RBC Transfusion:

Applying evidence-based transfusion care

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(Presented by Yulia Lin May 2024)

Disclosure

- J. Callum:
  - Research funding from Canadian Blood Services, Octapharma Canada[1], Defense Research and Development[1] and Novo Nordisk[2]
- Y. Lin
  - Research funding from Canadian Blood Services and Octapharma
  - Consultant for Choosing Wisely Canada
- This is a talk about using red cell transfusions for adult patients
- Management of major hemorrhage is covered in a separate talk

1. J. Callum
2. J Pendergrast

Outline

- 2 Cases
- Red blood cell basics
- Key risks of red blood cell transfusion
- When should you give red cell transfusions?
  - Multiple randomized trials and meta-analyses to guide your decisions

Case 1

- 27 year old female, 2 days post C-section complicated by moderate post-partum hemorrhage
- Pre-delivery hemoglobin was 10.5 g/dL
- Hemoglobin this morning is 5.7 g/dL
- Heart rate 87, blood pressure 102/56.
- She is pale and tired but no pre-syncope or lightheadedness
- You have ordered a dose of intravenous iron
- Plan is for discharge today
- Should you transfuse 1 unit of RBCs before sending her home?

Case 2

- 76 year old woman 4 days post-op from hip fracture surgery (after fracture from a fall)
- Plan to discharge tomorrow
- Hemoglobin 7.1 g/dL
- Asymptomatic, vitals stable
- No cardiac history
- Should you transfuse red blood cells?

Red blood cell basics

- Volume ~300 mL, hematocrit 50-65%, anticoagulant SAG-M
  - Some units may have lower volumes so ensure you include the volume required on your order (~5 mL/kg for an adult dose)
- Each unit increases hemoglobin by 1.0 g/dL
- Small amount of residual plasma
- Acceptable for transfusion for 42 days from donation
- Red cells in Rwanda are not routinely leukoreduced, but can be requested on an as-needed basis
  - Leukoreduction reduces the risk of transfusion reactions (marginally), reduces the risk of HLA alloimmunization (important only for patients undergoing aggressive chemotherapy), and prevents some infectious transmissions (HTLV, CMV)

Irradiated red blood cells

If not available, transfuse red blood cells over 14 days from collection
[Kopolovic, et al. Blood 2015:16;126: 406-14]

PATIENTS REQUIRING IRRADIATED BLOOD [146]

- First and second degree family members or HLA-selected donors.
- Intra-uterine or neonatal exchange transfusion.
- Congenital T-cell immunodeficiency.
- Autologous stem cell transplant recipients from 7 days prior to stem cell collection to 3 months post-transplant (6 months if total body irradiation is part of the conditioning regimen).
- Allogeneic stem cell transplant from initiation of conditioning regimen and continued until over 6 months post-transplant and lymphocyte count >1x10^9/L and patient free of chronic GvHD and off all immunosuppressive agents (otherwise continue indefinitely).
- CAR-T cell infusion from 7 days prior to collection and for 3 months after infusion.
- All patients with Hodgkin's Disease.
- Certain therapeutics in select patient populations (see box to right)

Alemtuzumab (anti-CD52)
Anti-thymocyte globulin (ATG)
Bendamustine
Cladribine (2-CDA)
Clofarabine
Deoxycoformicin
Fludarabine
Nelarabine

http://www.bcshguidelines.com/documents/irrad_bcsh_072010.pdf


HEADWIND LIMIT: 9 m/s
CROSSWIND LIMIT: 9 m/s
TAILWIND LIMIT: 4 m/s
CONTROLLER WILL CONFIRM WIND SPEED
zipline

Risks of RBCs

- Transfusion associated circulatory overload (TACO) – 1in 50 to 1 in100
  - *300 mL of RBCs is not the same as 300 mL of saline*
- Transfusion-related acute lung injury (TRALI) – 1 in 10,000
- Acute and delayed hemolytic transfusion reactions
  - ABO-immune hemolysis (by mistake) – 1 in 354,000
  - RBC alloantibodies 1 in 13 (hemolytic disease of the newborn risk for girls and young women)
  - Delayed hemolytic transfusion reactions 1 in 2500
- Anaphylaxis – 1 in 40,000
- More bleeding (from GI bleeding trials)
- HLA alloimmunization (leading to long waits for organ transplants)
- Increased risk of thromboembolic complications
- Hyperhemolysis in patients with sickle cell disease
- Association of ICH in recipients of donors who decades later had multiple ICH (cerebral amyloid angiopathy)

What about the risk of HIV, HBV or HCV?

<1 in 1,000,000	Transmission of West Nile Virus
1 in 2,000,000	Residual risk of hepatitis B per unit[87]
1 in 4,000,000	Transmission of Chagas disease per unit
1 in 12,900,000	Residual risk of human immunodeficiency virus (HIV) per unit[87]
1 in 27,100,000	Residual risk of hepatitis C per unit[87]
<1 in 1,000,000,000	Transmission of HTLV per unit[88]

Bloody easy 5.1, Ontario Transfusion Handbook, 2022.

Sub-Saharan Africa
HBV = 1:233
HCV = 1;400
HIV = 1:1000

Jayaraman S, Transfusion. 2010;50:433

Rwanda

Trends and Gaps in National Blood Transfusion Services — 14 Sub-Saharan African Countries, 2014–2016 | MMWR (cdc.gov)

				Prevalence (%) of TTIs in collected blood units								
							Other TTIs			All TTIs		
	HIV population prevalence (%)			HIV			HBV, HCV, and syphilis			HIV, HBV, HCV, and syphilis		
Country	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
Côte d'Ivoire	3.0	2.8	2.7	0.3	0.04	0.2	8.6	9.0	8.9	9.0	9.0	9.1
Ethiopia	1.1	1.1	0.9	2.1	1.2	1.1	4.4	4.6	4.2	5.2	5.1	4.5
Ghana	1.7	1.6	1.6	0.7	0.5	0.3	9.7	7.1	11.6	11.8	8.3	12.7
Kenya	5.7	5.6	5.4	0.6	0.8	0.6	2.8	4.3	2.5	3.5	5.2	3.2
Lesotho	24.7	24.9	25	2.6	2.4	2.5	3.6	3.8	5.0	6.2	6.2	7.6
Mozambique	13.0	12.7	12.3	5.2	4.8	4.0	8.2	8.8	6.9	13.4	13.6	11.0
Nigeria	3.1	3.0	2.9	1.4	1.4	1.5	11.3	11.7	13.1	12.9	13.2	14.6
Rwanda	3.2	3.2	3.1	0.1	0.1	0.2	2.6	2.7	3.4	2.8	2.9	3.6
South Africa	18.8	18.9	18.9	0.2	0.2	0.1	0.3	0.3	0.5	0.5	0.5	0.7

Risk of donor testing positive

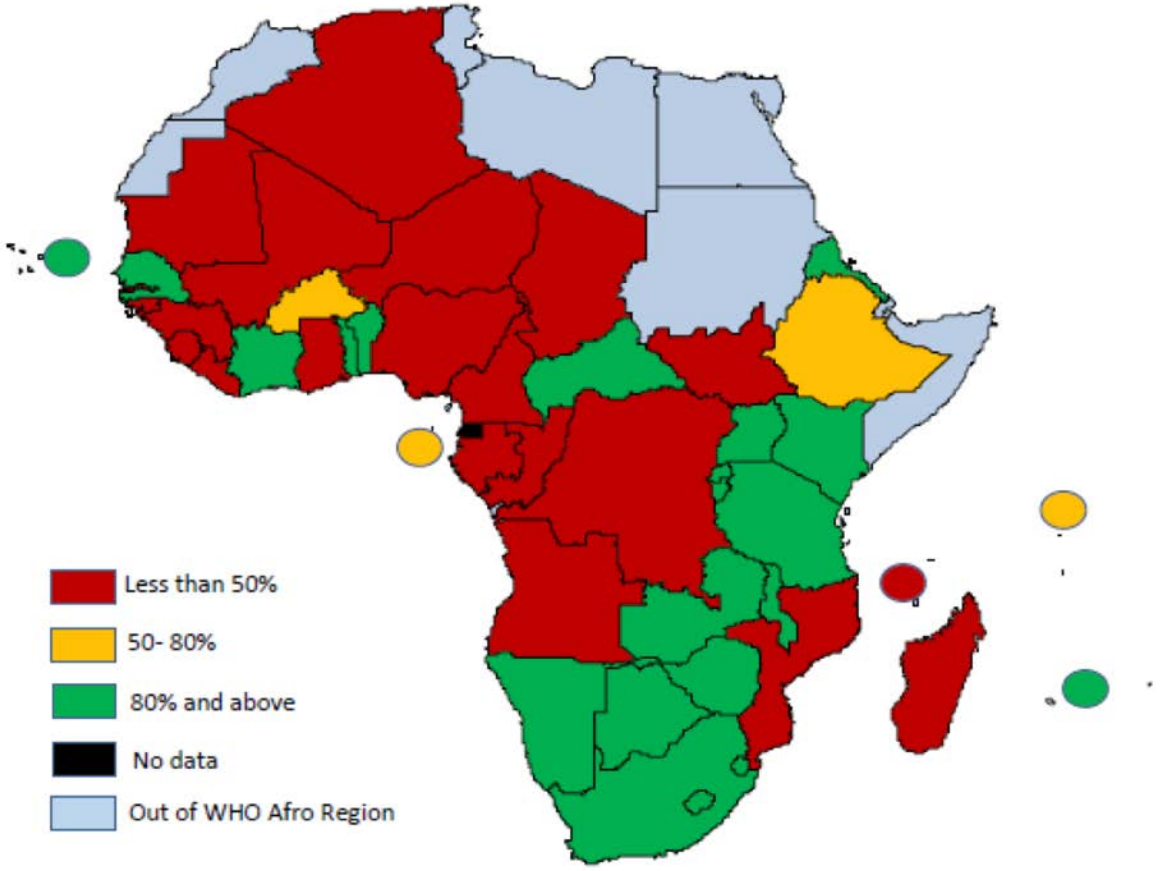


Figure 2. The average proportion of Voluntary non-remunerated blood donations in 46 countries of the WHO Afro Region in 2013

Loua, Glob Surg 2018;4:1

TACO

- Rate of TACO increases with increasing age:
  - aged 49 yr or less: 2.0%
  - aged 50-59 yr: 3.3%
  - aged 60-69 yr: 4.2%
  - aged 70-79 yr: 5.2%
  - aged 80 yr+: 7.4%
- Increased rate of TACO with increasing amount of volume transfused ($P<0.001$) and increasing total fluid balance ($P<0.001$)
- Odds ratio of death for TACO cases compared with transfused controls of 3.8 (95% CI, 2.2 to 6.7) ($P<0.001$)

Leanne Clifford et al. Anesthesiology. 2015; 122(1): 21–28.

Pre-transfusion RBC checklist

Red Blood Cell Pre-Transfusion Checklist

Alternatives failed or have been ordered?	❑ Anemia investigations completed (e.g., CBC, blood film, ferritin, iron saturation, vitamin B12, reticulocyte count) ❑ Iron (oral and IV), vitamin B12, erythropoietin ordered or not indicated
Consent?	Patient advised of risks of: ❑ TACO 1 in 100 ❑ Hemolytic reaction 1 in 7,000 ❑ TRALI 1 in 10,000 ❑ Major allergic reaction 1 in 40,000 ❑ Bacterial infection 1 in 250,000

- Back of blood easy 5.1

Tseng, et al. 2016 Apr;26(2):104-10. doi: 10.1111/tme.12284. Epub 2016 Feb 10.

Pre-transfusion RBC Checklist

Female under 45?	❑ Order Kell-negative units **Rwanda: Kell+ donors deferred** ❑ Inform recipient of the potential risk of transfusion causing hemolytic disease of the newborn in future pregnancies
At risk for FATAL transfusion-associated Graft vs. Host Disease? **Or units >14 days**	Order irradiated blood if patient has any history of the following: ❑ Hodgkin's lymphoma ❑ Allogeneic or autologous stem cell transplant ❑ Ever treated with fludarabine, cladribine, bendamustine, alemtuzumab, anti-thymocyte globulin (ATG) ❑ Congenital immunodeficiencies

Pre-transfusion RBC Checklist

Diuretics?

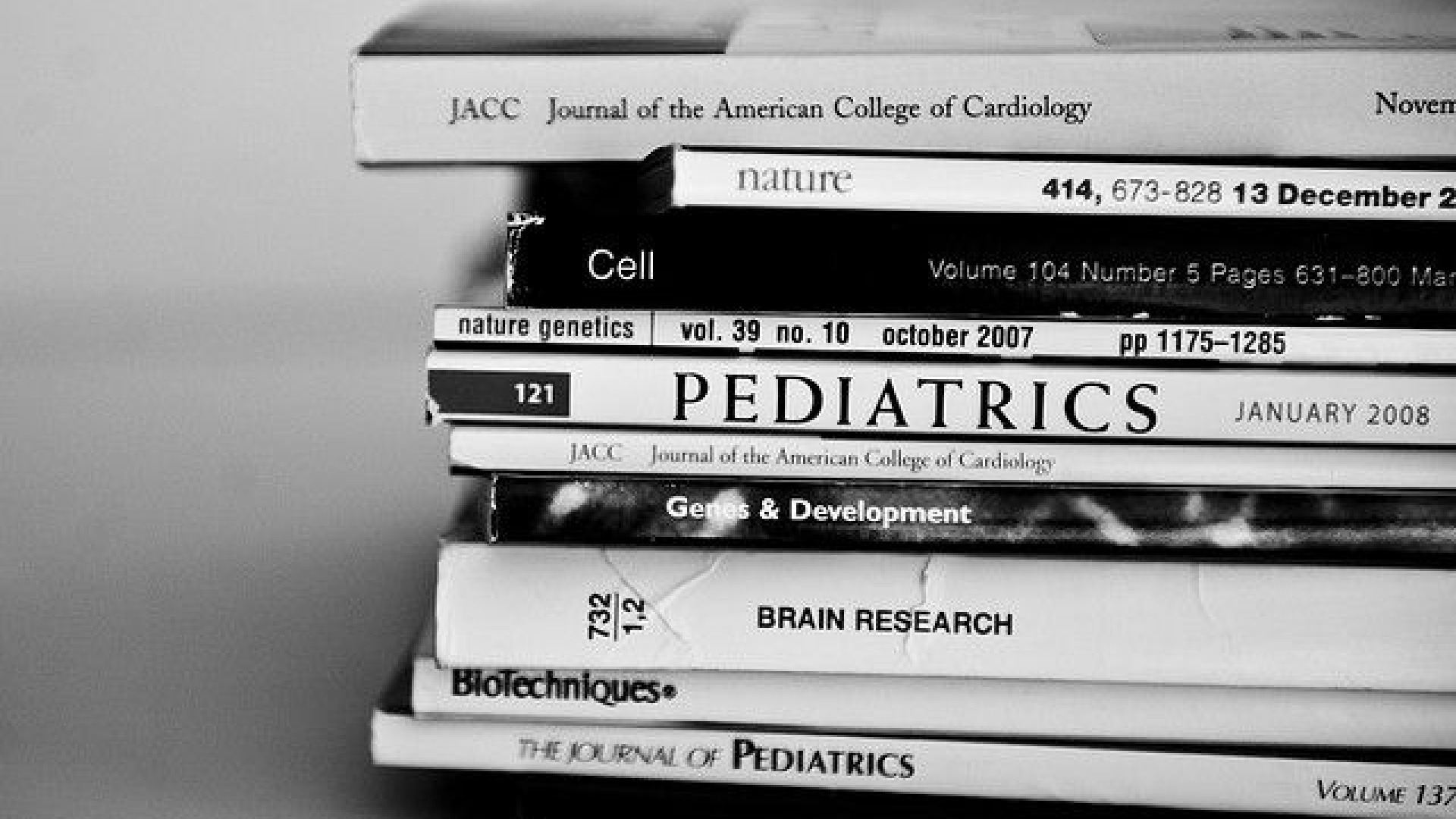
Does my patient have a history of:

- ❑ Age greater ≥70 years
- ❑ Renal dysfunction
- ❑ Left ventricular dysfunction
- ❑ Prior or current CHF
- ❑ Severe euvolemic anemia (hemoglobin <50 g/L)

- ❑ **If YES to any of the above:** prescribe PO/IV furosemide pre-transfusion (*unless currently hypovolemic*)

Rate and Dose?

- ❑ Specify rate of infusion (default rate is over 2 hours per unit; inpatients and patients at risk for TACO (need diuretics) infuse over 3-4 hours)
- ❑ Order 1 unit at a time (unless bleeding)


JACC Journal of the American College of Cardiology
nature
414, 673-828 13 December 2
Cell
Volume 104 Number 5 Pages 631-800
nature genetics
vol. 39 no. 10 october 2007
pp 1175–1285
121
PEDIATRICS
JANUARY 2008
JACC Journal of the American College of Cardiology
Genes & Development
732
1,2
BRAIN RESEARCH
BioTechniques
THE JOURNAL OF PEDIATRICS
VOLUME 137

Science not the "Art of Medicine"

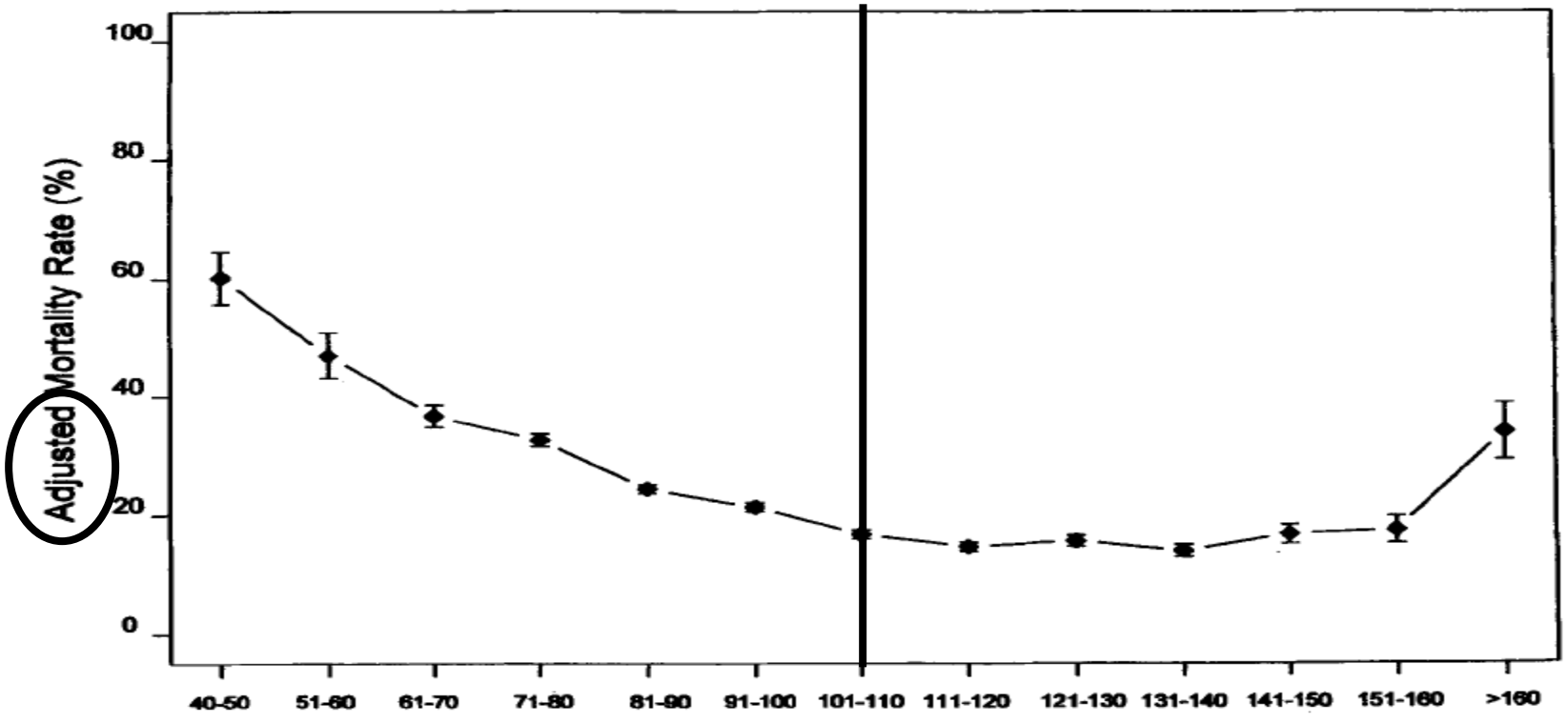
47 RCTs with 20,967 patients

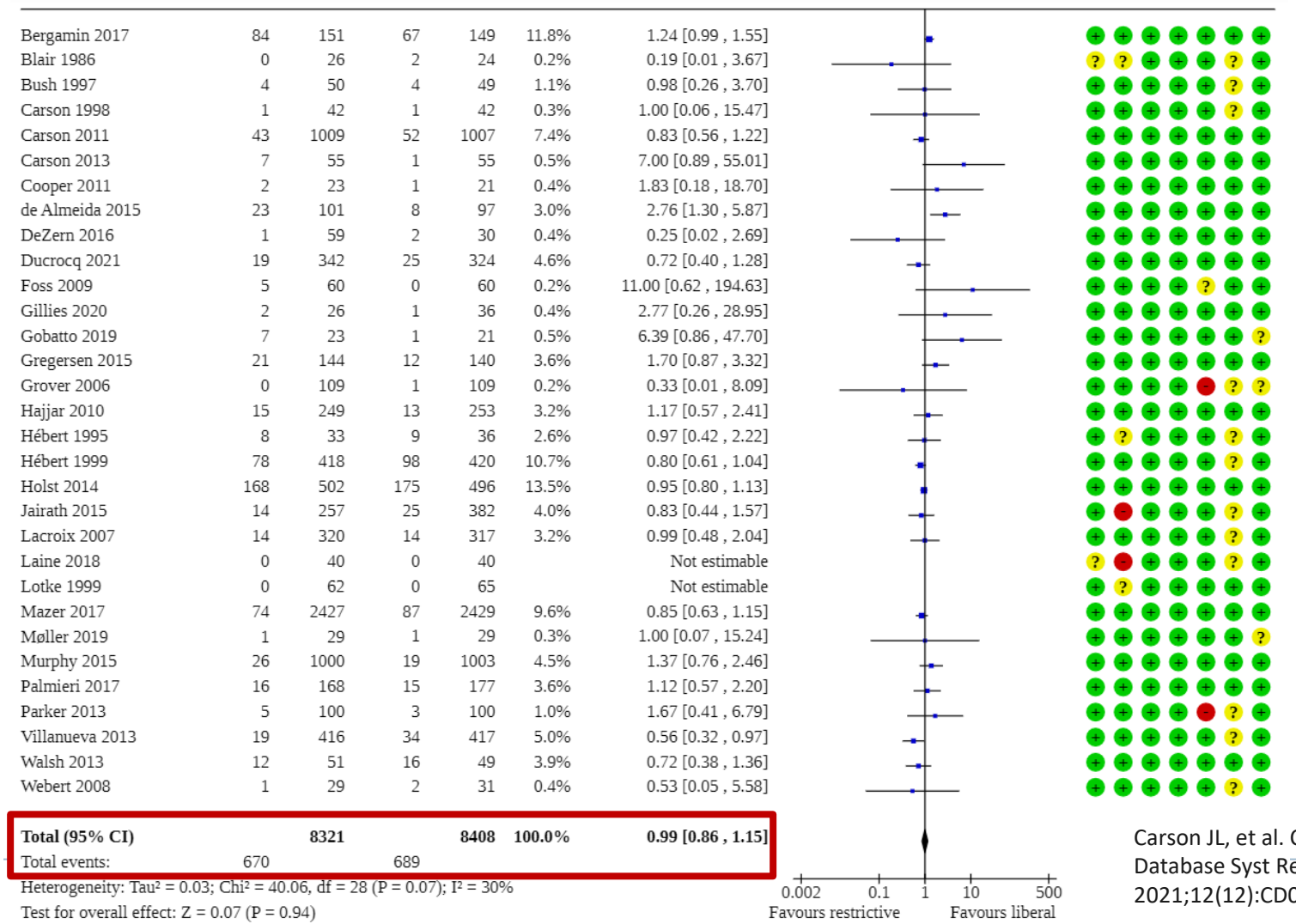
restrictive (7.0-7.5-8.0) vs. liberal (9.0-9.5-10.0)

Clinical trials.gov – 14 ongoing studies that will add an additional 15,000 patients

Pre-TRICC

Hebert P, et al. Am J Resp CCM 1997; 155: 1618-23





Bergamin 2017	84	151	67	149	11.8%	1.24 [0.99 , 1.55]
Blair 1986	0	26	2	24	0.2%	0.19 [0.01 , 3.67]
Bush 1997	4	50	4	49	1.1%	0.98 [0.26 , 3.70]
Carson 1998	1	42	1	42	0.3%	1.00 [0.06 , 15.47]
Carson 2011	43	1009	52	1007	7.4%	0.83 [0.56 , 1.22]
Carson 2013	7	55	1	55	0.5%	7.00 [0.89 , 55.01]
Cooper 2011	2	23	1	21	0.4%	1.83 [0.18 , 18.70]
de Almeida 2015	23	101	8	97	3.0%	2.76 [1.30 , 5.87]
DeZern 2016	1	59	2	30	0.4%	0.25 [0.02 , 2.69]
Ducrocq 2021	19	342	25	324	4.6%	0.72 [0.40 , 1.28]
Foss 2009	5	60	0	60	0.2%	11.00 [0.62 , 194.63]
Gillies 2020	2	26	1	36	0.4%	2.77 [0.26 , 28.95]
Gobatto 2019	7	23	1	21	0.5%	6.39 [0.86 , 47.70]
Gregersen 2015	21	144	12	140	3.6%	1.70 [0.87 , 3.32]
Grover 2006	0	109	1	109	0.2%	0.33 [0.01 , 8.09]
Hajjar 2010	15	249	13	253	3.2%	1.17 [0.57 , 2.41]
Hébert 1995	8	33	9	36	2.6%	0.97 [0.42 , 2.22]
Hébert 1999	78	418	98	420	10.7%	0.80 [0.61 , 1.04]
Holst 2014	168	502	175	496	13.5%	0.95 [0.80 , 1.13]
Jairath 2015	14	257	25	382	4.0%	0.83 [0.44 , 1.57]
Lacroix 2007	14	320	14	317	3.2%	0.99 [0.48 , 2.04]
Laine 2018	0	40	0	40		Not estimable
Lotke 1999	0	62	0	65		Not estimable
Mazer 2017	74	2427	87	2429	9.6%	0.85 [0.63 , 1.15]
Møller 2019	1	29	1	29	0.3%	1.00 [0.07 , 15.24]
Murphy 2015	26	1000	19	1003	4.5%	1.37 [0.76 , 2.46]
Palmieri 2017	16	168	15	177	3.6%	1.12 [0.57 , 2.20]
Parker 2013	5	100	3	100	1.0%	1.67 [0.41 , 6.79]
Villanueva 2013	19	416	34	417	5.0%	0.56 [0.32 , 0.97]
Walsh 2013	12	51	16	49	3.9%	0.72 [0.38 , 1.36]
Webert 2008	1	29	2	31	0.4%	0.53 [0.05 , 5.58]
Total (95% CI)		**8321**		**8408**	**100.0%**	**0.99 [0.86 , 1.15]**
Total events:	670		689			

Heterogeneity: Tau² = 0.03; Chi² = 40.06, df = 28 (P = 0.07); I² = 30%

Test for overall effect: Z = 0.07 (P = 0.94)

Carson JL, et al. Cochrane Database Syst Rev. 2021;12(12):CD002042.

Reduces the risk of transfusion: 0.54 (0.47- 0.63; P<0.001)

And the number of units transfused (mean difference −1.43 unit, (−2.01 to −0.86; P<0.001)

Cost to put a single RBC unit into a patient US$741 in 2010

Holst L, et al. BMJ 2015;350:h1354

RBC - TRICC Study

- NEJM 1999; 340:409-17 - Hebert et al
  - n=838 non-bleeding, ICU patients, Hb <9 g/dL
  - RCT - transfusion Hb <7 vs <10
  - **Non-leukoreduced RBCs**
  - Stratified by APACHE 2 score
  - Groups equal with respect to baseline characteristics
  - Average patient: 58 year old male, with 1-2 organ failure, mechanically vented, admitted to the ICU from the OR

Outcome - Mortality

Outcome	<7 g/dL	<10 g/dL	P value
30-day	18.7%	23.3%	P=0.11
Hospital	22.2%	28.1%	P=0.05

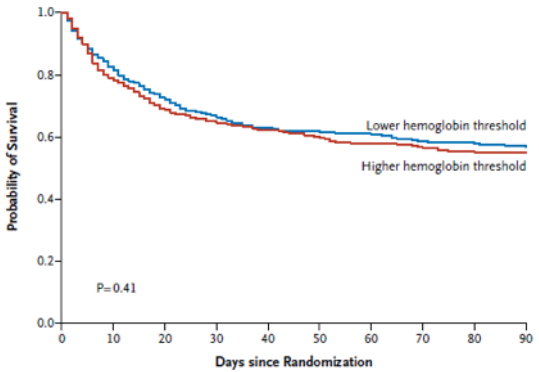
NNT = 17 patients to prevent one in-hospital death

Morbidity Outcomes in TRICC

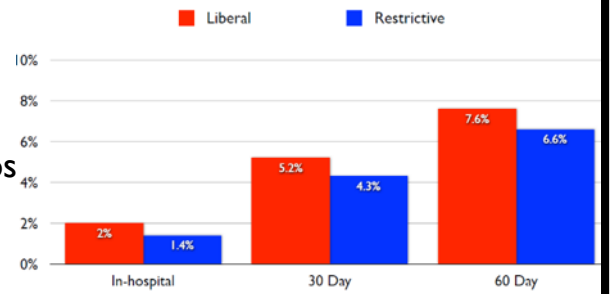
	Restrictive N (%)	Liberal N (%)	P Value
MI	3 (0.7)	12 (2.9)	0.02
Pulmonary Edema	22 (5.3)	45 (10.7)	0.01
ARDS	32 (7.7)	48 (11.4)	0.06

Key RBC Trials

TRISS
Holst
NEJM 2014
Septic Shock
n=998
7 vs 9 g/dL
No subgroups



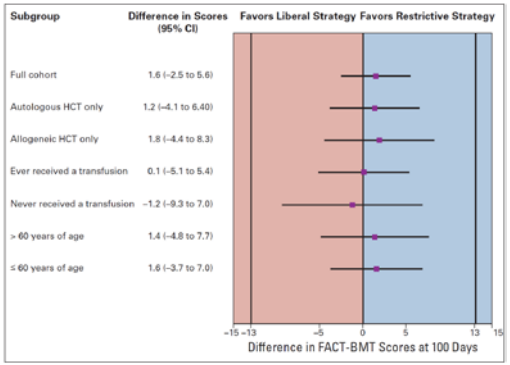
FOCUS
Carson
NEJM 2011
Fractured hips
Periop
n=2016
8 vs 10



TRICS III
Mazer
NEJM 2017
CVSx
n=5035
7.5 vs 9.5 g/dL
No subgroups

Composite: 0.90 (0.76-1.07)
Death: 0.85 (0.62-1.16)
Stroke: 0.92 (0.61-1.38)
MI: 1.00 (0.79-1.27)
Kidney Failure: 0.84 (0.60-1.19)

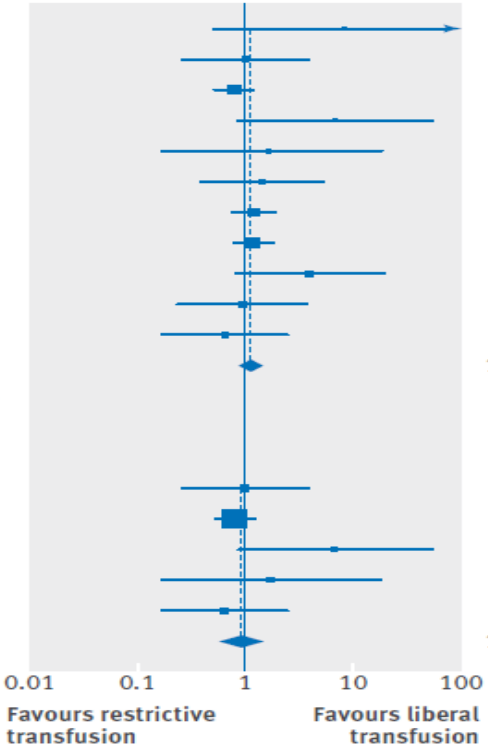
TRIST
Tay
JCO 2020
Hematology
n=300
7 vs 9



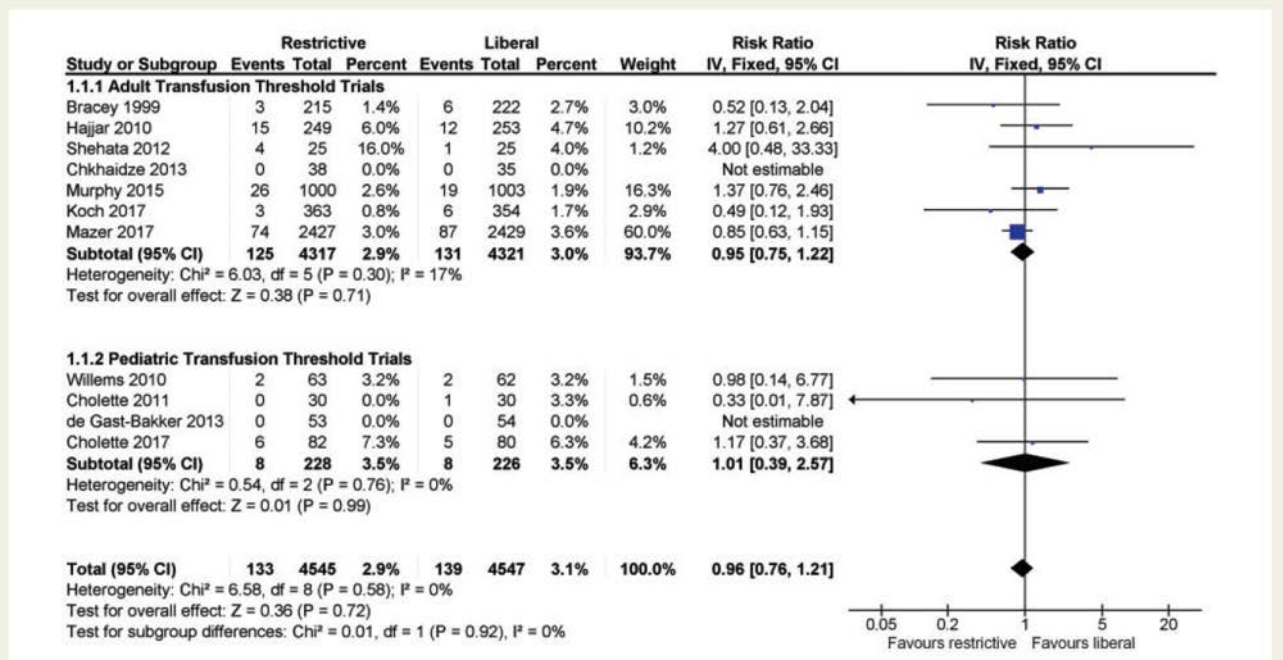
BMJ 2016;352:i1351

No benefit in CVD patients

Study	No of events/ total No of patients: Restrictive transfusion	Liberal transfusion	Risk ratio MH random effect (95% CI)	Weight (%)	Risk ratio MH random effect (95% CI)
All studies					
Almeida 2015	7/22	0/12		0.9	8.48 (0.53 to 136.76)
Bush 1997	4/49	4/50		3.8	1.02 (0.27 to 3.85)
Carson 2011	43/1008	52/995		27.7	0.82 (0.55 to 1.21)
Carson 2013	7/55	1/55		1.6	7.00 (0.89 to 55.01)
Cooper 2011	2/24	1/21		1.3	1.75 (0.17 to 17.95)
Gregersen 2015	6/34	3/25		4.0	1.47 (0.41 to 5.32)
Hebert 1999	29/111	31/146		23.9	1.23 (0.79 to 1.91)
Holst 2014	33/75	24/66		26.5	1.21 (0.80 to 1.82)
Jairath 2015*	6/49	2/67		2.8	4.10 (0.86 to 19.47)
Parker 2013	4/70	4/67		3.7	0.96 (0.25 to 3.67)
Walsh 2013	3/17	4/15		3.8	0.66 (0.18 to 1.50)
Total	144/1514	126/1519		100.0	1.15 (0.88 to 1.50)
Test for heterogeneity: τ^2=0.03, χ^2=11.58, df=10, P=0.31, I^2=14%					
Test for overall effect: z=1.04, P=0.30					
Studies randomised by CVD					
Bush 1997	4/49	4/50		3.8	1.02 (0.27 to 3.85)
Carson 2011	43/1008	52/995		27.7	0.82 (0.55 to 1.21)
Carson 2013	7/55	1/55		1.6	7.00 (0.89 to 55.01)
Cooper 2011	2/24	1/21		1.3	1.75 (0.17 to 17.95)
Walsh 2013	3/17	4/15		3.8	0.66 (0.18 to 1.50)
Total	59/1153	62/1136		100.0	0.96 (0.58 to 1.59)
Test for heterogeneity: τ^2=0.06, χ^2=4.67, df=4, P=0.32, I^2=14%					
Test for overall effect: z=0.17, P=0.87					



No benefit for cardiac surgery patients



Study or Subgroup	Restrictive Events	Total	Percent	Liberal Events	Total	Percent	Weight	Risk Ratio IV, Fixed, 95% CI
1.1.1 Adult Transfusion Threshold Trials								
Bracey 1999	3	215	1.4%	6	222	2.7%	3.0%	0.52 [0.13, 2.04]
Hajjar 2010	15	249	6.0%	12	253	4.7%	10.2%	1.27 [0.61, 2.66]
Shehata 2012	4	25	16.0%	1	25	4.0%	1.2%	4.00 [0.48, 33.33]
Chkhaidze 2013	0	38	0.0%	0	35	0.0%		Not estimable
Murphy 2015	26	1000	2.6%	19	1003	1.9%	16.3%	1.37 [0.76, 2.46]
Koch 2017	3	363	0.8%	6	354	1.7%	2.9%	0.49 [0.12, 1.93]
Mazer 2017	74	2427	3.0%	87	2429	3.6%	60.0%	0.85 [0.63, 1.15]
Subtotal (95% CI)	**125**	**4317**	**2.9%**	**131**	**4321**	**3.0%**	**93.7%**	**0.95 [0.75, 1.22]**
Heterogeneity: Chi² = 6.03, df = 5 (P = 0.30); I² = 17%								
Test for overall effect: Z = 0.38 (P = 0.71)								
1.1.2 Pediatric Transfusion Threshold Trials								
Willems 2010	2	63	3.2%	2	62	3.2%	1.5%	0.98 [0.14, 6.77]
Cholette 2011	0	30	0.0%	1	30	3.3%	0.6%	0.33 [0.01, 7.87]
de Gast-Bakker 2013	0	53	0.0%	0	54	0.0%		Not estimable
Cholette 2017	6	82	7.3%	5	80	6.3%	4.2%	1.17 [0.37, 3.68]
Subtotal (95% CI)	**8**	**228**	**3.5%**	**8**	**226**	**3.5%**	**6.3%**	**1.01 [0.39, 2.57]**
Heterogeneity: Chi² = 0.54, df = 2 (P = 0.76); I² = 0%								
Test for overall effect: Z = 0.01 (P = 0.99)								
Total (95% CI)	**133**	**4545**	**2.9%**	**139**	**4547**	**3.1%**	**100.0%**	**0.96 [0.76, 1.21]**
Heterogeneity: Chi² = 6.58, df = 8 (P = 0.58); I² = 0%								
Test for overall effect: Z = 0.36 (P = 0.72)								
Test for subgroup differences: Chi² = 0.01, df = 1 (P = 0.92), I² = 0%								

Figure 4 Mortality within 30 days of surgery in randomized controlled trials of adult and paediatric cardiac surgery patients. Fixed-effects meta-analysis.

OR 0.96 (0.76-1.21)

Shehata et al. Eur Heart J 2019; 1: 1081-1088

REALITY Trial – RCT 80 vs. 100 g/L in patients with acute myocardial infarction

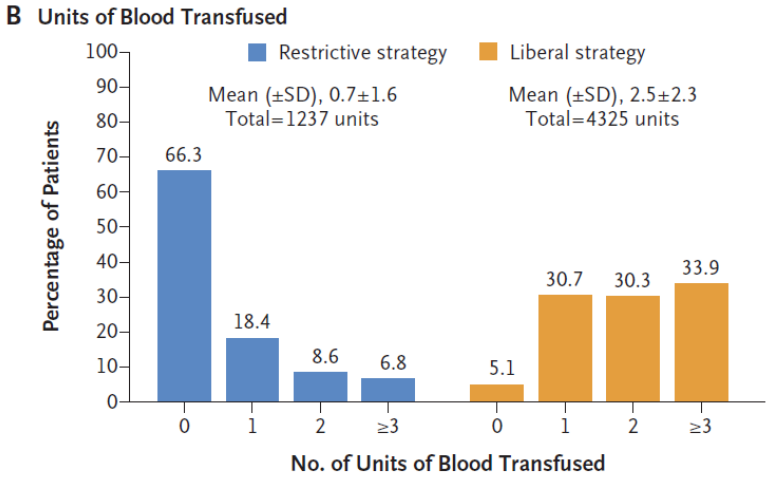
Table 3. Primary and Secondary Outcomes at 30 Days Among the As-Randomized Population in a Study of the Effect of a Restrictive vs Liberal Blood Transfusion Strategy on Patients With Acute Myocardial Infarction and Anemia

Outcome	No. (%)		Difference (95% CI), %	Relative risk (1-sided 97.5% CI)
	Restrictive	Liberal		
Primary (major adverse cardiovascular events), No./total No. (%) [95% CI][a]				
As-treated population	36/327 (11.0) [7.5 to 14.6]	45/322 (14.0) [10.0 to 17.9]	−3.0 (−8.4 to 2.4)	0.79 (0.00 to 1.19)
As-randomized population	38/342 (11.1) [7.6 to 14.6]	46/324 (14.2) [10.2 to 18.2]	−3.1 (−8.4 to 2.3)	0.78 (0.00 to 1.17)

JAMA. 2021;325(6):552-560. doi:10.1001/jama.2021.0135

MINT Trial

70-80 vs 100 g/L for patients with acute myocardial infarction



4x RBCs

No difference in primary Outcome of recurrent MI Or death

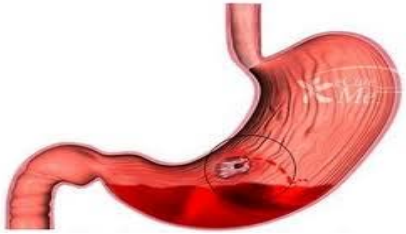
RR 1.15 (0.99-1.34)

2 major problems:

(1) one-third transfused before randomization

(2) Recurrent MI rate was 2x the rate of all other MI trial (raising concerns for validity of the primary outcome)

Acute UGI Bleeding



921 pts with severe UGIB

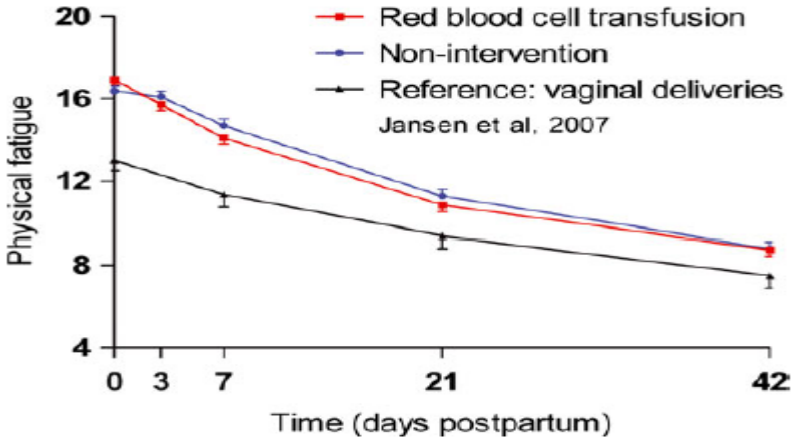
- **Restrictive** Hb < 7 g/dL
- **Liberal** Hb < 9 g/dL

6 week survival	95%	91%	P=0.02
Further bleeding	10%	16%	P=0.05
Adverse events	40%	48%	P=0.02
RBC transfusion	1.5 units	3.7 units	P<0.001
No RBC transfusion	51%	15%	P<0.001

Villanueva et al. NEJM Jan 2013;368:11-21

PPH – WOMB Trial

- 37 Dutch hospitals, 521 women randomized
- PPH with >1000 ml, Hb drop of 19+ points, and hemoglobin between 4.8-7.9 g/L, no severe symptoms of anemia (dyspnea, syncope, HR>100)
- Randomized to transfusion or no transfusion



BJOG 2014;121:1005–1014.

Table 2. Blood loss, haemoglobin concentration, and RBC transfusion

Variable	Transfusion (*n* = 258)	Non-intervention (*n* = 261)	*P*
RBC transfusion			
Units per woman	2 (2–2)	0 (0–0)	<0.001
Total units*	517	88	<0.001
Hb concentration after transfusion, g/dl)**	9.0 (8.5–9.6)	8.9 (8.2–9.7)	0.56
Hb concentration at discharge (g/dl)***	9.0 (8.5–9.5)	7.4 (6.8–7.7)	<0.001
Hb concentration at 6 weeks (g/dl)****	12.1 (11.3–12.6)	11.9 (10.9–12.6)	0.18

4.8

ORACL Trial

- Patients: Ortho trauma past initial resuscitation phase, hemodynamically stable, aged 18-50, Hb<90 g/L
- N=65
- Multicentre trial
- Intervention: Restrictive threshold 55 g/L
- Control: Liberal threshold 70 g/L
- Time: 1 year follow-up
- Outcome: Infection

Lower transfusion rate after randomization – 46 vs. 94%

Lower infection rate – 6 vs. 25%, p=0.012

Longer length of stay – 11.5 vs. 9 days, p=0.04

No differences in any other outcome

Mullis BH, et al. J Orthop Trauma. 2024 Jan 1;38(1):18-24

AABB RBC Guideline 2023

Recommendations for Adults

Recommendation 1

For hospitalized adult patients who are hemodynamically stable, the international panel recommends a restrictive RBC transfusion strategy in which the transfusion is considered when the hemoglobin concentration is less than 7 g/dL (strong recommendation, moderate certainty evidence).

Remark: in accordance with the restrictive strategy threshold used in most of the trials for subgroups of patients, clinicians may choose a threshold of 7.5 g/dL for patients undergoing cardiac surgery and 8 g/dL for patients undergoing orthopedic surgery or those with preexisting cardiovascular disease.

Recommendation 2

For hospitalized adult patients, the panel suggests a restrictive RBC transfusion strategy in which transfusion is considered when the hemoglobin concentration is less than 7 g/dL in those with hematologic and oncologic disorders (conditional recommendation, low certainty evidence).

Recommendations for Children

Recommendation 3

For critically ill children and hospitalized children at risk of critical illness who are hemodynamically stable and without a transfusion-dependent hemoglobinopathy, cyanotic cardiac condition, or severe hypoxemia, the international panel recommends a restrictive transfusion strategy in which a transfusion is considered when the hemoglobin level is less than 7 g/dL compared with one of less than 9.5 g/dL (strong recommendation, moderate certainty evidence).

Recommendation 4

The international panel suggests considering a transfusion threshold for hemodynamically stable children with congenital heart disease that is based on the cardiac abnormality and stage of surgical repair: 7 g/dL (biventricular repair), 9 g/dL (single-ventricle palliation), or 7 to 9 g/dL (uncorrected congenital heart disease) (conditional recommendation, low certainty evidence).

Carson JL, et al. JAMA. 2023 Nov 21;330(19):1892-1902

2018 Frankfurt Guidelines

- Newer but same as AABB plus:
  - The panel recommended a restrictive RBC transfusion threshold (hemoglobin concentration <7.5 g/dL) in patients undergoing cardiovascular surgery
  - The panel recommended a restrictive transfusion threshold (hemoglobin concentration 7-8 g/dL) in hemodynamically stable patients with acute gastrointestinal bleeding

Mueller et al. JAMA. 2019;321(10):983-997

Reasonable approach for inpatients

Remember not to transfuse for pallor/fatigue!

Patient scenario	Hemoglobin threshold	Transfusion approach
Young patient with severe iron or B12 deficiency anemia with only fatigue and pallor	Any	Iv iron (or B12 im/po)
Young patient with reversible asymptomatic anemia (eg. Postpartum, recovering young trauma)	<5 g/dL	1 unit
Average patient without symptoms or cardiac history (eg. ICU, CVICU, hem-onc)	<7 g/dL	1 unit
Cardiac history without symptoms	<7-8 g/dL	1 unit
Hemodynamic symptoms (tachycardia, pre-syncope, etc)	<9 g/dL	1 unit
Myocardial infarction with only fatigue and pallor	<8 g/dL	1 unit GO SLOW
Slow bleeding and asymptomatic anemia	<7 g/dL	1-2 units
Rapid hemorrhage (eg. stabbing, gunshot, varices)	Keep 6-11 g/dL	As many as you need! Don't forget to use the term uncrossmatched!


OPHTHALMOLOGY PAVILION
DIALYSIS

Case 1

- 27 year old female, 2 days post C-section complicated by moderate post-partum hemorrhage
- Pre-delivery hemoglobin was 10.5 g/dL
- Hemoglobin this morning is 5.7 g/dL
- Heart rate 87, blood pressure 102/56.
- She is pale and tired but no pre-syncope or lightheadedness
- You have ordered a dose of intravenous iron
- Plan is for discharge today
- Should you transfuse 1 unit of RBCs before sending her home?

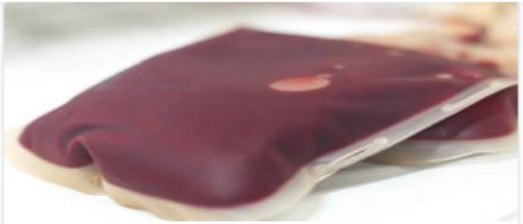
Case 2

- 76 year old woman 4 days post-op from hip fracture surgery (after fracture from a fall)
- Plan to discharge tomorrow
- Hemoglobin 7.1 g/dL
- Asymptomatic, vitals stable
- No cardiac history
- Should you transfuse red blood cells?

Summary

- Use these trials to help set your 'general' transfusion trigger where you might **consider** a transfusion
- Don't be overly prescriptive – just because the hemoglobin is 6.9 g/dL you have to transfuse…or 7.1 g/dL and you hold off
- Look at your patient – Are they symptomatic? Adjust the trigger to your patient's co-morbidities
- Unless rapid bleeding 1 unit at a time
- Write a rate
- Anticipate and prevent TACO

BloodBankGuy



023: RBC Transfusion Guidelines with Jeff Carson

Whither RBCs? There's no one better than lead author Dr. Jeff Carson to discuss the 2016 AABB RBC transfusion threshold recommendations!

035: Why Give Platelets? with Rick Kaufman

Platelets are tiny, but they can be a big issue! Dr. Rick Kaufman magnifies what the evidence shows about platelet transfusion.

Listen to This Episode!

016: Plasma Transfusion with Jeannie Callum

As many as 50% of plasma transfusions are unnecessary or inappropriate! You need to know why, and Dr. Jeannie Callum explains it SO well!