Patient Blood Management: Essential Or Non-Essential

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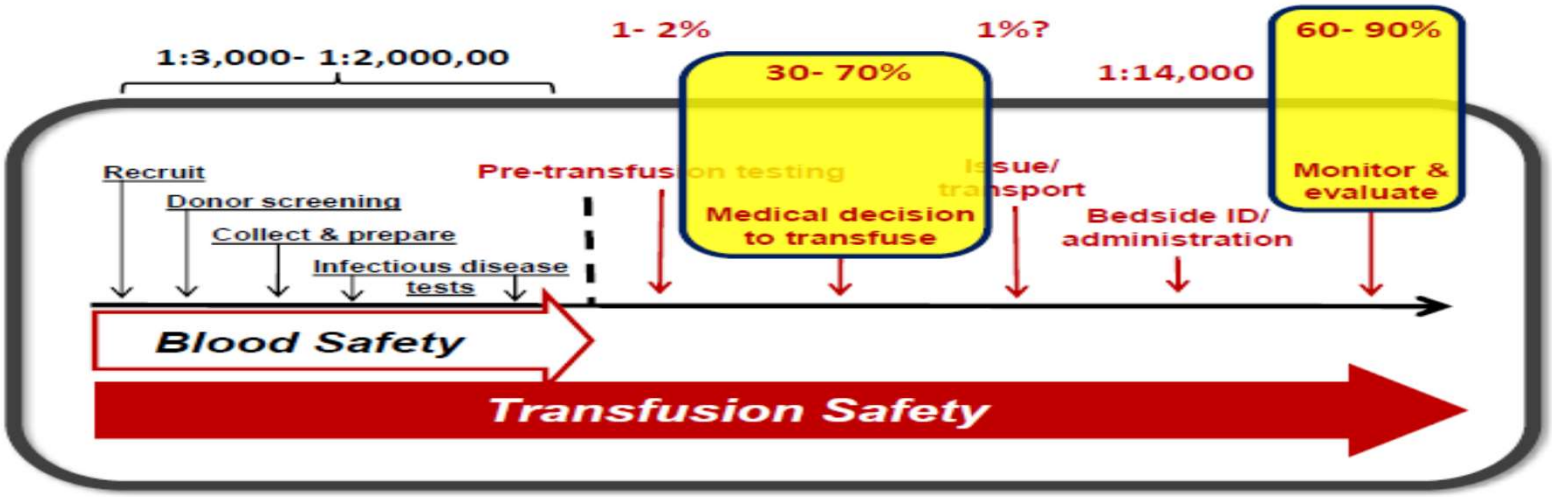
Transfusion Safety Error Rates



Tim Hannon, MD

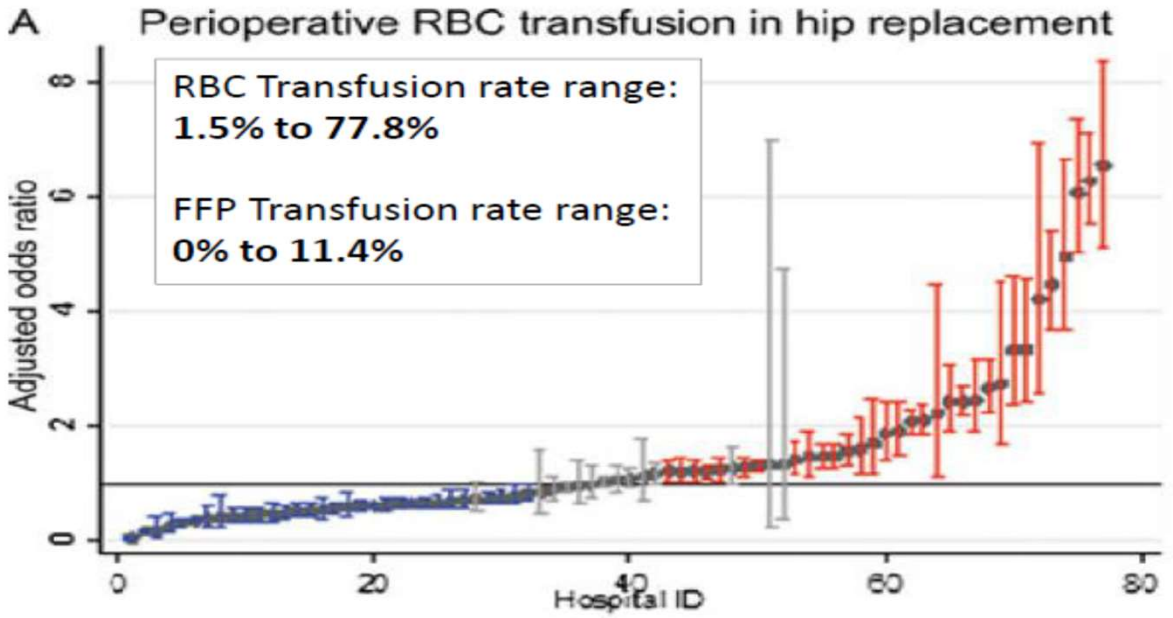
Dzik, Transfusion 2003;43
Maskens, Transfusion 2014;54(1)

- Red blood cell transfusions, once regarded as ‘one of the great advances in modern medicine,’ are now considered harmful in many clinical situations.
- Earlier cancer recurrence and decreased survival following cancer surgery
- Increased postoperative infection, more rapid progression of HIV, activation of latent viruses, prolonged postoperative ventilator support, poorer wound healing.
- Increased mortality in critically ill patients

* “RBC transfusion appears to be harmful for almost all cardiac surgery patients and wastes a scarce commodity and other health service resources. ”

Murphy GJ, Reeves BC, Rogers CA, et al. Increased Mortality, Postoperative Morbidity, and Cost After Red Blood Cell Transfusion in Patients Having Cardiac Surgery. Circulation 2007; 116: 2544-2552.

Do We follow Our Guidelines: Variations in Blood Transfusion Rates



(*Ann Surg* 2013;257: 266–278)

What is Patient Blood Management ?

Originator of the term PBM

MJA 1988 Professor ***James Isbister, AM*** proposed the need for a paradigm shift in the care of patients who are being considered for transfusion of fresh blood products.

Clinical Professor James Isbister BSc(Med), MB BS, FRACP, FRCPA.
Emeritus Consultant, Haematology & Transfusion Medicine,
Royal North Shore Hospital, Sydney, Australia.
Clinical Prof of Medicine, University of Sydney, Sydney, Australia;
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Adjunct Professor, Monash University, Melbourne, Australia;

Global Definition of PBM

"Patient blood management is a patient-centred, systematic, evidence based approach to improve patient outcomes by managing and preserving a patient's own blood, while promoting patient safety and empowerment"

www.anesthesia-analgesia.org

PBM world perspective

* World Health Organization has officially been urging member states to implement PBM since 2010 (WHA63.12).
* Patient blood management programs have already been rolled out successfully in some hospitals in Australia, Europe ,United States.
* PBM is still at its nascent stages in India
* Successful implementation of PBM reduces :
  1. perioperative blood loss and transfusion needs
  2. perioperative morbidity & mortality
  3. length of hospital stay and costs

Patient blood management (PBM)

* Proactive,
* Patient-centered
* Multidisciplinary approach to
  - Manage anemia,
  - Optimize hemostasis,
  - Minimize iatrogenic blood loss, and
  - Harness tolerance to anemia.

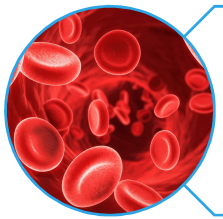
Patient Blood Management

Objectives

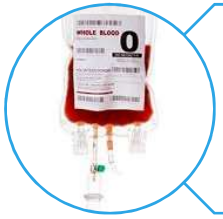
"The doctor wants to run a few more blood tests."

- What is it and Why is it needed?
- Review evidence for blood transfusion
- What is the ideal, recommended ways to practice it?
- Different patient population

Goals

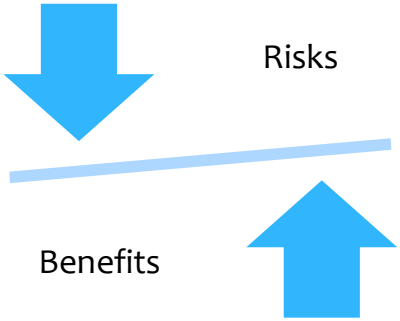


Rationally optimizing anemia and hemostasis

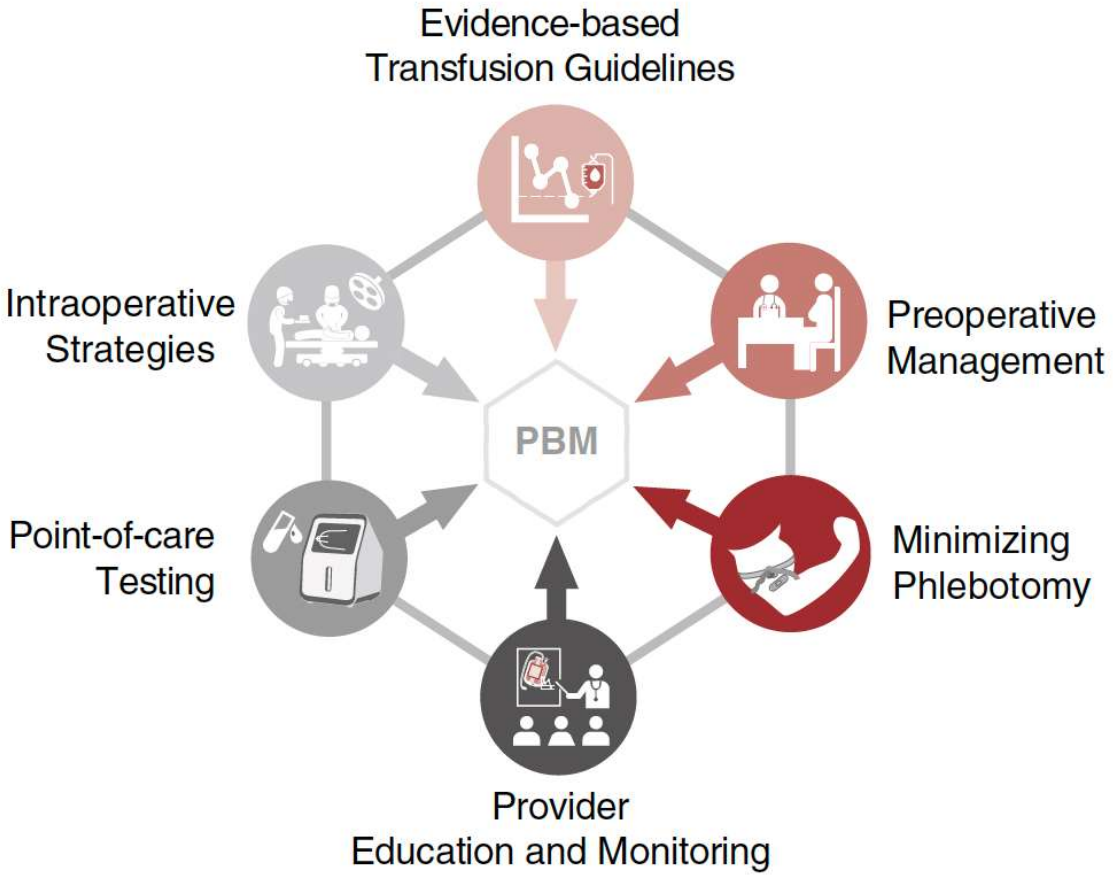


Restricting use of blood components

Improve patient outcomes, efficiency, and value



Elements of a PBM program



NEW NORMAL- Patient Blood Management

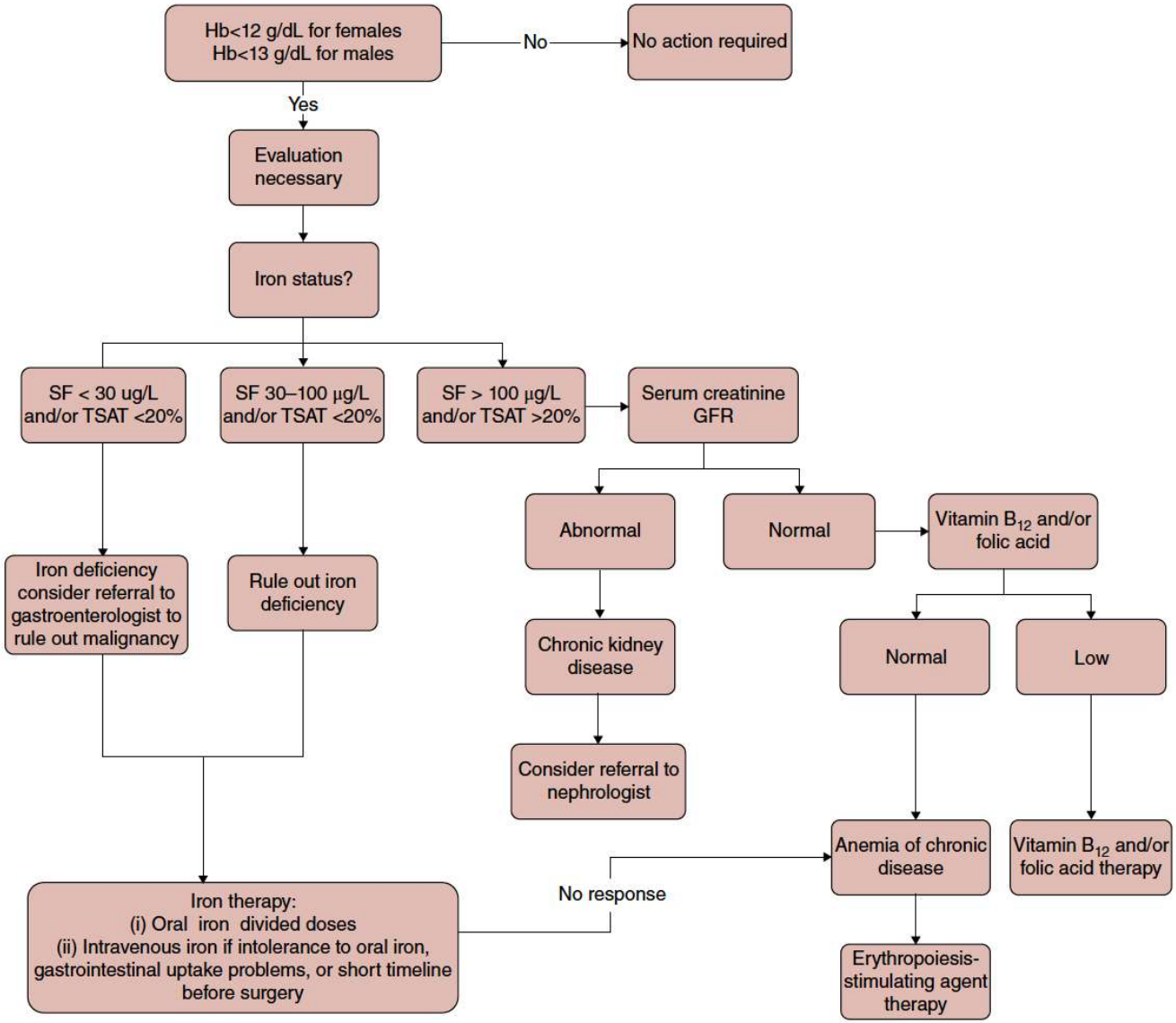
	1st Pillar **Optimization of Red cell mass**	2nd Pillar **Minimizing Blood loss**	3rd Pillar **Harness and optimize physiological reserve of anemia**
Pre-operative	Detect anaemia Identify underlying disorders Manage disorders Refer for further evaluation if necessary Treat suboptimal iron stores Treat other hematinic deficiencies	Identify and minimize bleeding risk Minimize iatrogenic blood loss Procedure planning and rehearsal	Assess/optimise patient's physiological reserve Compare estimated blood loss with patient-specific tolerable blood loss Formulate patient specific management plan
Intra-operative	Time surgery with haematological optimization	Meticulous haemostatic and surgical techniques Blood sparing surgical devices Anaesthetic blood conserving strategies Autologous blood transfusion Maintain normothermia Pharmacological haemostatic agents	Optimize cardiac output Optimize ventilation and oxygenation
Post-operative	Optimize erythropoiesis Be aware of drug interactions	Vigilant monitoring and management of post-operative anaemia Avoid secondary haemorrhage Maintain normothermia Minimise iatrogenic blood loss Haemostasis/anticoagulant management Avoid infection	Optimize anaemia reserve Maximise oxygen delivery Minimise oxygen consumption Avoid/treat infections promptly Restrictive transfusion thresholds

Optimize erythropoiesis	Minimize blood loss	Manage anemia
• Identify, evaluate, and treat underlying anemia • Preoperative autologous blood donation • Consider erythropoiesis stimulating agents (ESA) if nutritional anemias ruled out/treated • Refer for further evaluation if necessary	• Identify and manage bleeding risk (past/family history) • Review medications (antiplatelet, anticoagulation therapy) • Minimize iatrogenic blood loss • Procedure planning and rehearsal	• Compare estimated blood loss with patient-specific tolerable blood loss • Assess/optimize patient's physiologic reserve (*e.g.*, pulmonary and cardiac function) • Formulate patient-specific management plan using appropriate blood conservation modalities to manage anemia

- Patients with a potential need for blood transfusion to have a **type and screen/crossmatch**
- **Transfusion consent** with discussion of blood transfusion risks and benefits; alternatives to blood; an opportunity to ask questions
- **Review** by the transfusion service before surgery
- **WHO surgical safety check list-** compliance rate of 100%

Anesthesiology 2012; 116:1367–76

Algorithm for the detection, evaluation, and management of preoperative anaemia



INTRAOPERATIVE

Optimize erythropoiesis	Minimize blood loss	Manage anemia
• Time surgery with optimization of erythrocyte mass (note: unmanaged anemia is a contraindication for elective surgery)	• Meticulous hemostasis and surgical techniques • Blood-sparing surgical techniques • Anesthetic blood conserving strategies • Acute normovolemic hemodilution • Cell salvage/reinfusion • Pharmacologic/hemostatic agents	• Optimize cardiac output • Optimize ventilation and oxygenation • Evidence-based transfusion strategies

- Controlled hypotension
- Prevention of hypothermia
- Body Position
- Anti-fibrinolytics
- Point of care testing
- Possible benefits of regional anesthesia

Tranexamic Acid

- Synthetic lysine analogue antifibrinolytic agent; inhibits the activation of plasminogen to plasmin
- Eight times more active than its analogue epsilon aminocaproic acid (EACA); Aprotinin withdrawn in 2008
- Has been used successfully in cardiac & noncardiac surgeries
- Trauma- CRASH-2, CRASH-3, Dutch ULTRA study
- Gynaecology and Obstetrics- WOMAN trial (World Maternal Antifibrinolytic Trial)
- Bleeding patients who are on Direct Oral Anticoagulants (DOAC) like dabigatran, rivaroxaban, apixaban

POSTOPERATIVE

Optimize erythropoiesis

- Manage nutritional/correctable anemia (*e.g.*, avoid folate deficiency, iron-restricted erythropoiesis)
- ESA therapy if appropriate
- Be aware of drug interactions that can cause anemia (*e.g.*, ACE inhibitor)

Minimize blood loss

- Monitor and manage bleeding
- Maintain normothermia (unless hypothermia indicated)
- Autologous blood salvage
- Minimize iatrogenic blood loss
- Hemostasis/anticoagulation management
- Be aware of adverse effects of medications (*e.g.*, acquired vitamin K deficiency)

Manage anemia

- Maximize oxygen delivery
- Minimize oxygen consumption
- Avoid/treat infections promptly
- Evidence-based transfusion strategies

- Appropriate fluid resuscitation perioperatively to maintain perfusion pressure
- Avoid dehydration

Anesthesiology 2012; 116:1367–76

Summary of Major RBC Threshold Trials

Trial	Population	Participants (n)	Thresholds (hemoglobin)	Primary outcome
TRICC	Critical care	838	7 g/dL vs 10 g/dL	30d mortality 18.7% vs 23.3%, P=0.11
FOCUS	Hip fracture	2016	8 g/dL vs 10 g/dL	Death or inability to walk across room at 60d, 35.2% vs 34.7%, P=0.9
Villanueva et al.	Upper GI Hemorrhage	921	7 g/dL vs 9 g/dL	Mortality at 45d, 5% vs 9% P=0.02
TRISS	Septic Shock	998	7 g/dL vs 9 g/dL	90d mortality, 43% vs 45% P=0.44
TITRE2	Post-cardiac surgery	2003	7.5 g/dL vs 9 g/dL	Infection or ischemic event in 3mo, 35.1% vs 33.0% P=0.3
TRICS-III	Cardiac surgery	4860	7.5 g/dL vs 8.5 or 9.5 g/dL	Composite, 11.4% vs 12.5% P<0.001 for noninferiority

Society Guidelines – RBC Triggers

Year	Society	Hemoglobin Number
2001	Australasian Society for Blood Transfusion	7g/dL
2006	American Society of Anesthesiologists	No number
2009	American College of Critical Care Medicine	7g/dL
2009	Society for Critical Care Medicine	7g/dL
2011	Society for Advancement of Blood Management	8g/dL
2011	Society of Thoracic Surgeons	7 or 8g/dL
2012	National Cancer Care Network	7-9g/dL
2012	British Committee for Standards in Hematology	7-8g/dL
2016	AABB	7-8g/dL
2017	HVPAA	7-8g/dL

AABB-American Association of Blood Banks, HVPAA-The High Value Practice Academic Alliance

Indications for use of platelet transfusions in adults

Indication	Transfusion indicated (threshold)/not indicated
Prophylactic use (No bleeding or WHO grade 1)	
One adult dose required	
- Reversible bone marrow failure (BMF) including allogeneic stem cell transplant	10 x 10^9/L
- Reversible BMF with autologous stem cell transplant (consider no prophylaxis)	10 x 10^9/L
- Critical illness	10 x 10^9/L
- Chronic BMF receiving intensive therapy	10 x 10^9/L
- Chronic BMF to prevent persistent bleeding of grade > 2	Count variable
- Chronic stable BMF, abnormal platelet function, platelet consumption/ destruction (e.g. DIC, TTP) or immune thrombocytopenia (ITP, HIT, PTP)	Not indicated
Prophylactic use in the presence of risk factors for bleeding (e.g. sepsis, antibiotic treatment, abnormalities of haemostasis)	
- Reversible/chronic bone marrow failure or critical care	10 to 20 x 10^9/L
- Abnormal platelet function, platelet consumption/destruction, immune thrombocytopenia	Not indicated

Indications for use of platelet transfusions in adults

Indication	Transfusion indicated (threshold)/not indicated
Platelet transfusion preprocedure	
- Central venous catheter (CVC) excluding PICC line	20 x 10^9/l
- Lumbar puncture	40 x 10^9/l
- Percutaneous liver biopsy	50 x 10^9/l
- Major surgery	50 x 10^9/l
- Epidural anaesthesia, insertion & removal	80 x 10^9/l
- Neurosurgery or ophthalmic surgery involving the posterior segment of the eye	100 x 10^9/l
Bone marrow aspirate or trephine biopsies, PICC line insertion, traction removal of central venous catheters (CVCs), cataract surgery	Not indicated
Therapeutic use (Bleeding WHO grade 2 or above)	
- Severe bleeding	50 x 10^9/L
- Multiple trauma, brain or eye injury, spontaneous intracerebral haemorrhage	100 x 10^9/L
- Bleeding (WHO grade >2) but not severe	30 x 10^9/L
- Bleeding in specific clinical conditions – see the next table for indications	

Guidelines for Plasma transfusions

Abnormal standard coagulation tests (prothrombin time[PT]/activated partial thromboplastin time [APTT]) are poor predictors of bleeding risks in non-bleeding patients prior to an invasive procedure

A detailed personal and family bleeding **history**, drug history and the bleeding risk associated with the planned procedure must be assessed as a matter of routine for all patients undergoing a planned procedure

Standard coagulation tests should be considered in patients undergoing procedures with a moderate or high bleeding risk, any patients on anticoagulants, or those who have a personal/family bleeding history.

The impact of commonly used doses of FFP to correct clotting results, or to reduce the bleeding risk, is very limited particularly when the PT ratio or International Normalised Ratio (INR) are between 1.5–1.9.

PT and APTT do not reflect the true haemostatic status of patients with advanced liver disease. Abnormalities of PT and APTT need to be interpreted with caution.

There is **no good evidence to endorse the use of prophylactic FFP for correction** of abnormal clotting tests in non-bleeding patients prior to interventions such as elective variceal banding.

Vitamin K should be administered in patients with prolonged PT that is likely to be due to acquired vitamin K deficiency.

Prophylactic transfusion of FFP and cryoprecipitate is not given in low bleeding risk procedures, such as paracentesis in patients of Chronic liver disease.

Clinical indications for the use of FFP*

- **Major Haemorrhage** – In the trauma setting transfuse empirically in a 1:1 ratio with red cells. Other settings give FFP in at least a 1 unit:2 unit ratio with red cells until results from coagulation monitoring are available. Once bleeding is controlled, further FFP should be guided by abnormalities in PT and APTT (keep PT/APTT ratio of <1.5x mean normal), or by the use of viscoelastic haemostatic assays in a near-patient setting.
- **PT Ratio/INR >1.5 with bleeding** – Clinically significant bleeding without major haemorrhage. FFP required if coagulopathy. Aim for a PT and APTT ratio of < 1.5, or local protocol range for near-patient viscoelastic assays.
- **PT Ratio/INR >1.5 and pre-procedure** – Prophylactic use when coagulation results are abnormal e.g. disseminated intravascular coagulation and invasive procedure is planned
- **Liver disease with PT Ratio/INR >2 and pre-procedure** – FFP not usually required before invasive procedure if PT ratio/INR is <2 and if there is no significant risk of bleeding
- **Thrombotic Thrombocytopenic Purpura (TTP)/plasma exchange****
- **Replacement of single coagulation factor.**

**National Blood Transfusion Committee Indication Codes for Transfusion, 2020.*

Institutional Standard Operating Procedures/Protocols

Written interdepartmental SOPs, Clinical protocols, guidelines, visual aids and checklists

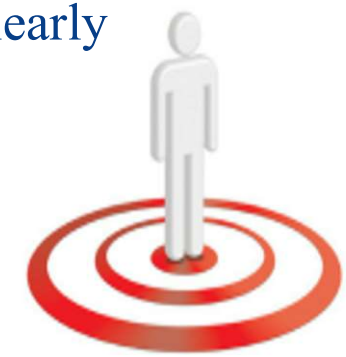
Help facilitate implementation, practice, and process helps in ensuring sustainability of the PBM program.

Specific algorithms for MTP, high-risk patients Eg. PPH, trauma, cardiac Sx etc.

Problems:
SoPs not easily available and understood.
Problems with reading the tables.
Feeling of superiority.
Seniority.

Patient-Centered Decision Making

* Individual PBM plan with transfusion triggers based on the patient's risk profile/tolerable erythrocyte deficit.
* Written patient information form/informed consent for allogeneic blood products (in emergency after transfusion).
* Clinician who ordered blood products is clearly identifiable and responsibility fixed.
* Documentation of the indication for each of the blood components clearly mentioned and understood.
* Single-unit policy (RBC units, platelet concentrate)
* Periodic audit of compliance to institutional guidelines



PBM in Critical Care

- In critically ill patients, a **restrictive transfusion strategy** should be employed.
- RBC transfusion should not be dictated by a Hb concentration alone, but should also be based on **assessment of the patient's clinical status.**
- The routine use of FFP in critically ill patients with coagulopathy is not advised TRALI/ARDS
- The **underlying causes of coagulopathy** should be identified.
- In critically ill patients, in the absence of acute bleeding, the administration of platelets may be considered appropriate at a platelet count of $<20 \times 10^9/L$
- Platelet threshold $> 50 \times 10^9/L$- for invasive procedure

Pre-PBM & Post-PBM ….

p-value=0.0005			Groups		Total
			Pre	Post	
Transfusion	Yes	Count	129	61	190
		%	24.9%	14.5%	20.3%
	No	Count	389	359	748
		%	75.1%	85.5%	79.7%
Total		Count	518	420	938
		%	100.0%	100.0%	100.0%

PRBC Transfusion Rate: Reduction from 24.9% to 14.5% post PBM

Hemoglobin before surgery, after surgery and at the time of discharge: Comparison before and after PBM

Groups		N	Mean	SD	p-value
Preop Hb	Pre-PBM	518	11.94	2.18	0.011
	Post-PBM	420	12.30	2.14	
Postop Hb	Pre-PBM	481	10.54	2.12	0.067
	Post-PBM	295	10.82	2.01	
Hb At Discharge	Pre-PBM	482	10.14	1.80	0.001
	Post-PBM	294	10.62	1.98	

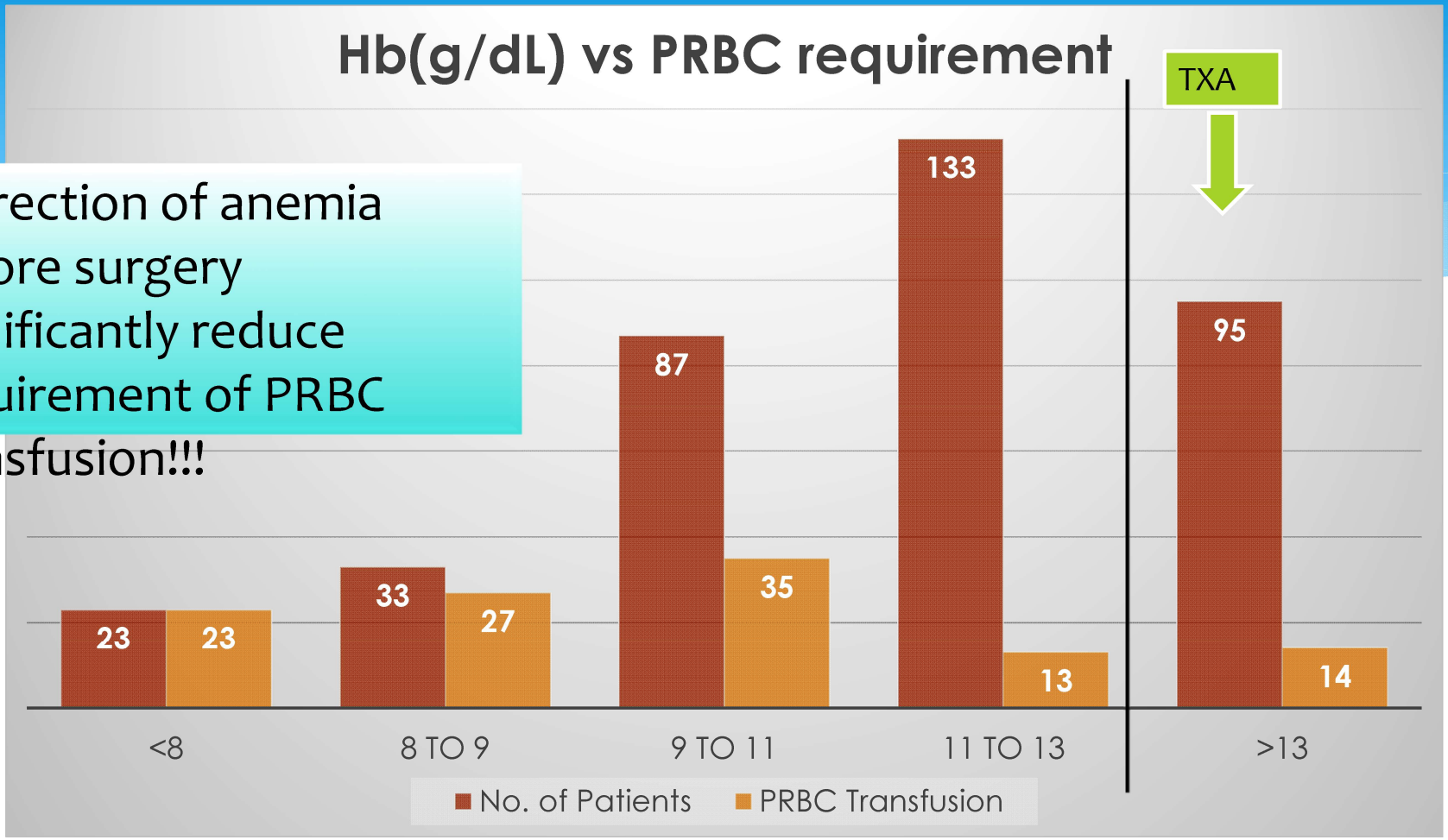
P-value = 0.0005			Groups		Total
			Pre-PBM	Post-PBM	
ICU Stay	Yes	Count	112	53	165
		%	21.6%	12.6%	17.6%
	No	Count	406	367	773
		%	78.4%	87.4%	82.4%
Total		Count	518	420	938
		%	100.0%	100.0%	100.0%

ICU Stay: Decreased from 21.6% to 12.6%

Length of stay post surgery: Mean decreased from 7.14 to 3.49 days

P-value=0.0005		N	Mean	SD
Length of stay after surgery	Pre-PBM	518	7.14	5.733
	Post-PBM	420	3.49	4.388

Correction of anemia before surgery significantly reduce requirement of PRBC transfusion!!!



Transfusion data

Year	Inpatients	PRBC issued	Mean PRBC /inpatient	All units issued	Mean components / inpatient
2015-2016	6298	1513	0.24	3062	0.49
2016-2017	9202	1958	0.21	4170	0.45
2017-2018	22040	2423	0.11	5256	0.24
2018-2019	44175	3015	0.07	6920	0.16
2019-2020	42404	3726	**0.09**	7819	**0.18**
AIIMS-R	55789	9907	**0.18**	25541	**0.46**

US national Average: 0.07* (2013)

https://www.hcup-us.ahrq.gov/reports/statbriefs/sb215-Red-Blood-Cell-Transfusions-Trends.jsp

Cost effectiveness of PBM

Costs of transfusion

Cost of consumables for transfusion of 1 PRBC = ₹ 2,000 (US$30)

Cost of transfusion of 8630 units of PRBC = ₹ 17,260,000 (US$ 241,600) (predicted requirement for 2018-19)

Actual cost accrued due to implementation of restrictive transfusion thresholds = ₹ 6,030,000 (US$ 84,406)

Savings from PRBC consumables =₹ 11,230,000 (US$ 157,200)

Savings in laboratory consumables = ₹ 40,000

Cost of PBM

Manpower required for implementation of our model of PBM

2 Resident Physicians and 2 Technicians

Cost of manpower = ₹ 3,360,000

Cost Benefit analysis: Money saved due to implementation of PBM in 1 year =

₹ 7,870,000 (US$ 110,162)

Challenges In Implementation

1. Broad scope of PBM programmes (multidisciplinary, multimodal, and applicable to many clinical procedures)
2. Need to implement long-lasting attitudinal changes among healthcare professionals
3. Lack of a widely accepted practical framework to implement, target, and monitor

* a PBM programme in a hospital or healthcare organisation
* to measure, benchmark, assess results of PBM programmes, PBM-related patient outcomes according to a set of **key performance indicators (KPI)**

PROCESS DIMENSIONS	CLINICAL RECOMMENDATIONS		PROCESS KPIs
PILLAR I. Optimize red cell mass	1	Assess preoperative anaemia early enough to implement the appropriated treatment	% of patients with an Hb determination 21-90 days before surgery (1)
	2	Asses preoperative iron metabolism	% of patients with a Ferritin determination 21-90 days before surgery (1) (2)
	3	Treat preoperative anaemia	% of patients treated preoperatively 7-90 days before surgery
	4	Preoperative anaemia is a contraindication for elective surgery	% of patients with anaemia prior to surgery
	5	Treat periprocedural anaemia	% of patients treated with IV iron during hospital stay
	6	Do not transfuse preoperatively	% of patients with preoperative transfusion
PILLAR II. Minimize blood loss and bleeding	7	Apply regional anaesthesia, whenever possible, to reduce blood loss	% of patients under spinal anaesthesia
	8	Minimize surgical bleeding with antifibrinolytics	% of patients treated with antifibrinolytics perioperatively
	9	Reuse own blood, whenever possible	% of patients with blood recovery systems preoperatively
PILLAR III. Harness and optimize physiological reserve of anaemia	10	Apply restrictive transfusion thresholds	Hb level prior to transfusion
	11	Apply restrictive transfusion thresholds	% of patients transfused with Hb ≥ 8 g/dl
	12	Single-unit red cell transfusions	% of single-unit transfused patients

OUTCOMES DIMENSIONS	OUTCOMES KPIs
INTERMEDIATE OUTCOMES	Transfusion rate
	Transfusion index
	Total transfusion index
HARD OUTCOMES	In-hospital mortality
	Complications
	Length of stay
	30-day related readmissions

Blood Scarcity in India is not True

Why Is There A Blood Shortage In India

India today faces a shortage of 10% relative to its blood requirements. In absolute terms, this means that we require to cover a shortfall of over 12 lakh units. Given that the eligible donor population of India is more than 512 million, this deficit is surprising. This World Blood Donor Day let's understand this.

Health | DoctorNDTV | Updated: June 14, 2017 12:06 pm IST

TRENDING


News Anchor Detained After Cops vs Cops Drama In Rahul Gandhi Video Case


UP Man Arrested, Sold Chicken Wrapped In Photos Of Gods, Say Cops


US Shooting: Suspect, 22, "Fired From Rooftop With High-Powered Rifle"


Image Credit: istockphoto.com/asiseeit

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News / Mail Today / Why India is facing a huge blood crisis

Why India is facing a huge blood crisis

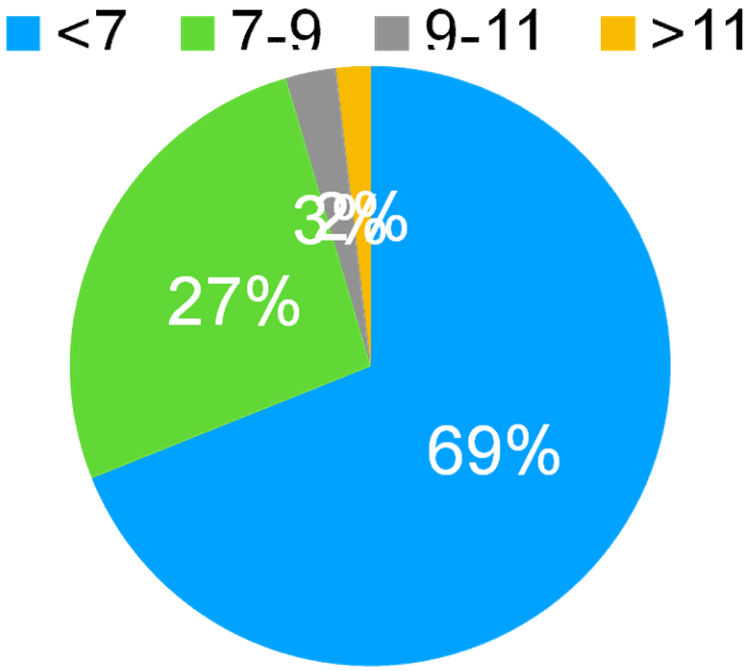
India has the world's largest shortage of blood, with all states together battling a huge shortfall of 41 million units and demand outstripping supply by over 400%, says the first of its kind study published in the journal The Lancet. And demand is rising, says the findings.

ADVERTISEMENT

Obstetrics and Gynaecology

- Prevalence of anemia in pregnant women who received transfusion

Hb values- pregnant (1026 out of 1047 pregnant were Tx PRBC/ WB)					
	Hb				
	<7	7-9	9-11	>11	Not mentioned
	408	157	16	11	434

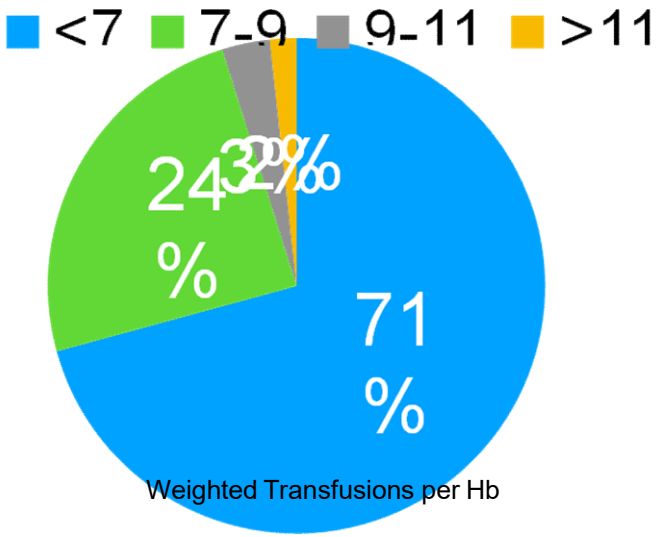


Obstetrics and Gynaecology

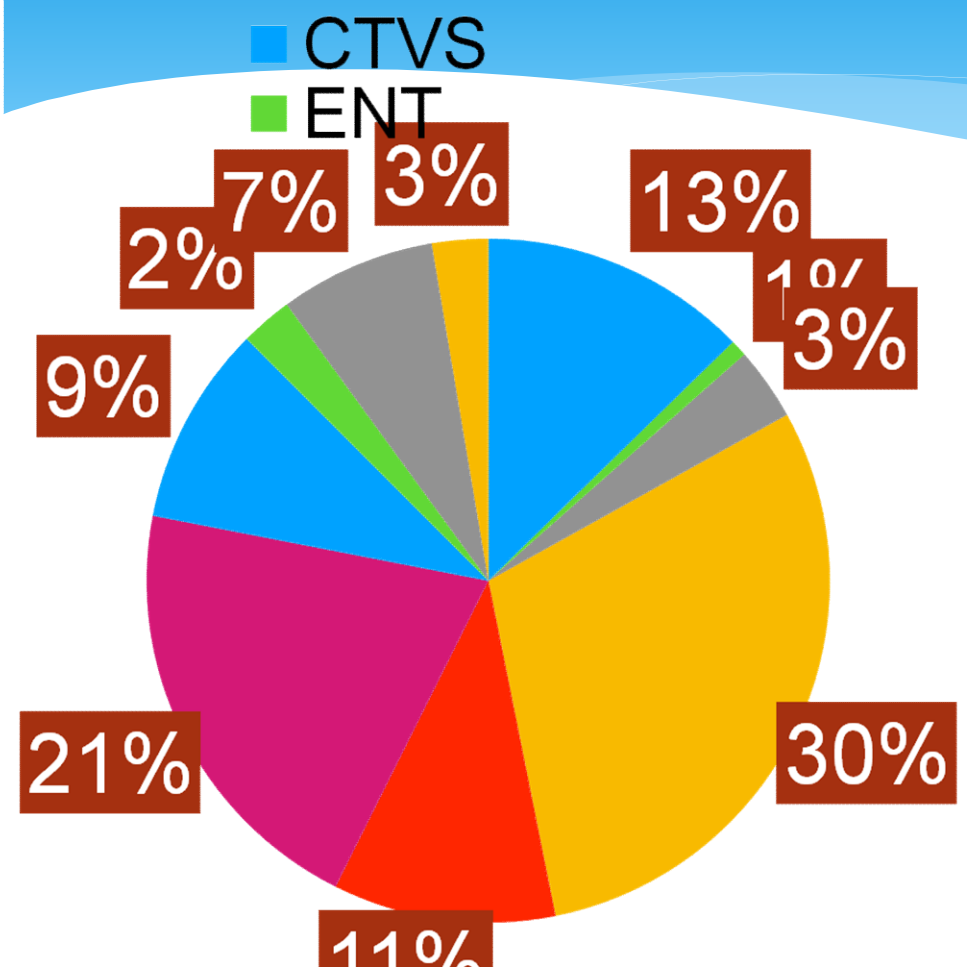
- Pre Transfusion Hemoglobin of the patients

	Hb					
No. of unit Issued [PRBC]	**<7**	**7-9**	**9-11**	**>11**	**Not mentioned**	**Total**
1 unit	284	105	14	4	329	736
2 unit	52	18	2	3	50	125
3 unit	4	0	0	0	1	5
4 unit	2	0	0	0	2	4
Paediatrics bag	1	0	0	0	1	2
Total	343	123	16	7	383	872

Anemic patients require significantly more transfusions
Patients with Hb> 11 required only 2% of the total transfusions
Even if anemia is corrected to > 9 in 50% of the patients, transfusion requirement will decrease by more than 50%



Number of Requests- Surgical Branches

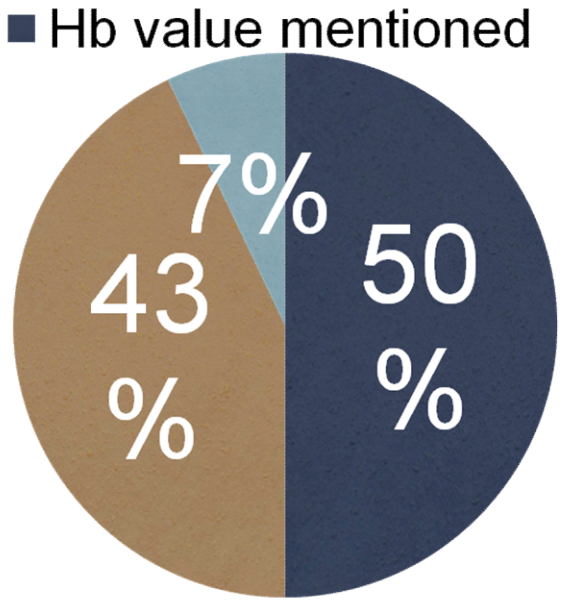


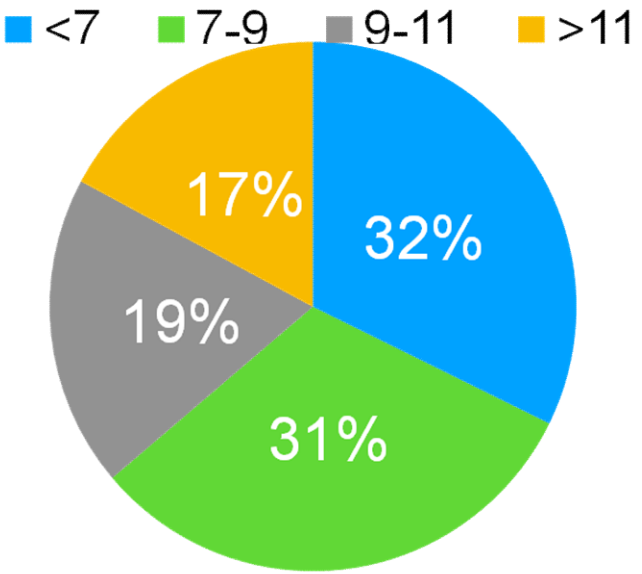
Department	Number of requests	Department	Number of requests
CTVS	129	**Orthopaedics**	210
ENT	8	**Paediatric surgery**	96
Gastro surgery	35	**Plastic surgery**	25
General Surgery	304	**Surgical Oncology**	75
Neurosurgery	107	**Urology**	27
		Total	1016

Hemoglobin level of patients taken for surgery

Surgical branches

	Hb level					
	<7	7-9	9-11	>11	PRBC Transfused Hb Not mentioned	No PRBC transfusion
No. Of patients	164	160	97	87	436	72
% of total	16.14	15.75	9.55	8.56	42.91	7.09





No. Of PRBC issued at pre op Hb

	Hb of patient					
No. of PRBC Issued	<7	7-9	9-11	>11	Not mentioned	Total
1 unit	79	89	54	39	220	481
2 unit	51	39	20	22	86	218
3 unit	9	2	2	7	16	36
4 unit	2	0	3	5	11	21
> 4 unit	0	0	2	0	0	2
Not mentioned	0	0	1	0	3	4
Paediatrics bag	7	17	5	3	60	92
Total	148	147	87	76	396	854

Correction of pre-operative nutritional anemia can result in upto 40% reduction in requirement of transfusion in surgical departments

Take Home Message : BRAND

* Benefits of Transfusion: Research has not shown any major benefit for patients.
* Risks of Transfusion: Allogeneic blood transfusions substantially alter the recipient immune system
* Alternative Therapies: Anaemia and active bleeding
* No therapy: No transfusion should not be confused with no therapy
* Decision: Blood management is the path to be taken bcz blood saves life, while transfusions do not.

Patient Blood Management

We're part of it!

"Blood components and blood products will never be without risk. The best way to reduce that risk is to reduce their use ."

"1997, the Krever Commission Report

"Blood saves lives when you need it; but only increases the risk and cost when you don't" - Dr. Steve Frank