removal from their temperature controlled environment?
- 1 hour
  - 2 hours
  - 4 hours
  - 8 hours
18. Which of the following protocols best explains the frequency in which vital signs are recorded for an adult receiving transfusion of a blood component?
- No baseline, 15 min after the start, q1h, post transfusion
  - Less than 30 min prior, 5 min after the start, q30min, post transfusion
  - Less than 30 min prior, 15 min after the start, q2h, post transfusion
  - Less than 30 min prior, 15 min after the start, q1h, post transfusion
19. If a transfusion reaction has occurred or is suspected, the clerical check that must be performed includes:
- The blood component or product label
  - The patient's hospital identification band
  - The patient's Transfusion Service Identification Number (if applicable e.g. a red cell transfusion)
- ii, iii
  - i, ii
  - i, iii
  - i, ii, iii



20. Which of the following statements is true regarding the steps taken when a transfusion reaction is suspected?

- i. Continue the transfusion, but slow it down to mitigate the symptoms.
  - ii. Stop the transfusion, and retain the remainder of the component/product and IV tubing.
  - iii. Notify the most responsible health care practitioner or attending and the Transfusion Service/Laboratory immediately
- a. i, ii
  - b. i, iii
  - c. ii, iii
  - d. i, ii, iii

**References**

Alberta Health Services *Transfusion of Blood Components and Products Policy*, Mar. 2015

Alberta Health Services *Transfusion of Blood Components and Products – Adult Acute procedure*, Mar. 2015

Alberta Health Services *Transfusion of Blood Components and Products – Pediatric/Neonate Acute procedure*, Mar. 2015

Canadian Standards for Transfusion Medicine, Ver. 3

Health Canada *Blood Regulations*, effective Oct. 2014

Mollison's Blood Transfusion in Clinical Medicine: Klein HG, Anstee DJ, 11<sup>th</sup> ed. 2006

Standards for Blood Banks and Transfusion Services – AABB, 28<sup>th</sup> ed.

Transfusion Therapy: Clinical Principles and Practice – AABB: Paul D. Mintz, 3<sup>rd</sup> ed. 2010

**Appendix A: Post Learning Module Assessment Answer Sheet**

Name: \_\_\_\_\_

e-People ID# \_\_\_\_\_

Unit/Dept: \_\_\_\_\_

- i. a b c d
- ii. a b c d
- iii. a b c d
- iv. a b c d
- v. a b c d
- vi. a b c d
- vii. a b c d
- viii. a b c d
- ix. a b c d
- x. a b c d
- xi. a b c d
- xii. a b c d
- xiii. a b c d
- xiv. a b c d
- xv. a b c d
- xvi. a b c d
- xvii. a b c d
- xviii. a b c d
- xix. a b c d
- xx. a b c d

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**Appendix B: Post Learning Module Assessment Answer Key**

1. b
2. c
3. d
4. b
5. a
6. b
7. d
8. c
9. c
10. b
11. d
12. a
13. c
14. a
15. c
16. d
17. c
18. d
19. d
20. c

---

**Appendix C: Learning Activity Answer Key****Learning Activity 1**

1. Group A → Anti-B Only  
Group B → Anti-A Only  
Group O → Anti-A and Anti-B  
Group AB → No ABO antibodies
2. A Pos → O Pos, O Neg, A Pos, A Neg  
A Neg → O Neg, A Neg  
B Pos → O Pos, O Neg, B Pos, B Neg  
O Pos → O Pos, O Neg  
AB Pos → Any Blood Group
3. D
4. A
5. B
6. True
7. IVIG, RhIG and Prothrombin Complex Concentrate (PCC) are all examples of blood products.

**Learning Activity 2**

- |          |          |
|----------|----------|
| 1. True  | 6. True  |
| 2. False | 7. True  |
| 3. False | 8. True  |
| 4. True  | 9. False |
| 5. False | 10. True |

**Learning Activity 3**

1. 8
2. Components
3. Vented
4. Central
5. Is not
6. Transfusion
7. Blood component/product

**Learning Activity 4**

1. i) patient identification on transfusion order matches patient identification on component/product
  1. blood component/product received is consistent with transfusion order
  2. component/product number on container matches component/ product number on the tag
  3. ABO-Rh on the component label matches the tag
  4. ABO-Rh of the component is compatible with the patient ABO-Rh
- vi) component/product is not expired
  - a. no abnormalities exist (leaks, hemolysis, particulates etc.)
2. i) patient's identification (refer to AHS *Patient Identity Verification Policy*)
  - iii) patient's identification matches transfusion tag
  - iii) transfusion service identification number on the tag matches the transfusion service identification number on the band
3. True
4. Four hours
5. Room temperature
6. Thirty
7. Slowly
8. Notified

**Learning Activity 5**

1. a. True
2. a. True
3. a. True
4. b. False

Appendix D (sample only, see [www.albertahealthservices.ca/10380.asp](http://www.albertahealthservices.ca/10380.asp) for original)



## AHS Transfusion Performance Checklist

Pre-Transfusion	Transfusion	Post-Transfusion
<ul style="list-style-type: none"> <li><input type="checkbox"/> Written (signed) consent obtained and documented</li> <li><input type="checkbox"/> Order for transfusion present and documented</li> <li><input type="checkbox"/> Confirm pre/post medications, labs, and any special product requirements</li> <li><input type="checkbox"/> Requisition completed appropriately</li> <li><input type="checkbox"/> Appropriate procedure for identifying patient followed during collection of pre-transfusion specimen (not required for blood products)</li> <li><input type="checkbox"/> Specimen labeled appropriately</li> <li><input type="checkbox"/> Required tubing and equipment assembled</li> <li><input type="checkbox"/> Pre-transfusion assessment data documented, including vital signs, pre-medication</li> <li><input type="checkbox"/> IV inserted/patency confirmed</li> <li><input type="checkbox"/> Pick-up of blood component or product to be transfused arranged</li> <li><input type="checkbox"/> Visual inspection of blood component or product performed.</li> <li><input type="checkbox"/> Line primed with correct/compatible IV fluid</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> AHS hand hygiene procedures followed</li> <li><input type="checkbox"/> Line primed with correct/compatible IV fluid</li> <li><input type="checkbox"/> Blood component/product verified by 2 people. Verification check included:                             <ul style="list-style-type: none"> <li><input type="checkbox"/> Patient ID on order matches patient ID on component/product</li> <li><input type="checkbox"/> Blood component/product received is consistent with transfusion order</li> <li><input type="checkbox"/> Component/product number on container matches component/ product number on the tag</li> <li><input type="checkbox"/> ABO-Rh on the component label matches the tag</li> <li><input type="checkbox"/> ABO-Rh of the component is compatible with the patient ABO-Rh</li> <li><input type="checkbox"/> Component/product is not expired</li> </ul> </li> <li><input type="checkbox"/> Additional verifications performed at the bedside included:                             <ul style="list-style-type: none"> <li><input type="checkbox"/> Patient's identification</li> <li><input type="checkbox"/> Patient's identification matches transfusion tag</li> <li><input type="checkbox"/> Transfusion service ID# on the tag matches the transfusion service ID# on the band</li> </ul> </li> <li><input type="checkbox"/> Infusion performed at appropriate rate</li> <li><input type="checkbox"/> Patient monitoring performed as per AHS product monographs</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> All required documentation completed in the health record</li> <li><input type="checkbox"/> IV line flushed to ensure all blood component/product is transfused</li> <li><input type="checkbox"/> Documentation of completed transfusion forwarded to Transfusion Service/ laboratory</li> <li><input type="checkbox"/> If patient experiences an adverse transfusion reaction, steps in AHS <i>Acute Transfusion Reaction Chart</i> followed.</li> <li><input type="checkbox"/> All blood component/product containers, tubing, solutions and tags are NOT discarded without further consultation from the Transfusion Service/ Laboratory</li> <li><input type="checkbox"/> Patient notified of transfusion.</li> </ul>

Ver. 4 Dec. 2014

Date (yyyy-Mon-dd): \_\_\_\_\_

Date (yyyy-Mon-dd): \_\_\_\_\_

Preceptor/Educator Name: \_\_\_\_\_ ID# \_\_\_\_\_

Learner's Name: \_\_\_\_\_

**Transfusion of Blood Components and Products Module Evaluation**

Participant Name (optional): \_\_\_\_\_

Site:\_\_\_\_\_ Unit/Area:\_\_\_\_\_ Date:\_\_\_\_\_

1. The module was easy to read and comprehend. Yes No
2. The directions and learning objectives were clear and easy to understand. Yes No
3. The amount of detail was appropriate. Yes No
4. The post learning assessment was appropriate. Yes No
5. What, if any, additional resources did you access in order to complete this module?
6. Having completed this module, how confident do you feel in performing this skill?
7. Is there information in the module that you think is NOT relevant to the topic of Blood Component/Product Administration? If so, please identify it.
8. Is there additional relevant information that you think needs to be included in the module? If so, please identify it.
9. How long did it take for you to complete this learning module? \_\_\_\_\_
10. Any other comments:

**Thank you for completing the Transfusion of Blood Components and Products Learning Module Evaluation**

Please submit completed evaluation by fax to Transfusion Medicine Lead at 780-342-8268 or through email to [Transfusion.SafetyTeam@albertahealthservices.ca](mailto:Transfusion.SafetyTeam@albertahealthservices.ca)