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.

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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.
- Dose: transfuse 1 unit for all non-urgent red blood cell (RBC) transfusions; recheck patient symptoms (dyspnea, chest pain, syncope) and hemoglobin (Hb) before considering additional units.

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: o Patients with sickle cell disease and uncomplicated vaso-occlusive crisis. Consult hematology. o Healthy patients with chronic nutritional anemia (iron, B12, folate deficiency) without hemodynamic symptoms (e.g., dyspnea, chest pain, syncope). o Healthy postpartum patients without hemodynamic symptoms (e.g., dyspnea, chest pain, syncope).
Hb less than 70 g/L	• Transfusion is likely appropriate. • Younger adults with no ischemic cardiovascular disease and transient reversible anemia may tolerate lower Hb. • 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 90-100 g/L	• Transfusion is likely appropriate in patients with acute myocardial infarction.
Hb greater than 90 g/L	• Transfusion is likely *inappropriate* (exception: patients with acute myocardial infarction). • If transfusion is ordered, clearly document the indication in the patient's chart and discuss reason(s) with the patient.
Acute bleeding patient • Maintain Hb greater than 70 g/L. • If pre-existing cardiovascular disease, maintain Hb greater than 80 g/L. • In massive hemorrhage protocol, target Hb 70-90 g/L.	

- 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 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 transfusions during their dialysis treatment.
- Whenever possible, non-urgent transfusions should be completed during the day shift, for optimum patient safety.

Platelets – Adult Inpatients

Clinical Setting		
Diagnosis/Indication	**Platelet Count x 10^9/L**	**Recommendation and dose**
• Hypoproliferative thrombocytopenia. • 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 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. 1 dose
• Procedures with expected blood loss greater than 500 mL. • Major non-neuraxial surgery.	Less than 50	1 dose, immediately before procedure. Check platelet count before starting procedure.
• Neuraxial anesthesia.	Less than 50-80	1 dose
• Neuraxial surgery. • Head trauma. • CNS hemorrhage.	Less than 100	1 dose and check platelet count.
• Platelet dysfunction and significant bleeding e.g., post cardiopulmonary bypass. • *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. For life-threatening bleeding only.
Acute bleeding patient • Maintain platelet count greater than 50 x 10^9/L. • 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).		

- In general, 1 dose should raise the platelet count by at least 15 x 10^9/L within 60 minutes post transfusion.

- If post transfusion platelet increment is less than 7.5 x 10^9/L for two transfusions of ABO identical platelets, consult Transfusion Medicine Laboratory regarding investigation for platelet refractoriness.
- 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.
- 1 dose = 1 pooled platelet psoralen treated, or 1 apheresis platelet psoralen treated.
- 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.

Plasma – Adult Inpatients

Clinical Setting		
Diagnosis/Indication	**INR**	**Recommendation and dose**
• Liver disease with coagulopathy and low-risk invasive procedure planned (e.g., arterial line, IV line, PICC line, bone marrow procedure, paracentesis, thoracentesis).	Any	Do not transfuse plasma.
• Major bleeding. • Liver disease with coagulopathy and high-risk invasive procedure planned.	Greater than or equal to 1.8	See dosing table below.
• Microvascular bleeding. • Massive hemorrhage protocol.	Greater than or equal to 1.8 or 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. See dosing table below.
• Urgent warfarin reversal and o Serious bleeding. o Urgent surgical procedure required within 6 hours.	Greater than 1.5	Only give plasma if prothrombin complex concentrate (PCC) is not available or is contraindicated (e.g., history of heparin-induced thrombocytopenia). Co-administer Vitamin K 10 mg IV. See dosing table below.
• Congenital coagulation factor deficiency where a factor concentrate is not available and o Serious bleeding. o Urgent surgical procedure Required.	Any	Consult hematology.

- 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 of low-risk and high-risk invasive procedures.
- As of 2023, Canadian Blood Services provides Solvent Detergent Plasma (S/DP) and frozen Plasma (FP). S/DP and FP have the same clinical indications.
- 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.
- The standard volume for S/DP is 200 mL/unit while the mean volume for FP is 289 mL/unit. (See NAC recommendations, reference #4 for additional information).
- Dose: 10-15 mL/kg. 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.
- The weight-based dosing table below is modified from the NAC recommendations table (refer to reference # 4).

Weight based plasma dosing table

Weight (kg)	**Dose 12.5 mL/kg [1] (mL)**	**S/D Plasma[2] (# of units)**	**FP[3] (# of units)**
< 40 kg	Use actual weight (kg) to calculate dose at 12.5 mL/kg, round # of units based on S/D plasma 200 mL/unit or FP 289 mL/unit.		
40-44.9	570	3	2
45-49.9	630	3	2
50-54.9	690	3	2
55-59.9	750	4	3
60-64.9	820	4	3
65-69.9	880	4	3
70-74.9	940	5	3
75-79.9	1000	5	3
80-84.9	1070	5	4
85-89.9	1130	6	4
90-94.9	1190	6	4
95-99.9	1250	6	4
100 and greater[4]	1250	6	4

1. Dose calculated using upper weight for each weight increment, rounded up to nearest 10 mL.
2. Number of S/D 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).
3. 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).
4. For weight 100 kg and greater, dose is capped using 95-99.9 kg weight increment dose.

- Allow time for thawing (30 minutes).
- 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 per unit, administer pre-transfusion diuretic.

REFERENCES:

General (red cells, platelets, and plasma)

1. Callum, JL et al; Canadian Blood Services; Bloody Easy 5.1; Blood Transfusions, Blood Alternatives and Transfusion Reactions; A Guide to Transfusion Medicine 5th Edition; 2023.
2. Canadian Blood Services (CBS). Circular of information [Internet]. Ottawa (CA); CBS; 2020 [cited 2025 Jan 28]. Available from: https://www.blood.ca/en/hospital-services/products/component-types/circular-information
3. Sunnybrook Health Sciences Centre, Toronto
4. St. Michael's Hospital, Toronto

Red Blood Cells

1. Carson JL et al. Red Blood Cell Transfusion: 2023 AABB International Guidelines. JAMA 2023;330:1892-1902.
2. Carson JL et al. Restrictive or liberal transfusion strategy in myocardial infarction and anemia. N Engl J Med 2023;289:2446-2456.
3. Ducrocq G et al. Effect of a restrictive vs. liberal blood transfusion strategy on major cardiovascular events among patients with acute myocardial infarction and anemia: The REALITY randomized clinical trial. JAMA 2021;325:552-560.
4. Mueller MM et al. Patient Blood Management: Recommendations from the 2018 Frankfurt Consensus Conference. JAMA 2019;321:983-997.
5. Choosing Wisely Canada www.choosingwiselycanada.org Lists from the Canadian Society for Transfusion Medicine, the Canadian Hematology Society, the Canadian Society of Internal Medicine, and the Canadian Society of Palliative Care Physicians.
6. Prokopchuk-Gauk O et al. National Advisory Committee on Blood and Blood Products. Guidelines & recommendations NAC recommendations for the use of irradiated blood components in Canada [Internet]. Ottawa: National Advisory Committee on Blood and Blood Products; 2017 Oct 17 [updated 2023 Apr 30; cited 2024 Nov 28]. Available from: https://nacblood.ca/en/resource/recommendations-use-irradiated-blood-components-canada

Platelets

1. Kaufman RM et al. Platelet Transfusion: A Clinical Practice Guideline From the AABB. Ann Int Med 2015;162(3):205-213.
2. Kumar A et al. platelet transfusion: a systematic review of the clinical evidence. Transfusion 2015;55:1116-1127.
3. Nahirniak S et al. Guidance on Platelet Transfusion for Patients With Hypoproliferative Thrombocytopenia. Trans Med Rev 2015;29(1):4-13.
4. Estcourt LJ et al. Guidelines for the Use of Platelet Transfusions. British J Haem 2017;176:365-394.
5. Patel IJ et al. Society of Interventional Radiology consensus guidelines for the periprocedural management of thrombotic and bleeding risk in patients undergoing percutaneous image-guided interventions - Part II: recommendations: endorsed by the Canadian Association for Interventional Radiology and the Cardiovascular and Interventional Radiological Society of Europe. J Vasc Interv Radiol 2019;30: 1168-1184.
6. Neunert C et al. American Society of Hematology 2019 guidelines for immune thrombocytopenia. Blood Adv 2019;3:3829-3866.
7. Samuelson Bannow BT, et al. Management of cancer-associated thrombosis in patients with thrombocytopenia: guidance from the SSC of the ISTH. J Thromb

Haemost 2018;16:1246-1249
8. Choosing Wisely Canada www.choosingwiselycanada.org List from the Canadian Society for Transfusion Medicine.
9. Baharoglu MI et al. Platelet transfusion versus standard care after acute stroke due to spontaneous cerebral haemorrhage associated with antiplatelet therapy (PATCH): a randomised, open-label, phase 3 trial. The Lancet (British edition). 2016;387(10038):2605–13.
10. Blais-Normandin I et al. Pathogen-reduced platelets. In: Khandelwal A, Abe T, editors. Clinical Guide to Transfusion [Internet]. Ottawa: Canadian Blood Services, 2022 [cited 2025 Jan 28]. Chapter 19. Available from: https://professionaleducation.blood.ca/en/transfusion/clinical-guide/pathogen-reduced-platelets

Plasma

1. Green L et al. British Committee of Haematology Guidelines on the spectrum of fresh-frozen plasma and cryoprecipitate products: their handling and use in various patient groups in the absence of major bleeding. British J Haem 2018;181:54-67.
2. Patel IJ et al. Society of Interventional Radiology consensus guidelines for the periprocedural management of thrombotic and bleeding risk in patients undergoing percutaneous image-guided interventions - Part II: recommendations: endorsed by the Canadian Association for Interventional Radiology and the Cardiovascular and Interventional Radiological Society of Europe. J Vasc Interv Radiol 2019;30: 1168-1184.
3. Tinmouth A et al. National Advisory Committee on Blood and Blood Products. Guidelines & recommendations NAC recommendations for the use of solvent-detergent plasma in Canada [Internet]. Ottawa: National Advisory Committee on Blood and Blood Products; 2023 Mar 10 [updated 2023 Jul 20; cited 2024 Nov 28]. Available from: https://nacblood.ca/en/resource/nac-recommendations-use-solvent-detergent-plasma-canada
4. Tinmouth A. National Advisory Committee on Blood and Blood Products. Guidelines & recommendations NAC recommendations for management of dual inventory of solvent-detergent plasma and frozen plasma [Internet]. Ottawa: National Advisory Committee on Blood and Blood Products; 2023 Oct 13 [cited 2024 Nov 28]. Available from: https://nacblood.ca/en/resource/nac-recommendations-management-dual-inventory-solvent-detergent-plasma-and-frozen-plasma
5. Tinmouth A et al, for the Ontario Provincial Plasma Steering Committee. Ontario Regional Blood Coordinating Network Provincial Frozen Plasma/Prothrombin Complex Concentrate Audit Report 2013. Available at www.transfusionontario.org
6. Rossaint R, et al. The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition. Crit Care 2023;27:80.
7. Stanworth SJ et al. Haematological management of major haemorrhage: a British Society for Haematology guideline. BJH 2022;198:654-667.
8. Choosing Wisely Canada www.choosingwiselycanada.org List from the Canadian Society for Transfusion Medicine.
9. Octapharma Our Products in Canada. Octaplasma™ solvent detergent (S/D) treated human plasma product monograph [Internet]. Toronto (CA): Octapharma Canada Inc; 2005 Aug 11 [revised 2022 Oct 31; cited 2024 Nov 28]. Available from: https://www.octapharma.ca/api/download/x/b5e3a19300/octaplasma_pm_en_31_oct_2022.pdf
10. Tinmouth A. National Advisory Committee on Blood and Blood Products.

Guidelines & recommendations NAC recommendations for use Prothrombin Complex Concentrates in Canada [Internet]. Ottawa: National Advisory Committee on Blood and Blood Products; 2008 Sep 16 [updated 2022 Feb; cited 2024 Nov 28]. Available from: https://nacblood.ca/en/resource/recommendations-use-prothrombin-complex-concentrates-canada

11. Black L et al, Bloody easy coagulation simplified. 2nd ed. Toronto: Ontario Regional Blood Coordinating Network. 2019 [updated 2019 Feb; cited 2024 Nov 28].47p. Available from: https://transfusionontario.org/wp-content/uploads/2020/06/ORBCON-EN-BE_Coagulation_02259.pdf