# CLINICAL PRACTICE RECOMMENDATIONS FOR BLOOD COMPONENT USE IN ADULT INPATIENTS

These Clinical Practice Recommendations were compiled based on review of evidence-based guidelines (see references), Choosing Wisely® and Choosing Wisely Canada recommendations, the current literature, selected hospital transfusion guidelines, and expert opinion. They are presented as recommendations rather than guidelines because a formal literature search was not part of the preparation process. These recommendations are intended to assist hospitals that have not yet developed guidelines, are in the process of developing guidelines or updating their established guidelines.

Disclaimer
The Clinical Practice Recommendations for Blood Use in Adult Inpatients are not intended to replace sound clinical judgement concerning a patient's unique situation. Furthermore, although the advice and information included in these recommendations are believed to be true and accurate at the time of publication, neither the authors nor the publishers accept any legal responsibility for any errors or omissions that were made.

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## Red Blood Cells – Adult Inpatients

**General Recommendations:**

- These recommendations apply to adult inpatients and may not apply to transfusion-dependent outpatients. For patients with hemoglobinopathies (e.g., sickle cell disease) or cyanotic heart disease, consult hematology prior to transfusing.
- The underlying cause of anemia must always be considered in the transfusion decision-making process. Alternative therapies (e.g., iron) may be more appropriate than transfusion.
  Alternatives Resources:
  ONTraC Algorithm: Preoperative Hemoglobin Optimization & Anemia Management
  ONTraC Resources
  Using Blood Wisely: Alternatives to Blood Module
- Dose: transfuse 1 unit for all non-urgent red blood cell (RBC) transfusion;
  recheck patient symptoms (dyspnea, chest pain, syncope) and hemoglobin (Hb) before considering additional units.

**Table 1: Red Blood Cells**

| Hb threshold | Recommendation and clinical setting |
|---|---|
| Hb less than 50-60 g/L | • The following patients typically do not require transfusion until Hb is less than 50-60 g/L:<br>○ Patients with sickle cell disease and uncomplicated vaso-occlusive crisis. Consult hematology.<br>○ Healthy patients with chronic nutritional anemia (iron, B12, folate deficiency) without hemodynamic symptoms (e.g., dyspnea, chest pain, syncope).<br>○ Healthy postpartum patients without hemodynamic symptoms (e.g., dyspnea, chest pain, syncope). |
| Hb less than 70 g/L | • Transfusion is likely appropriate.<br>• Younger adults with no ischemic cardiovascular disease and transient reversible anemia may tolerate lower Hb.<br>• Depending on the etiology of anemia, alternative therapies (e.g., iron) may be more appropriate than transfusion in hemodynamically stable, non-bleeding patients. |
| Hb less than 80 g/L | • Consider transfusion in patients with uncorrected pre-existing cardiovascular disease. |
| Hb less than 90 g/L | • Consider transfusion only in patients with clear signs and symptoms of impaired tissue oxygenation. |
| Hb less than 90 g/L | • Transfusion may be appropriate for patients with acute myocardial infarction (MI); benefit is uncertain in all MI patients.<br>Consider individual patient factors, see Table 2. |
| Hb greater than 90 g/L | • Transfusion is likely *inappropriate.*<br>• If transfusion is ordered, clearly document the indication in the patient's chart and discuss reason(s) with the patient. |
| Acute bleeding patient<br>• Maintain Hb greater than 70 g/L.<br>• If pre-existing cardiovascular disease, maintain Hb greater than 80 g/L.<br>• In massive hemorrhage protocol, target Hb 70-90 g/L. | |

**Table 2: Acute MI Patient with Anemia (Hb less than 90 g/L)**
**Consider individual patient factors listed below.**
Red Blood Cells, reference 7 (Shih et al. CCS/NAC Joint Statement on Anemia and Acute Coronary Syndromes)

All Acute MI Patients

- Slowly transfuse 1 unit RBC, then clinical and Hb reassessment
- Consider pre-transfusion diuretic (fluid overload risk)
- Minimize blood draws/tests when possible
- Correct iron deficiency (particularly in patients with heart failure)

Favour a Restrictive Transfusion Strategy

- Type 2 MI (supply-demand mismatch)
- Risk of fluid overload (poor baseline oxygen status, elderly, relevant comorbidities)
- Potential future transplant required (risk of developing antibody)
- Potential future pregnancy (risk of developing antibody)
- Factors associated with Type 2 MI
    - Primary diagnosis other than MI
    - Comorbidities (e.g., renal failure, bleeding) more likely
    - Chronic anemia more likely
    - Arrythmia (atrial fibrillation) more likely
    - Lower dynamic increase in troponin level
    - Severe hypertension or hypotension and/or shock
    - Older (not observed in MINT trial)
    - Female sex (not observed in MINT trial)

Favour a Liberal Transfusion Strategy

- Type 1 MI (thrombotic occlusion at site of disrupted atherosclerotic plaque)
- Ongoing bleeding risk
- Upcoming invasive angiography
- Continuing ischemic symptoms
- Factors associated with Type 1 MI
    - Presentation is acute MI symptoms
    - Recognized coronary artery disease
    - Electrocardiogram: ST elevation
    - Higher dynamic increase in troponin level
    - Younger

- Do not transfuse based on Hb alone.
- One RBC unit usually raises Hb by approximately 10 g/L in adult patients.
- Transfusion-Associated Circulatory Overload (TACO): identify patients at risk and implement preventative strategies as appropriate.
  TACO Risk factors: age over 70 years, history of heart failure, left ventricular dysfunction, history of myocardial infarction, renal dysfunction, positive fluid balance.
  TACO Preventative strategies: transfuse 1 unit at a time, slow the rate of transfusion to a maximum of 4 hours (from time of removal from temperature-controlled environment) per

unit, administer pre-transfusion diuretic.

- Premedication for allergic transfusion reactions is usually indicated only in patients with recurrent minor reactions or previous anaphylactic reactions.
- In an emergency, if irradiated blood is indicated but is not available, RBCs stored for a minimum of 14 days, but preferably more than 21 days from collection should be transfused.
- For dialysis patients, consider administering non-urgent transfusion during their dialysis treatment.
- Whenever possible, non-urgent transfusion should be completed during the day shift, for optimum patient safety.

## Platelets – Adult Inpatients

| **Table 3: Platelets** | | |
|---|---|---|
| **Clinical Setting: Diagnosis/Indication** | **Platelet Count x $10^9$/L** | **Recommendation and dose** |
| • Hypoproliferative thrombocytopenia.<br>• Non-immune thrombocytopenia. | Less than 10 | 1 dose |
| • Procedures not associated with significant blood loss, including percutaneous procedures (e.g., non-subclavian central line placement, lumbar puncture, paracentesis). | Less than 20 | 1 dose |
| • High risk procedures in patients with liver disease/cirrhosis. | Less than 30 | 1 dose |
| • Patients with acute thrombosis and high risk of thrombus progression, where therapeutic anticoagulation cannot be stopped. | Less than 50 | Consult a thrombosis specialist.<br>1 dose |
| • Procedures with expected blood loss greater than 500 mL.<br>• Major non-neuraxial surgery. | Less than 50 | 1 dose, immediately before procedure.<br>Check platelet count before starting procedure. |
| • Neuraxial anesthesia. | Less than 50-80 | 1 dose |
| • Neuraxial surgery.<br>• Head trauma.<br>• CNS hemorrhage. | Less than 100 | 1 dose and check platelet count. |
| • Platelet dysfunction and significant bleeding e.g., post cardiopulmonary bypass.<br>• *Exception:* Transfusing platelets for spontaneous intracranial hemorrhage in patients not requiring surgical management, on antiplatelet agents, and with platelet count greater than 100 x $10^9$/L leads to increased morbidity. | Any | 1 dose |
| • Immune thrombocytopenia (immune thrombocytopenic purpura, heparin-induced thrombocytopenia, post-transfusion purpura, thrombotic thrombocytopenic purpura). | Case specific | Consult hematology before ordering.<br>For life-threatening bleeding only. |
| Acute bleeding patient<br>• Maintain platelet count greater than 50 x $10^9$/L.<br>• In massive hemorrhage protocol, transfuse to maintain platelet count greater than 50 x $10^9$/L (with head injury, greater than 100 x $10^9$/L). | | |

- Dose = 1 pooled platelet psoralen treated, or 1 apheresis platelet psoralen treated.
- In general, 1 dose should raise the platelet count by at least 15 x $10^9$/L within 60 minutes

post transfusion.

- Whenever feasible, transfuse platelets that are ABO and Rh blood group identical to the patient.

| **Table 4: If Rh blood group identical platelets are not available:** | |
|---|---|
| **Patient Rh Blood Group** | **Platelet Rh Blood Group for Transfusion** |
| Rh positive | Rh positive or Rh negative |
| Rh negative and<br>female age 45 years and under, with childbearing potential | Rh negative<br>If only Rh positive platelets are available and transfused, then Rh Immune globulin (RhIG) is required to prevent formation of anti-D antibody. |
| Rh negative and<br>female **not** of childbearing potential or male | Rh positive or Rh negative<br>If Rh positive platelets are transfused, RhIG is not recommended [risk of immunization from platelets is low (about 1%) and passive anti-D complicates compatibility testing procedures (potentially delaying transfusion)] |

| **Table 5: If ABO blood group identical platelets are not available, then ABO plasma compatible platelets are a reasonable alternative.** | |
|---|---|
| **Patient ABO Blood Group** | **Platelet ABO Blood Group for Transfusion**<br>(listed in preferred sequence) |
| O | O, B, A, AB |
| A | A, AB, B, O |
| B | B, AB, A, O |
| AB | AB, A, B, O |

- If post transfusion platelet increment is less than 7.5 x $10^9$/L for two transfusions of ABO identical platelets, consult the Transfusion Medicine Laboratory regarding investigation for platelet refractoriness. For more information on platelet refractoriness, refer to Bloody Easy 5.1 pages 30-31 and Canadian Blood Services Clinical Guide, Chapter 18.
- In Canada, effective 2024, platelets are “pathogen reduced”, available as Pooled Platelets Psoralen Treated and Apheresis Platelets Psoralen Treated. Pathogen reduced platelets have a decreased risk of bacterial transmission and transfusion-transmitted infections.
- Also effective 2024, platelets (including pathogen reduced platelets) are suspended in approximately 60% Platelet Additive Solution (PAS-E) and approximately 40% donor plasma. Less plasma lowers the risk of allergic transfusion reactions.
- For patients requiring irradiated blood, irradiation of platelets is not necessary as pathogen reduction/psoralen treatment is considered equivalent.
- Apheresis Platelets PAS-E Added (pathogen reduction technology not used) are also manufactured by Canadian Blood Services (very limited national inventory) for patients with a history of hypersensitivity reactions to amotosalen or other psoralen products. Apheresis Platelets PAS-E Added are also available for intrauterine and neonatal/pediatric transfusion where psoralen treatment long term safety data is limited.
  For patients requiring irradiated blood, irradiation is required if Apheresis Platelets PAS-E will be transfused.

## Plasma – Adult Inpatients

| Table 6: Plasma | | |
|---|---|---|
| **Clinical Setting: Diagnosis/Indication** | **INR** | **Recommendation and dose** |
| • Low-risk invasive procedure planned (e.g., arterial line, IV line, PICC line, bone marrow procedure, paracentesis, thoracentesis); including patient with liver disease. | Any | DO NOT transfuse plasma. |
| • High-risk invasive procedure planned and patient with liver disease. | Greater than 2.5 | Vitamin K 10 mg, slow IV infusion<br>**OR**<br>See Table 7, example plasma dosing. |
| • High-risk invasive procedure planned. | Greater than or equal to 1.8 | See Table 7, example plasma dosing. |
| • Major Bleeding. | Greater than or equal to 1.8 | See Table 7, example plasma dosing. |
| • Microvascular bleeding.<br>• Massive hemorrhage protocol. | Greater than or equal to 1.8<br>or<br>unknown and cannot wait for result. | *Massive hemorrhage protocol:* commence at a minimum ratio of 2:1 (RBC:plasma) for the first 30-60 minutes, then administer based on coagulation test results.<br><br>See Table 7, example plasma dosing. |
| • Urgent warfarin reversal and<br>○ Serious bleeding.<br>○ Urgent surgical procedure required within 6 hours. | Greater than 1.5 | Prothrombin Complex Concentrate (PCC) is the emergency reversal agent for warfarin. For PCC information, refer to Bloody Easy 5.1 pages 122-125.<br>Only give plasma if PCC is not available or is contraindicated (e.g., history of heparin-induced thrombocytopenia).<br>Co-administer Vitamin K 10 mg IV.<br><br>See Table 7, example plasma dosing. |
| • Congenital coagulation factor deficiency where a factor concentrate is not available and<br>○ Serious bleeding.<br>○ Urgent surgical procedure required. | Any | Consult hematology. |
| **NOTE:**<br>Plasma is neither indicated nor effective for reversal of heparin, low molecular weight heparin or direct oral anticoagulants (DOACs). For DOAC reversal information, refer to the Thrombosis Canada website, Clinical Guides, DOACs." | | |

- The effectiveness of plasma in reversing an elevated INR is dependent upon the etiology of the coagulopathy and the degree of PT/INR elevation.
- Patients with liver disease have preserved thrombin generation despite elevated INR levels and often do not need correction of an abnormal INR prior to a procedure.
- See plasma reference 2 for Radiology definitions low-risk and high-risk invasive procedures.
- Plasma must be ABO blood group compatible.
- Patients with known anti-IgA antibodies should receive plasma from IgA deficient donors.
- As of 2023, Canadian Blood Services provides Solvent Detergent Plasma (S/DP) and Plasma Components (FP) including frozen plasma and apheresis frozen plasma.
  Effective September 2025, Canadian Blood Services manufacture of Pathogen Reduced Plasma (Apheresis Frozen Plasma Psoralen Treated) was launched in Ottawa and will be gradually expanded across Canada. Implementation of pathogen reduction technology reduces the risk of transfusion-transmitted infections and enhances the safety profile.
- Clinical indications for all types of plasma are the same.
- Contraindications to S/DP:
  - Patients with IgA deficiency and documented anti-IgA antibodies.
    These patients would also potentially experience allergic reactions to FP. These patients should only receive FP from IgA deficient donors.
    IgA deficiency alone (no anti-IgA antibodies) is not a contraindication as most patients with this relatively common deficiency do not form antibodies and will not have an adverse reaction.
  - Patients with severe deficiency of protein S.
    S/DP contains significantly lower levels of protein S compared to FP. This could lead to an increased risk of blood clots. Patients with severe deficiency of protein S requiring plasma transfusion should receive FP.
- Contraindication/Precaution for Pathogen Reduced Plasma (Apheresis Frozen Plasma Psoralen Treated):
  - Do not use in patients with a history of hypersensitivity reactions to amotosalen or other psoralen products.
  - Caution, limited safety data for use in intrauterine and neonatal/pediatric transfusion.
- The standard volume: S/DP is 200 mL/unit.
  The mean volume: frozen plasma is 289 mL/unit,
  apheresis frozen plasma is 249 ml/unit,
  pathogen reduced plasma is 203 mL/unit.
- Dose: 10-15 mL/kg. See Table 7: Example Weight-based Plasma Dosing
  Avoid single unit plasma transfusion; dose would be inadequate.
- A dose of 10-15 mL/kg raises coagulation factor levels by approximately 20% for about 5 hours.
- Allow time for thawing (30 minutes).
- Thawed FP and Pathogen Reduced Plasma may be stored up to 5 days/120 hours at 1-6°C in TML approved, monitored refrigerator.
- Thawed S/DP may be stored up to 5 days/120 hours at 2-8°C in TML approved, monitored refrigerator.
  The S/DP manufacturer has provided guidance if on visual inspection, refrigerated thawed S/DP has a slight reversible protein precipitation:
  - Precipitate may be resolubilized by *rewarming the bag to 37°C for up to 10 minutes*.
  - If the particulate matter dissolves after rewarming, the product is acceptable to transfuse.
  - If the particulate matter remains following rewarming, discard the product.
- Transfusion-Associated Circulatory Overload (TACO): identify patients at risk and implement preventative strategies as appropriate.
  TACO Risk factors: age over 70 years, history of heart failure, left ventricular dysfunction, history of myocardial infarction, renal dysfunction, positive fluid balance.

TACO Preventative strategies: slow the rate of transfusion to a maximum of 4 hours (from time of removal from temperature-controlled environment) per unit, administer pre-transfusion diuretic.

**Table 7: Example Weight-based Plasma Dosing***
***Prescriber expertise is required to determine dose required [10 (lower) to 15 (higher) mL/kg], balancing each individual patient's clinical scenario (e.g., severity of bleeding, TACO risk).***

| Weight (kg) | Dose 10 mL/kg[1] (mL) | Dose 15 mL/kg[2] (mL) | S/DP; Pathogen Reduced Plasma[3] (# of units) | FP[4] (# of units) |
|---|---|---|---|---|
| < 40 kg | Use actual weight (kg) to calculate dose at 10-15 mL/kg, round # of units based on S/DP & Pathogen Reduced Plasma 200 mL/unit or FP 289 mL/unit. | | | |
| 40-44.9 | 450 | 600 | 2-3 | 2 |
| 45-49.9 | 500 | 675 | 3 | 2 |
| 50-54.9 | 550 | 750 | 3-4 | 2-3 |
| 55-59.9 | 600 | 825 | 3-4 | 2-3 |
| 60-64.9 | 650 | 900 | 4 | 2-3 |
| 65-69.9 | 700 | 975 | 4-5 | 3 |
| 70-74.9 | 750 | 1050 | 4-5 | 3 |
| 75-79.9 | 800 | 1125 | 4-5 | 3-4 |
| 80-84.9 | 850 | 1200 | 5-6 | 3-4 |
| 85-89.9 | 900 | 1275 | 5-6 | 3-4 |
| 90-94.9 | 950 | 1350 | 5-7 | 4 |
| 95-99.9 | 1000 | 1425 | 5-7 | 4 |
| 100 and greater[5] | 1000 | 1500 | 5-7 | 4-5 |

***** Modified from NAC recommendations table (Plasma reference 10); added Pathogen Reduced Plasma (Apheresis Frozen Plasma Psoralen Treated) information per CBS Circular of Information, (General reference 2)].

1. Dose calculated using upper weight for each weight increment, rounded up to nearest 5 mL.
2. Dose calculated using lower weight for each weight increment, rounded up to nearest 5 mL
3. Number of S/DP and Pathogen Reduced Plasma units rounded to nearest dose volume (mL), using volume 200 mL/unit (i.e., 3 units = 600 mL, 4 units = 800 mL, 5 units = 1000 mL, 6 units = 1200 mL, 7 units = 1400 mL).
4. Number of FP units rounded to nearest dose volume (mL), using mean unit volume 289 mL (i.e., 2 units = 578 mL, 3 units = 867 mL, 4 units = 1156 mL, 5 units = 1445).
5. For weight 100 kg and greater, dose is capped using 95-99.9 kg weight increment dose.

**Example tables for equivalent weight-based doses of S/D plasma and frozen plasma (FP):**

***Follow local policy for plasma dosing/substitution established by the transfusion medicine service***

(a) Simple weight-based table for S/D plasma and FP.

| Weight (kg) | Target dose[1] | S/D Plasma[2] | FP[3] |
|---|---|---|---|
| < 40 kg | 12 mL/kg | 12 mL/kg | 12 mL/kg |
| 40-54.9 kg | 600 mLs | 3 units (600 mLs) | 2 units (avg 580 mLs) |
| 55-74.9 kg | 815 mLs | 4 units (800 mLs) | 3 units (avg 870 mLs) |
| 75-94.9 kg | 1030 mLs | 5 units (1000 mLs) | 4 units (avg 1160 mLs) |
| 95+ kg[3] | 1200 mLs | 6 units (1200 mLs) | 5 units (avg 1450 mLs) |

(b) Expanded table including dose range for S/D plasma and FP.

| Weight (kg) | 10 mL/kg[4] | 15 mL/kg[4] | S/D Plasma dose[2] | FP dose[3] |
|---|---|---|---|---|
| < 40 kg | -- | -- | 12 mL/kg | 12 mL/kg |
| 40-44.9 kg | 450 mL | 600 mL | 3 units | 2 units |
| 45-49.9 kg | 500 mL | 675 mL | 3 units | 2 units |
| 50-54.9 kg | 550 mL | 750 mL | 3 units | 2-3 units |
| 55-59.9 kg | 600 mL | 825 mL | 3-4 units | 3 units |
| 60-64.9 kg | 650 mL | 900 mL | 4 units | 3 units |
| 65-69.9 kg | 700 mL | 975 mL | 4 units | 3 units |
| 70-74.9 kg | 750 mL | 1050 mL | 4-5 units | 3 units |
| 75-79.9 kg | 800 mL | 1125 mL | 4-5 units | 3-4 units |
| 80-84.9 kg | 850 mL | 1200 mL | 5-6 units | 4 units |
| 85-89.9 kg | 900 mL | 1275 mL | 5-6 units | 4 units |
| 90-94.9 kg | 950 mL | 1350 mL | 5-6 units | 4 units |
| 94.9-99.9kg | 1000 mL | 1425 mL | 6 units | 4-5 units |
| 100+ kg[3] | 1000 mL | 1425 mL | 6 units | 4-5 units |

1. Target dose calculated using middle weight x 12.5 mL/kg.
2. Number of S/D Plasma units calculated using a unit volume of 200 mLs.
3. Number of FP units calculated assuming a mean unit volume of 289 mLs.
4. For weights above 100 kg, the plasma dose is capped using 100kg dose.
5. Dose for 10 mL/kg calculated using upper weight for each category.
6. Dose for 15 mL/kg calculated using lower weight for each category.

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### Red Blood Cells


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**Plasma**

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