Blood Utilization
Clinical Guideline

Blood Utilization Clinical Guideline

These guidelines are recommendations only

This guideline does not mean that patients need to be transfused when they meet these indications; nor does it mean that patients must be transfused for these indications only. The decision to transfuse should be made by the patient's provider only after a careful assessment of the patient's clinical condition and laboratory parameters. Documentation for transfusion of all blood and blood components should include the indication(s) for the transfusion; this is especially important if the circumstances/indication for the transfusion falls outside established guidelines. While most content applies to both campuses, the few differences are called out when needed. This guideline may be used for auditing purposes.

Definitions

BW	birth weight	Hct	hematocrit	PT	prothrombin time
CMV	cytomegalovirus	Hgb	hemoglobin	PTT	partial thromboplastin time
DIC	disseminated intravascular coagulation	HLA	human leukocyte antigen	RBC	red blood cell
dL	deciliter	INR	international normalized ratio	SDP	single donor platelet
FV	Fox valley campus	MKE	Milwaukee campus	µL	microliter
g	grams	NICU	Neonatal Intensive Care Unit		

General Considerations

- **Blood Bank Phone Numbers**
  - Milwaukee Campus: 414-266-2119.
  - ThedaCare Neenah (TCN): 920-454-5862
- To speak to Blood Bank physician on call
  - FV: 920-454-5862 (ask for lead or pathologist to be paged if needed after hours)
  - MKE: Find "Blood Bank on call" in the on call system.

- See Appendix A for blood modifications and attributes. All products should be used within 4 hours of spiking bag.
- **Contact Hematology service for suspected factor deficiencies**.

- FV: CMV-negative products are only needed for neonates with birth weight (BW) ≤1500 grams and CMV-negative transplant recipients. TCN blood bank has CMV-negative for all neonates < 120 days of age.
- If CMV-negative products are unavailable, CMV-safe (i.e., leukocyte reduced) products are considered an equivalent option.

Relevant orders:
FV: NICU/PEDS Blood transfusion # 201088
MKE: Enter "Transfusion" into the order field and choose "Transfusion - Blood Product Orders"

Relevant Policies & Procedures and guidelines:
- Blood and Blood Components – Verification Procedure, Administration, and Monitoring - FV
- Blood and Blood Components – Verification Procedure, Administration, and Monitoring - MKE
- Refusal to Consent to Treatment or Blood Products -FV & MKE
- ECMO Transfusion Management Based on Bleeding Risk Guideline

Always feel free to call the Blood Bank (phone numbers above) or Consult with Children's Wisconsin Pediatric Hematology

RED BLOOD CELLS

Notes:

- Below recommendations are based on results of 2 large, randomized control trials (Franz et al., and Kirpalani et al. in reference list) in extremely low birth weight infants, so should be applicable to older premature and term babies.
- Significant respiratory support defined as: mechanical ventilation, CPAP, FiO2 >35%, or Nasal Cannula > 1LPM.

INDICATIONS:

- RBC transfusions are indicated to improve oxygen carrying capacity. Indication(s) and special circumstances for transfusion that take place outside these guidelines should be documented in the order.
- Recommended thresholds for transfusion (each patient's clinical condition should be assessed when deciding to transfuse):

≤ 4 months of age	>4 months of age
1. Shock due to blood loss or from arterial hypoxia and low cardiac output when those conditions cannot be ameliorated by other means 2. If ≤7 days old and • Sick or requiring significant respiratory support Hgb <11 g/dl or Hct < 33% • Not sick, with no significant respiratory support: Hgb <10 g/dl or Hct <30% 3. If 8-21 days old and • Sick or requiring significant respiratory support: Hgb <10 g/dl or Hct <30% • Not sick, with no significant respiratory support: Hgb <8.5 g/dl or Hct < 26% 4. If >21 days old and • Sick or requiring significant respiratory support: Hgb <9 g/dl or Hct < 27% • Not sick, with no significant respiratory support: Hgb <7 g/dl or Hct <21% 5. With cyanotic congenital heart disease: Hgb <13 g/dL or Hct < 39% Please refer to unit guideline regarding the need to hold enteral feeding during RBC transfusions.	1. Shock due to blood loss or from arterial hypoxia and low cardiac output when those conditions cannot be ameliorated by other means 2. Hgb < 7 g/dL or Hct <21%: • Symptomatic (elevated RR, HR, low BP, dizzy) • Pre-operative anemia with other corrective therapy not available • Receiving chemo- or radiation-therapy • With severe traumatic brain injury 3. Hgb <13 g/dL or Hct <39% with: • Severe pulmonary disease • Cyanotic heart disease 4. Chronic hemolytic or other anemia • Sickle cell disease (cerebrovascular accident; acute chest syndrome; splenic sequestration; aplastic crisis; recurrent or prolonged priapism) • Pre-operative requirement to reach Hgb > or = 10 g/dl or Hct > or = 30%

Recommended dose: 10-15 mL/kg (to increase Hgb 1-2 g/dL or Hct by 3-6%)

- Order volume needed.
  - FV: Blood Bank will send a satellite unit for volumes < 150mL and will hold on to the remainder for the rest of the hospital stay (expiration date printed on the product) in case more packed RBCs are needed.
  - MKE: Providers must indicate in the order that they anticipate more transfusions, so the unit is saved.
- Product should be used within 4 hours of spiking bag.

Product Attributes (See Appendix A)

- RBCs at FV and MKE undergo irradiation and leukocyte reduction which is as efficacious as giving CMV-negative products for prevention of transfusion-transmitted CMV. Other modifications to be considered must be indicated in order:

≤ 4 months of age	> 4 months of age
• FV: CMV-negative for Birth weight ≤ 1500 grams • Neonatal RBC: O negative, irradiated ○ FV Campus: CMV-negative and HgbS-negative. ○ MKE provides CMV- and HgbS-unscreened.	FV: CMV-negative if: • CMV-negative candidate for, or recipient of transplant • Immunodeficiency/suppression

PLATELETS

Pathogen reduced platelet (PRP) units (treated with amotosalen and ultraviolet A light to cause deoxyribonucleic acid intercalation and prevent pathogen replication) and SDPs are interchangeably provided when platelets are ordered.

Notes:

- In patients > 4 months old with inherited, reversible drug-induced or uremia-associated platelet dysfunction, desmopressin acetate (DDAVP) should be considered before platelet transfusion.
- Transfusion of platelets usually will not result in significant platelet count rise for patients with immune thrombocytopenia or thrombotic thrombocytopenic purpura and is usually avoided.

INDICATIONS:

- Platelets are administered for the prevention and treatment of bleeding in patients with thrombocytopenia or platelet function defect.
- Indication(s) and special circumstances for transfusion that take place outside these guidelines should be documented in the order.
- Recommended thresholds for platelet transfusion (each patient's clinical condition should be assessed when deciding to transfuse):

≤ 4 months	>4 months
1. Platelet count <25,000/µL in stable term and preterm neonates who are not bleeding (prophylaxis) 2. Platelet count <50,000/µL with: a. Any evidence of bleeding b. Prior to an invasive procedure c. Critically ill neonates 3. Platelet count <100,000/µL in neonates undergoing neurosurgery 4. Platelet dysfunction, as directed by hematology	1. Active bleeding or prior to invasive procedure when: a. Platelet count <50,000/µL b. Platelet count <100,000/µL if critically ill or around neurosurgery c. Platelet dysfunction regardless of count 2. Massive bleeding 3. Prophylaxis for bone marrow failure and count <10,000/µL 4. DIC and platelet count <10,000/µL 5. Platelet dysfunction a. Acquired (drugs, uremia, cardiopulmonary bypass) b. Inherited: as directed by Hematology

Recommended dose: 10-15mL/kg

- 5-10 mL/kg increases platelet count by 30,000/µL to 50,000/µL at least 10 min after transfusion
- FV: Order the volume needed of the SDP unit (200-300 mL). Blood bank will hold remainder of the unit for up to 72 hours in case additional platelet needed for the rest of the hospitalization.
- MKE: May be ordered as ¼ SDP, ½ SDP, full SDP or in mLs.
- Product should be used within 4 hours of spiking bag.

Product Attributes (See Appendix A)

- All non-PRP platelet undergo irradiation and leukocyte reduction which is as efficacious as giving CMV-negative products for prevention of transfusion-transmitted CMV.
- Other modifications to be considered must be indicated in order:

≤ 4 months	>4 months
CMV-negative for BW ≤ 1500 gram at FV campus	CMV-negative at FV campus if: • CMV-negative candidate for or recipient of transplant • Immunodeficiency/suppression

WHOLE BLOOD OR RECONSTITUTED WHOLE BLOOD

TYPES OF WHOLE BLOOD AND THEIR INDICATIONS

- **Low-(AB) titer type O Whole Blood** – only for initial resuscitation for anticipated massive bleeding in trauma (>40mL/kg in 24 hours)
- **Reconstituted whole blood** – exchange transfusion for newborns
  - Notify Blood Bank when ordering exchange transfusion.
  - Blood bank will supply the following reconstituted RBC and Plasma for exchange transfusion:
    - Fresh (RBC stored < or = 7 days)
    - 24-hour stability once reconstituted by blood supplier
    - 50% +/- 3% Hct, unless otherwise specified (MKE requires desired Hct to be in order)
    - Irradiated
    - Suspended in citrate-phosphate-dextrose-adenine-1; volume reduced if suspended in RBC additive solution
    - Type O Rh-negative red cells, type AB plasma (MKE provides type O Rh-compatible red cells, type AB plasma for patients ≤ 4 months old)
    - Lacking implicated red cell antigen, if applicable
    - Leucocyte-reduced
    - HgbS-negative (MKE provides HgbS-unscreened)
- Product should be used within 4 hours of spiking bag.

FRESH FROZEN PLASMA

Fresh Frozen Plasma (FFP) or Frozen Plasma 24 (FP24) are provided interchangeably and are therapeutically equivalent.

Notes:

- Neonates have decreased levels of most procoagulant and anticoagulant factors. In steady state there is no increased bleeding or thrombosis. When there is unexpected thrombosis, bleeding or risk for bleeding, replacement of these factors may be indicated, even in the absence of laboratory testing.
- Evidence of efficacy of, and specific indications for, prophylactic plasma transfusion in neonates is lacking.
- Plasma transfusion to prevent bleeding from or to correct mild prolongation of PT is generally ineffective.
- While fibrinogen is present in plasma, cryoprecipitate is the preferred treatment of bleeding due to low or dysfunctional fibrinogen.
- Plasma is not indicated for volume expansion, wound healing or heparin reversal.
- There is no evidence to support plasma replacement of low-volume chest tube drainage without plasma protein deficiency.

INDICATIONS:

- Administered for replacement of plasma proteins
- DIC
- Bleeding with documented coagulopathy PT or PTT >1.5x normal
- Replacement for clinically significant deficiency:
  - Multiple coagulation factor defects (ex. Liver disease, vitamin K deficiency)
  - Therapeutic plasma exchange (e.g., for thrombotic thrombocytopenic purpura, after surgery or invasive procedure, with active bleeding)
  - Clinically significant plasma protein deficiency and no available specific protein concentrate (ADAMTS-13, c1 esterase inhibitor, Protein S, clotting factors 5 and 11)
  - Emergent vitamin K replacement (neonates with vitamin K deficiency and bleeding) or Vitamin K antagonist reversal (Active bleeding or emergent surgery when INR >2) ***when prothrombin complex concentrate (this is the 1st choice) not available.***
  - Unexplained bleeding unresponsive to other measures
- Indication(s) and special circumstances for transfusion that take place outside these guidelines should be documented in the order.

Recommended dose: 10-20 mL/kg

- About 20 mL/kg should increase coagulation factors into the therapeutic range.
- FV campus: order the necessary volume (adult unit [200-300 mL] will be dispensed).
- MKE campus may order adult unit or exact volume needed.
- Product should be used within 4 hours of spiking bag

CRYOPRECIPITATE

Contains: Fibrinogen, von Willebrand Factor, Factor 8 and Factor 13

NOTES:

- When used in DIC, should be given with plasma, to avoid increased thrombosis
- Fibrinogen concentrate should be considered instead of cryoprecipitate in patents with congenital hypofibrinogenemia

INDICATIONS:

- Disseminated intravascular coagulation (DIC)
- Hypofibrinogenemia (fibrinogen < 100 mg/dL) or dysfibrinogenemia with active bleeding or requiring invasive procedure.
- Hemophilia A or von Willebrand Factor if factor concentrate unavailable or desmopressin acetate (DDAVP) cannot be used.
- Factor XIII deficiency with active bleeding or requiring an invasive procedure, if factor 13 concentrate is not available.

Recommended dose: 1 donor unit per 5-10kg body weight. For patients <5kg, order 1 donor unit.

- One donor unit (20-25mL) per 5-10 kg will typically raise the fibrinogen by 100 mg/dL. Monitor for desired outcome.
- Product should be used within 4 hours of spiking bag

GRANULOCYTE CONCENTRATE (MKE Only)

- Limited indications but can be *considered* for select patients with severe neutropenia and severe infection in coordination with Hematology, Immunology, or Infectious Disease. Consult with blood bank physician on call.
- Always irradiated
- May be collected from steroid- and/or granulocyte colony stimulating factor stimulated donors.
- Product should be used within 4 hours of spiking bag

Appendix A

Blood Product Modification/Attributes

Procedure	Used for:	Blood products that undergo modification (MKE & ThedaCare)	Comments
Irradiation	Prevention of: • Transfusion-associated graft versus host disease in immunocompromised patients and those receiving products from HLA-similar donor.	All (no order required) • RBCs • Platelets (Non-PRP) • Granulocytes (this product available in MKE only)	• Not required for previously frozen products (FFP/FP24, cryoprecipitate AHF) • Some units for trauma resuscitation or emergent requests may not be irradiated due to urgency
Pre-storage leukocyte reduction	Prevention of: • Febrile non-hemolytic transfusion reaction • HLA alloimmunization • Transfusion-transmitted CMV	All (no order required) • RBCs • Platelets	
Saline washing	Prevention of: • Complications of hyperkalemia (in large volume transfusions [>20 mL/kg], CV surgery, renal failure); when fresh blood is indicated but not available • Recurrence of anaphylactic and some severe allergic transfusion reactions (including from IgA deficiency)	Upon request (order required): • RBCs • Platelets (e.g., management of suspected RBC polyagglutination [T-antigen activation]	• Some loss of RBCs, platelets • Some platelet activation • Unit expires 24h after washing completed • **Not** available for STAT transfusions (requires 3 hours prep)
Fresh blood	Used for intrauterine/exchange transfusions Prevention of: • Complications of hyperkalemia (in large volume transfusions [>20 mL/kg], CV surgery, renal failure)	Upon request (order required): • RBCs	
Plasma-/volume-reduction	Prevention of: • Fluid overload in vulnerable recipients • Recurrent refractory allergic transfusion reaction	Upon request (order required): • Platelets	• RBCs will be hard- packed instead
Extended RBC antigen matching	Prevention of: • RBC alloimmunization in patients with sickle cell disease or thalassemia	• RBCs	• Most immunogenic antigens (C, E, K) are matched for patients with known sickle cell disease. Must indicate in order or call blood bank for other patients. • HgbS-negative for patients with sickle cell or thalassemia
Directed donation ***Must call Blood Bank**	Prevention of: • Hemolysis or platelet refractoriness in alloimmunized (HLA, RBC and platelet antigens) individuals • Recurrent anaphylactic transfusion reaction	Upon request and as determined by blood bank	• In the US, direct- donated blood products from family members are not safer than those from random donors.
HLA Matching ***Must call Blood Bank**	Prevention of: • Platelet refractoriness caused by HLA alloimmunization	Upon request (order required): • Platelets	

References

1. Franz AR, Engel C, Bassler D, et al. Effects of Liberal vs Restrictive Transfusion Thresholds on Survival and Neurocognitive Outcomes in Extremely Low-Birth-Weight Infants: The ETTNO Randomized Clinical Trial. *JAMA*. 2020;324(6):560-570. doi:10.1001/jama.2020.10690
2. Kirpalani H, Bell EF, Hintz SR, et al. Higher or Lower Hemoglobin Transfusion Thresholds for Preterm Infants. *N Engl J Med*. 2020;383(27):2639-2651. doi:10.1056/NEJMoa2020248
3. Wong ECC, Roseff SD, eds. Pediatric Transfusion: A physician's handbook 5th edition, AABB press, 2020.
4. Curley A, Stanworth SJ, Willoughby K, et al. Randomized Trial of Platelet-Transfusion Thresholds in Neonates. *N Engl J Med*. 2019;380(3):242-251. doi:10.1056/NEJMoa1807320
5. Giers G, Wenzel F, Fischer J, et al. Retrospective comparison of maternal vs. HPA-matched donor platelets for treatment of fetal alloimmune thrombocytopenia. *Vox Sang*. 2010;98(3 Pt 2):423-430. doi:10.1111/j.1423-0410.2009.01268.x
6. Valentine SL, Bembea MM, Muszynski JA, et al. Consensus Recommendations for RBC Transfusion Practice in Critically Ill Children From the Pediatric Critical Care Transfusion and Anemia Expertise Initiative. *Pediatr Crit Care Med*. 2018;19(9):884-898. doi:10.1097/PCC.0000000000001613
7. Lacroix J, Hébert PC, Hutchison JS, et al. Transfusion strategies for patients in pediatric intensive care units. *N Engl J Med*. 2007;356(16):1609-1619. doi:10.1056/NEJMoa066240
8. Nellis ME, Karam O, Valentine SL, et al. Executive Summary of Recommendations and Expert Consensus for Plasma and Platelet Transfusion Practice in Critically Ill Children: From the Transfusion and Anemia EXpertise Initiative-Control/Avoidance of Bleeding (TAXI-CAB). *Pediatr Crit Care Med*. 2022;23(1):34-51. doi:10.1097/PCC.0000000000002851
9. Chou ST, Alsawas M, Fasano RM, et al. American Society of Hematology 2020 guidelines for sickle cell disease: transfusion support. *Blood Adv*. 2020;4(2):327-355. doi:10.1182/bloodadvances.2019001143

Team leader(s):

- Dr. Petra Laeven Sessions, Pediatric Hospitalist, Medical Director CW - Fox Valley Hospital
- Dr. Rowena Punzalan, Transfusion Service Medical Director CW- Milwaukee Hospital
- Dr. Kimberly Seeger Langlais, Section Chief Neonatology CW – Fox Valley Hospital
- Dr. Carey Ehlert, Medical Director NICU – Milwaukee Hospital
- Dr. Alicia Sprecher, Associate Medical Director NICU – Milwaukee Hospital

Approved by the above workgroup on 08/27/2025
Approved by CW Blood Utilization Committee on 09/23/25

Medical Disclaimer

This Clinical Guideline (CG) is designed to provide a framework for evaluation and treatment. It is not intended to establish a protocol for all patients with this condition, nor is it intended to replace a clinician's judgement. Adherence to this CG is voluntary. Decisions to adopt recommendations from this CG must be made by the clinician in light of available resources and the individual circumstances of the patient. Medicine is a dynamic science; as research and clinical experience enhance and inform the practice of medicine, changes in treatment protocols and drug therapies are required. The authors have checked with sources believed to be reliable in their effort to provide information that is complete and generally in accord with standards accepted at the time of publication. However, because of the possibility of human error and changes in medical science, neither the authors nor Children's Hospital and Health System, Inc., nor any other party involved in the preparation of this work warrant that the information contained in this work is in every respect accurate or complete, and they are not responsible for any errors in, omissions from, or results obtained from the use of this information.