Patient Blood Management

Patient Blood Management:
A Multimodal Strategy to Improve Outcome by Optimizing, Conserving and Managing Patients‘ Own Blood

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Patient **B**lood **M**anagement

PBM is seen as a new paradigm in transfusion medicine

The aim of this workshop is

- to explain the rationals and fundamentals of PBM

- to help to implement this strategy

- to improve patients‘ outcome and to reduce costs

Paradigm Shift

GIVE BLOOD

GIVE LIFE

ANSARA

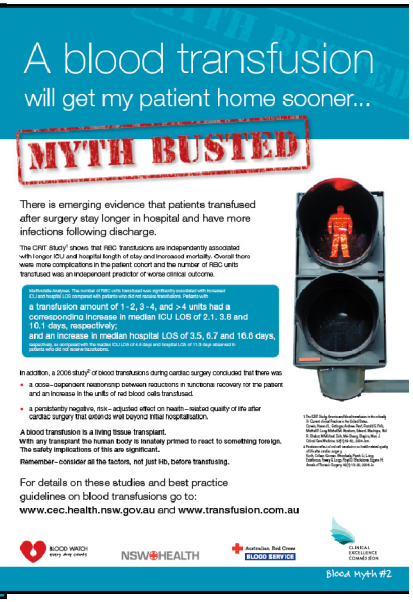
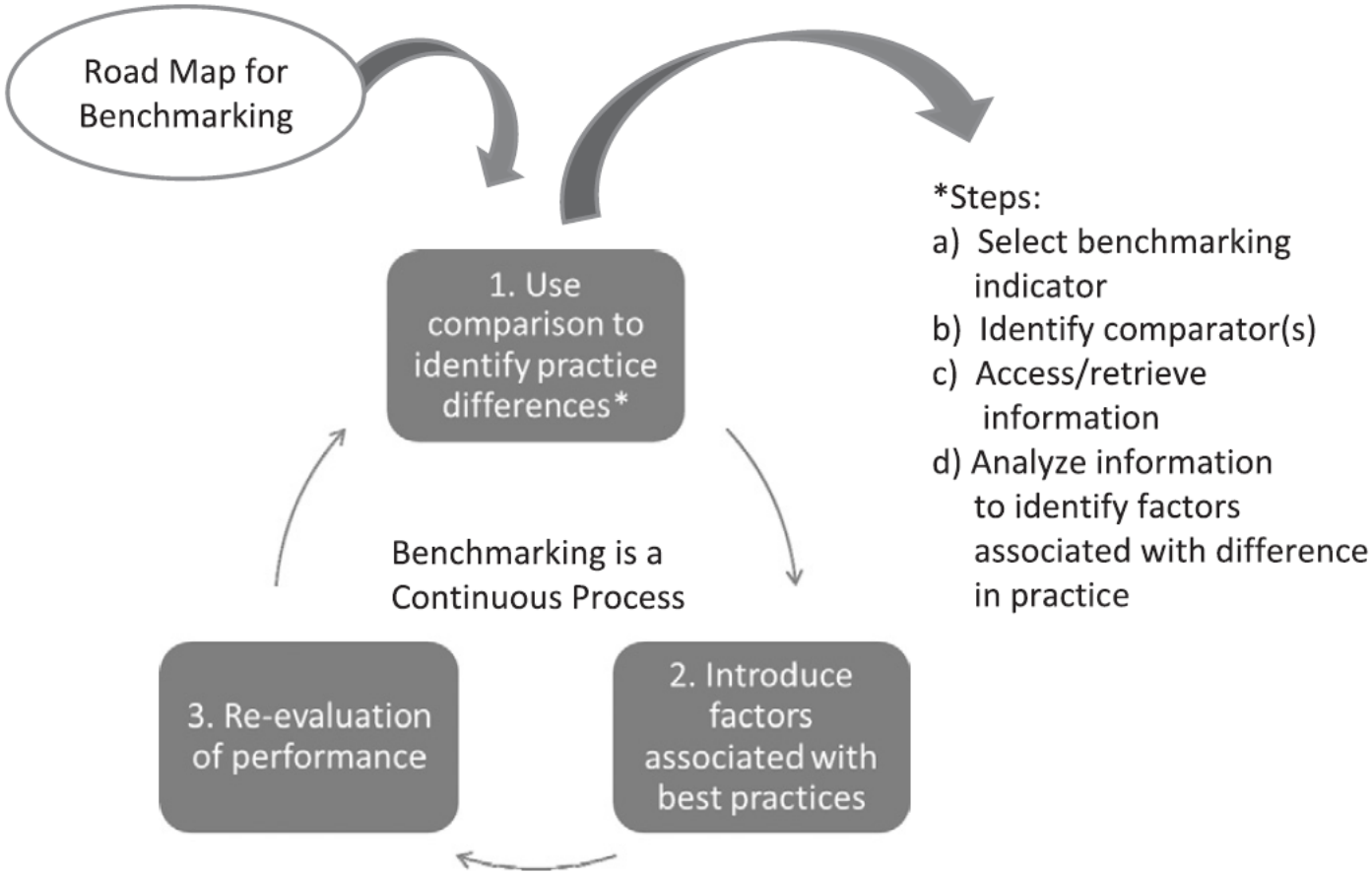
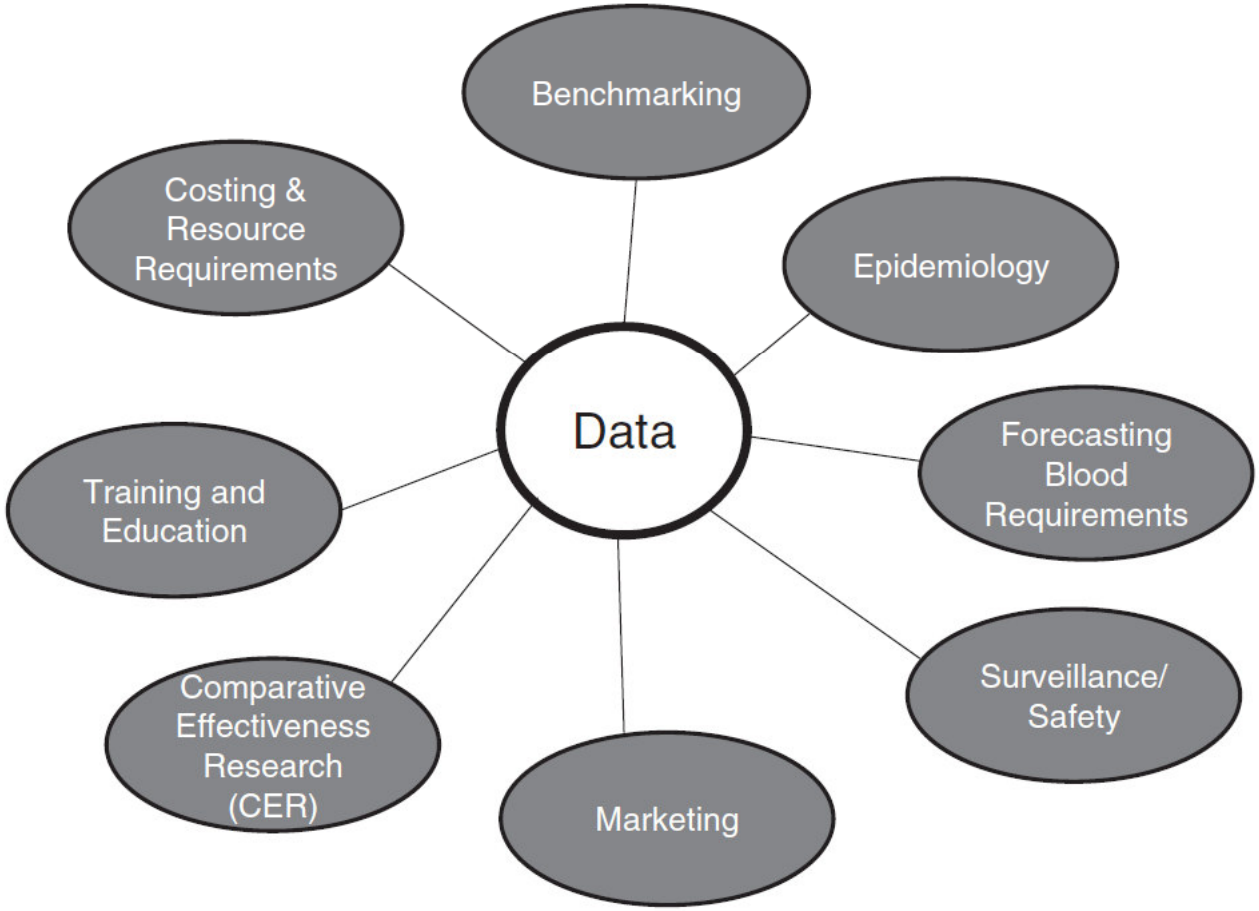


Illustration of the benchmarking process



Apelseth et al: Transfusion Medicine Reviews, Vol 0, No 0 (Month), 2011: pp 1-12

Potential uses of benchmarking in transfusion medicine.



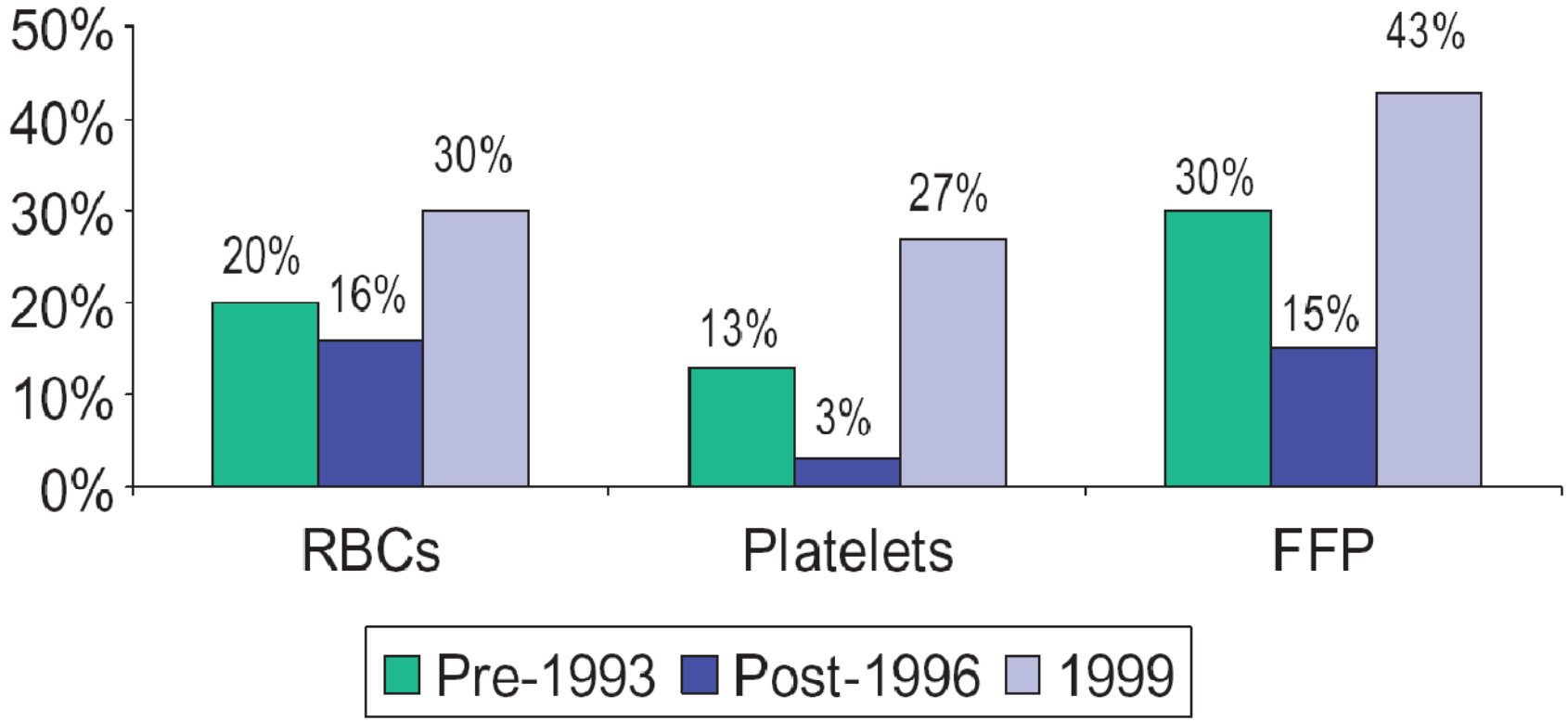
Apelseth et al: Transfusion Medicine Reviews, Vol 0, No 0 (Month), 2011: pp 1-12

Reduction in Patients or UnitsTransfused by Intervention

Intervention	Products	Measure	Relative Change, %
Guideline			
As solitary intervention	RBCs	Proportion of patients receiving transfusions	–17
	Platelets	Units/patient per week	–20
		Units	–14
In combination with other interventions	RBCs	Proportion of patients receiving transfusions	–43
		Units/patient	–12 to –65
		Units	–21 to –62
	FFP	Proportion of patients receiving transfusions	64 to –21
		Units/patient	–18
		Units	–9 to –77
	Platelets	Units/patient	–23
		Units	–15
	Albumin	Grams	–44
	Cryoprecipitate	Units/patient	–44
Audit/feedback			
As solitary intervention	RBCs	Regression slope of units/patient per month	$t = -0.014$
	FFP	Regression slope of units/patient per month	$t = -0.017$
	Platelets	Regression slope of units/patient per month	$t = 0.05$
	Cryoprecipitate	Regression slope of units/patient per month	$t = -0.23$
In combination with other interventions	RBCs	Proportion of patients receiving transfusions	–79
		Units/patient	–12 to –29
		Units	–19 to –62
	FFP	Proportion of patients receiving transfusions	–21
		Units/patient	–18
		Units	–9 to –77
	Platelets	Units/patient	–23
		Units	–15
	Cryoprecipitate	Units/patient	–44
Audit/approval			
As solitary intervention	FFP	Units/admission	–55
In combination with other interventions	RBCs	Units/patient	–27
	FFP	Units/patient	–35 to –52
	Platelets	Units/patient	–22
		Units	–17
Form (reminder)			
As solitary intervention	RBCs	Regression slope of units/patient per month	$t = -2.53$
	Platelets	Regression slope of units/patient per month	$t = -1.88$
	FFP	Regression slope of units/patient per month	$t = -1.64$
In combination with other interventions	RBCs	Proportion of patients receiving transfusions	–27
		Units/patient	–12
		Units	–62
	FFP	Units/patient	–18 to –35
		Units	–9 to –52
	Platelets	Units/patient	–22 to –23
		Units	–15 to –17
	Cryoprecipitate	Units/patient	–44
	Albumin	Grams	–44
Education			
In combination with other interventions	RBCs	Proportion of patients receiving transfusions	–43 to –79
	FFP	Units/patient	–12 to –65
		Units	–46 to –77

Tinmouth et al: Arch Intern Med. 2005;165:845-852

Durability of change in transfusion practice — inappropriate transfusions

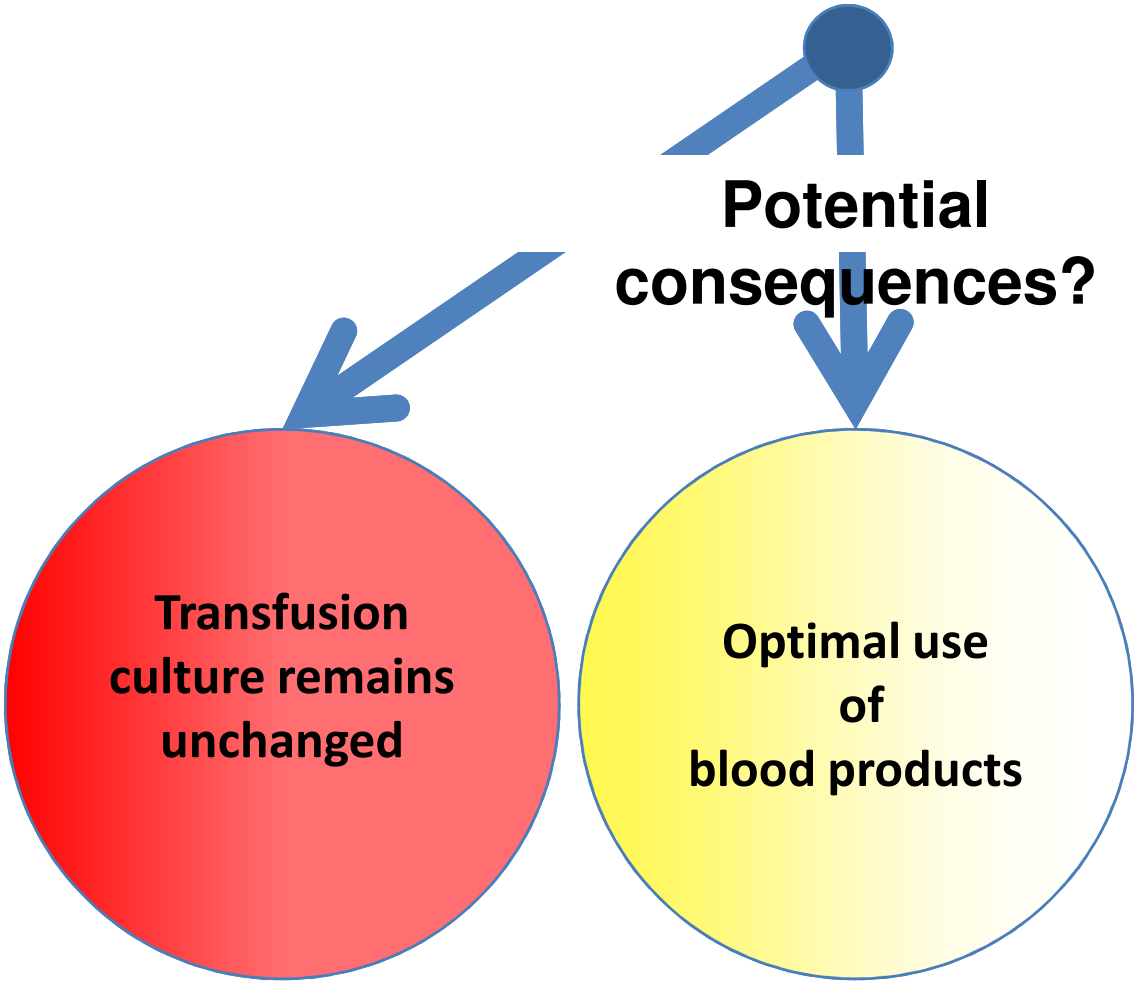


Multiple interventions evaluated 3 years after start of interventions: guidelines, education, new transfusion form, prospective audit

Tinmouth A: TRANSFUSION 2007;47:132S-136S

RBC Transfusions in Austria

- **5th highest RBC utilization per capita**
- **Extreme inter-center transfusion variability for matched pa**



Manual of Optimal Blood Use

Support for safe, clinically effective and efficient use of blood in Europe

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Essentials of decision on transfusion

- Assess clinical condition
- Use clinical guidelines
- Inform patient and obtain consent
- Record the decision and rationale

Essentials of ordering blood component

- Identify the patient correctly
- Take blood sample and correctly label the tube
- Complete the request/electronic order form correctly
- Take note of special transfusion requirements
- Send the sample and request form to the Blood Bank
- Communicate with Blood Bank if blood is required urgently

Assess the

Essentials of monitoring transfused patient

- Monitor patient's vital signs regularly
- Recognise, diagnose respond to adverse event
- Record outcome of transfusion
- Assess need for further transfusion

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pa

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Essentials of pretransfusion testing

- Determine patient's ABO and RhD type
- Detect clinically significant red cell antibodies
- Select and crossmatch red cell units
- Apply compatibility label

the blood component

the blood component

Essentials of administering blood components

- Identify the patient correctly
- Ensure there is a written instruction to transfuse
- Record pretransfusion vital signs
- Check (control) patients blood group if this normal procedure
- Repeat check of patient identification against component label/documentation
- Inspect component unit/check expiry date
- Set rate of transfusion according to instructions
- Complete all documentation

Essentials of delivery to clinical area

- Component labelling must match patient identifiers
- Record removal of unit from storage location
- Deliver to appropriate person in clinical area
- Maintain correct storage conditions until transfusion

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EU Optimal Blood Project

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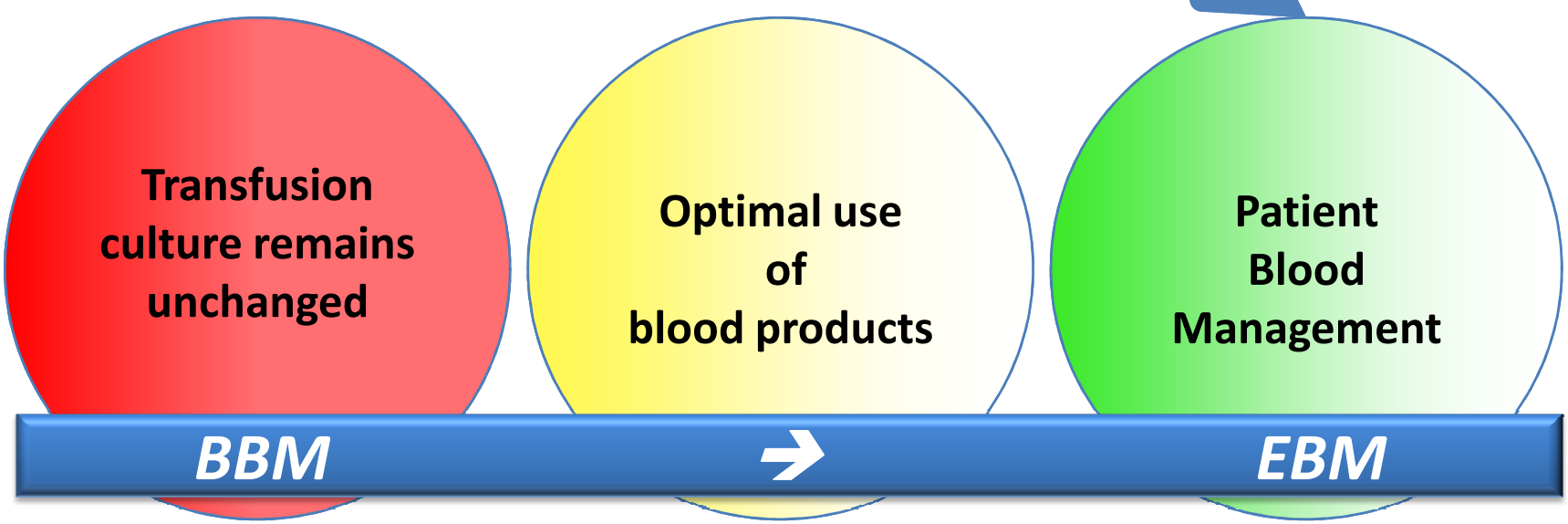
RBC Transfusions in Austria

- **5th highest RBC utilization per capita**
- **Extreme inter-center transfusion variability for matched pa**

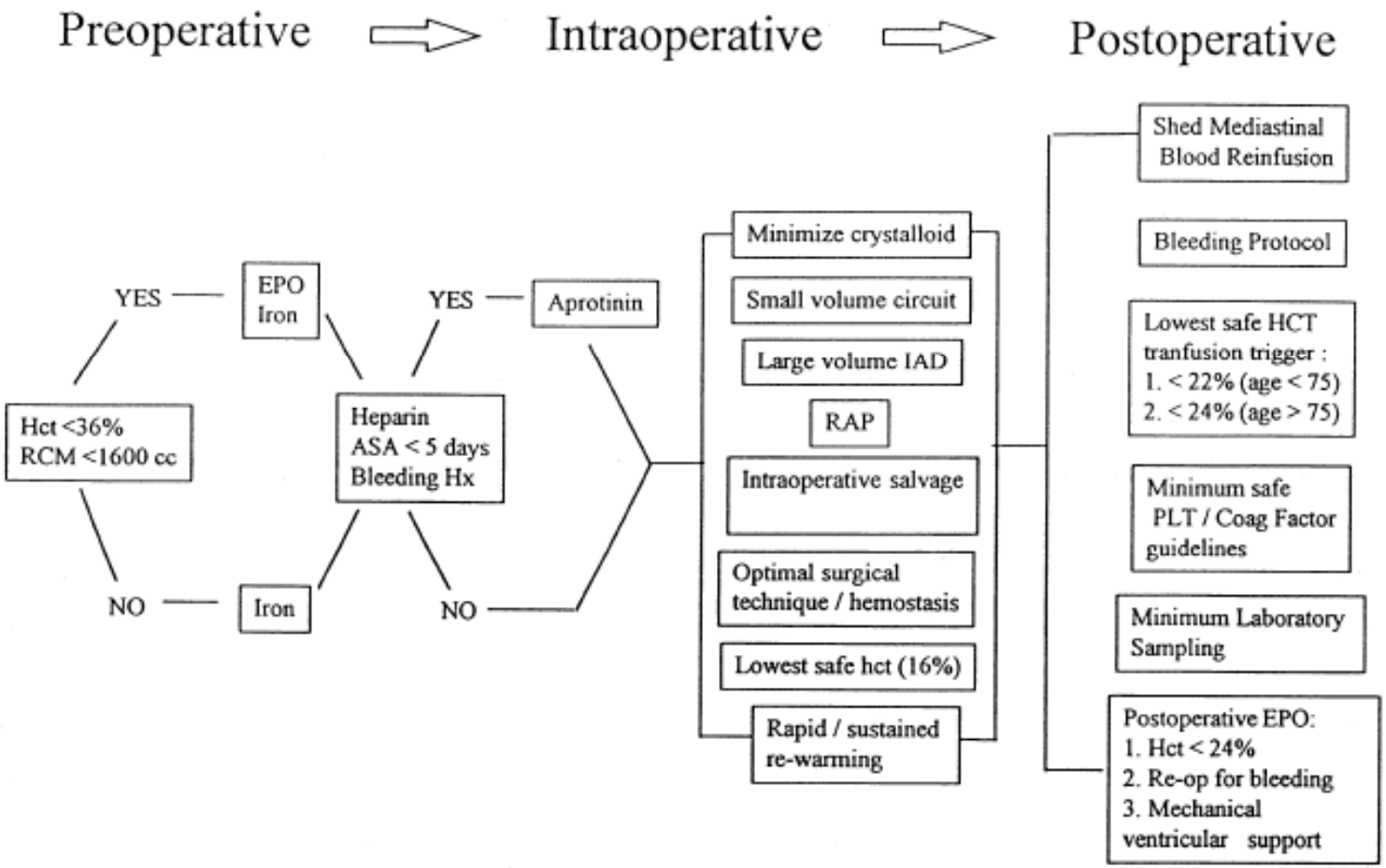
Potential consequences?



What is patient blood management?

- PBM views a patient‘s own blood as a valuable and unique natural resource that should be conserved and managed appropriately.
- PBM employs a patient-specific **perioperative multi-disciplinary, multimodal team approach** to optimising, conserving and managing patients own blood.
- PBM aims to identify patients at risk of anemia and provide a managed plan aimed at **reducing or eliminating the need for allogeneic transfusion with an acceptable risk of anemia.**

Comprehensive Multimodality Blood Conservation: 100 Consecutive CABG Operations Without Transfusion



Helm et al: Ann Thorac Surgery 98: 65, 125-136

Predictors of RBC transfusions

Procedure	THR	TKR	CABG
Independent Variable	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)
Hemoglobin preop.(%)*	0.65 (0.60;0.70)	0.68 (0.63;0.73)	0.69 (0.63;0.75)
Min. hemoglobin postop.(%)*	1.50 (1.38;1.64)	1.48 (1.35;1.63)	1.52 (1.36;1.70)
Lost RBGvolume (%) **	1.82 (1.64;2.01)	1.81 (1.62;2.02)	1.81 (1.58;2.07)
Center rank‡	1.34 (1.24;1.46)	1.35 (1.25;1.46)	-
Correctly classified (%)	97.4%	97.2%	97.0%

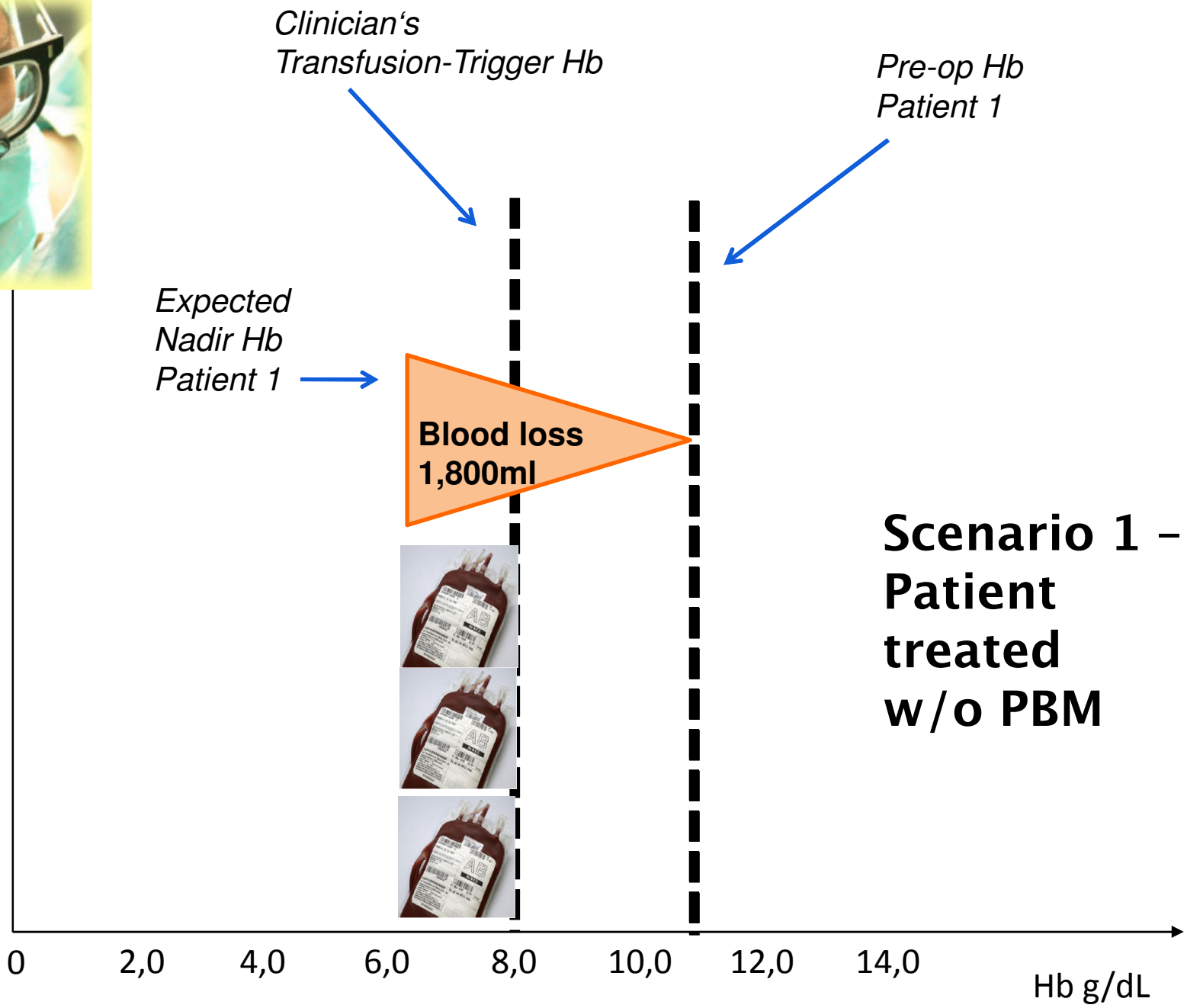
* Percentage of WHO cut-off values

** Percentage of the preoperatively circulating RBC volume

‡ Centers ranked according to the mean perioperative RBC loss

Principle of PBM

	1st Pillar Optimize erythropoiesis	2nd Pillar Minimize blood loss & bleeding	3rd Pillar Harness & optimize physiological reserve of anaemia
Preoperative	• Detect anemia • Identify underlying disorder(s) causing anemia • Manage disorder(s) • Refer for further evaluation if necessary • Treat suboptimal iron stores/iron deficiency/anemia of chronic disease/iron-restricted erythropoiesis • Treat other hematinic deficiencies • Note: Anemia is a contraindication for elective surgery	• Identify and manage bleeding risk • Minimising iatrogenic blood loss • Procedure planning and rehearsal • Preoperative autologous blood donation (in selected cases or when patient choice) • Other	• Assess/optimize patient's physiological reserve and risk factors • Compare estimated blood loss with patient-specific tolerable blood loss • Formulate patient-specific management plan using appropriate blood conservation modalities to minimize blood loss, optimize red cell mass and manage anemia • Restrictive transfusion thresholds
Intraoperative	• Timing surgery with hematological optimization	• Meticulous hemostasis and surgical techniques • Blood-sparing surgical techniques • Anesthetic blood conserving strategies • Autologous blood options • Pharmacological/hemostatic agents	• Optimize cardiac output • Optimize ventilation and oxygenation • Restrictive transfusion thresholds
Postoperative	• Stimulate erythropoiesis • Be aware of drug interactions that can increase anemia	• Vigilant monitoring and management of post-operative bleeding • Avoid secondary hemorrhage • Rapid warming / maintain normothermia (unless hypothermia specifically indicated) • Autologous blood salvage • Minimizing iatrogenic blood loss • Hemostasis/anticoagulation management • Prophylaxis of upper GI hemorrhage • Avoid/treat infections promptly • Be aware of adverse effects of medication	• Optimize anemia reserve • Maximize oxygen delivery • Minimize oxygen consumption • Avoid/treat infections promptly • Restrictive transfusion thresholds



Scenario 1 – Patient treated w/o PBM

Clinician's Transfusion-Trigger Hb

Pre-op Hb Patient 1

Expected Nadir Hb Patient 1

1st Pillar

Optimise haemo-poiesis

- Fe
- B_{12}
- Folic Acid
- ESAs

Blood loss 1,800ml

Scenario 2 – Patient treated w/ PBM

0 | 2,0 | 4,0 | 6,0 | 8,0 | 10,0 | 12,0 | 14,0

Hb g/dL

2nd Pillar

Minimise blood loss & bleeding

Clinician's Transfusion-Trigger Hb

Pre-op Hb Patient 1

Expected Nadir Hb Patient 1

Bloo 1,800

Blood loss 1,000ml

- Meticulous surgical hemostasis,
- Topical hemostatic agents
- Systemic hemostatic agents
- Anesthesiological techniques
- Normothermia
- Induced hypotension
- etc.

Scenario 2 – Patient treated w/ PBM

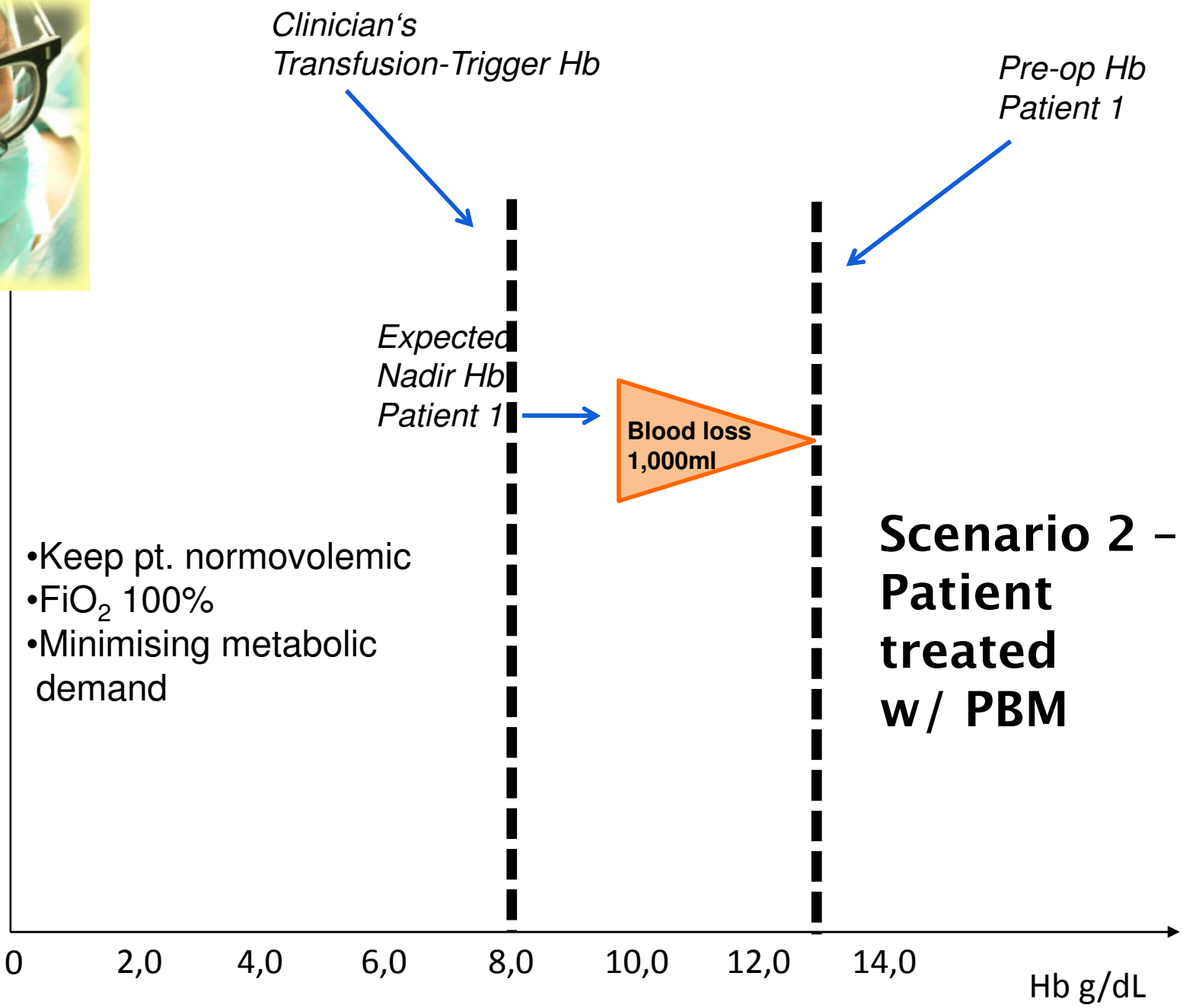
0 2,0 4,0 6,0 8,0 10,0 12,0 14,0

Hb g/dL

3rd Pillar

Harness & optimise physio-logical tolerance of anaemia

- Keep pt. normovolemic
- FiO_2 100%
- Minimising metabolic demand



Scenario 2 – Patient treated w/ PBM

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Anesthesiology:
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Editorial Views

Patient Blood Management: The Pragmatic Solution for the Problems with Blood Transfusions

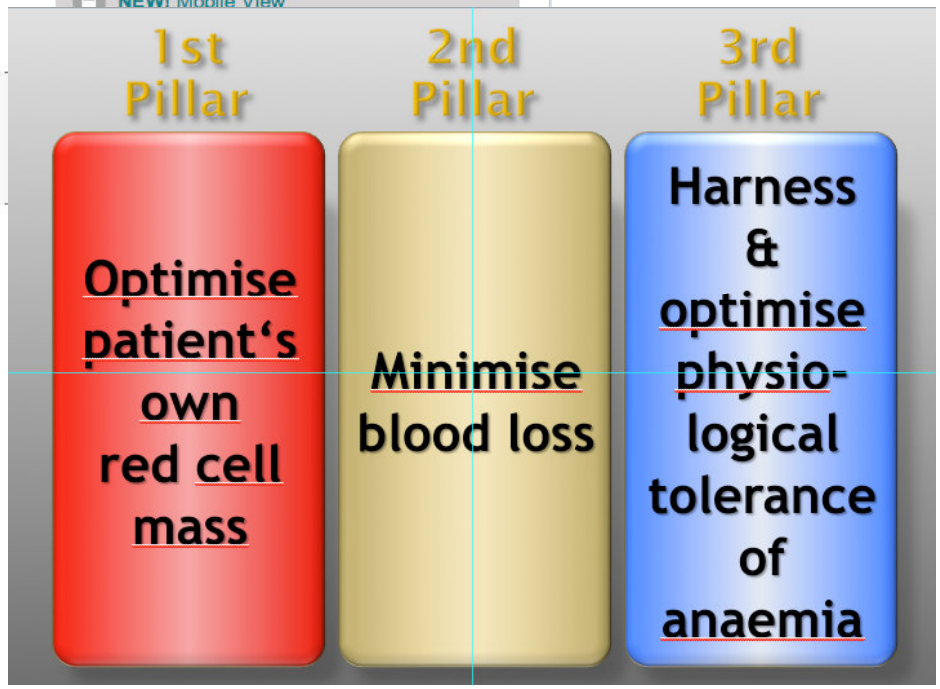
Spahn, Donat R. M.D., F.R.C.A.; Moch, Holger M.D.; Hofmann, Axel M.E.; Isbister, James P. M.B., F.R.A.C.P.

EDITORIALS

New Blood, Old Blood, or No Blood?

John W. Adamson, M.D.

Patient blood management



Adamson J.W. New Engl J Med (2008) 358: 1225

Patient blood management is key before elective surgery

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See Online/Articles
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Writing in *The Lancet*, Khaled Musallam and colleagues address an important topic through their analysis of the American College of Surgeons' National Surgical Quality Improvement Program database;[1] namely, what is the prevalence of preoperative anaemia in patients undergoing major non-cardiac surgery and what are the implications? Moreover, by removal of data for allogeneic red-blood-cell transfusions in their analysis (and thus in the absence of treatment for anaemia) the independent and natural course of preoperative anaemia is shown. The main finding of their study[1] was that preoperative anaemia—even to a mild degree—was significantly and independently associated with increased postoperative morbidity and mortality. This association might be aggravated by concomitant perisurgical blood loss[2] and (frequently unnecessary) allogeneic transfusions.[3] I believe that Musallam and colleagues' findings could have an enormous effect on health-care systems worldwide because preoperative diagnosis and treatment of anaemia (apart from transfusions of red blood cells) has almost never been undertaken routinely before surgery.[3]

Anaemia is a serious but easily treatable condition. Treatment is less costly than is transfusion and would possibly improve outcomes, not only by increased tolerance of perioperative blood loss and avoidance of allogeneic transfusions but also through elimination of the risk of anaemia by maintaining increased physiological haemoglobin values throughout the perioperative period.[4]

Because of the nature of Musallam and colleagues' retrospective observational study,[1] the cause of anaemia was not assessed. However, about a third of patients with anaemia probably would have had nutritional deficiencies, a third probably would have had chronic disease, and a third would have had anaemia from an unknown cause.[5] Moreover, diagnostic and interventional blood loss might have had an additional role in the rates of anaemia reported.

Because of the prevalence, treatability, and negative outcomes of preoperative anaemia, preservation and improvement of preoperative red-blood-cell mass is essential as one of the three pillars of the new patient blood management strategy,[6] which lasts for the entire perioperative period and has a patient-specific perioperative multidisciplinary and multifaceted team approach. Implementation of the patient blood management strategy not only reduces transfusion requirements but also improves postoperative outcome, at least in patients undergoing orthopaedic and cardiac surgery.[7,8]

However, some drawbacks of preoperative anaemia treatment need to be considered. Diagnosis and treatment of preoperative anaemia is time consuming and therefore detection and assessment of anaemia should be undertaken close to 28 days before a scheduled surgery to enable adequate treatment.[9] Furthermore, in case of unexplained anaemia a planned surgery with substantial predicted blood loss should be rescheduled.[9] In some populations of patients, treatment with iron or erythropoiesis-stimulating drugs might be ineffective, have serious side-effects, and therefore not be indicated.[10,11] Moreover, at least in patients with chronic disease, anaemia might be regarded as an adaptive mechanism. For such patients, treatment of mild-to-moderate anaemia with iron or erythropoiesis-stimulating drugs might increase mortality despite an improvement in functional capacity and wellbeing.[12]

Nonetheless, Musallam and colleagues' study[1] strongly suggests that implementation of treatment of anaemia as part of a universal patient blood management strategy should become standard of care in patients undergoing elective surgical procedures, particularly in those where substantial blood loss is expected. However, additional studies are urgently needed to secure the efficacy and safety of preoperative treatment of anaemia.

Hasan Jamali/AP/Press Association Images

Gombotz H: www.thelancet.com
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Invited comment

Patient Blood Management (Teil 1)

Individuelles Behandlungskonzept zur Reduktion und Vermeidung von Anämie, Blutverlust und -transfusionen

Der Beitrag ist im Rahmen der 2. Österreichischen Benchmarkstudie entstanden, die vom Fonds der Bundesgesundheitsagentur finanziert wurde.

Hans Gombotz • Axel Hofmann • Peter Rehak • Johann Kurz

Bluttransfusionen gehören heute zu den teuersten Behandlungsformen und sind zudem mit Komplikationen verbunden. „Patient Blood Management" ist ein multidisziplinäres, evidenzbasiertes Behandlungsmodell, mit dessen Hilfe das patienteneigene Blutvolumen optimal behandelt und damit Transfusionen deutlich reduziert werden können. Der ersten Teil des Beitrags geht auf die aktuelle Situation, die Abschätzung des Transfusionsbedarfs sowie die Bereitsstellungspraxis von Blutprodukten ein.

Bluttransfusion unter Kritik Obwohl von Blutspendeorganisationen immer wieder als lebensrettende Maßnahme propagiert, ist die Behandlung mit allogenen Blutderivaten, insbesondere mit Erythrozytenkonzentraten, zunehmend unter Kritik geraten. In zahlreichen meist retrospektiven Untersuchungen zeigte sich nämlich in praktisch allen klinischen Bereichen ein deutlicher Zusammenhang zwischen Transfusion von Blutprodukten und Komplikationen wie z.B.

- erhöhte Infarkt- und Infektionsrate,
- tranfusionsassoziierte Volumenüberladung (TACO) oder
- Lungenversagen (TRALI)

– verbunden mit längerem Intensiv- und Spitalaufenthalt sowie einer erhöhten Mortalität.

Risiken abwägen Auch konnten bisher angenommene Vorteile einer Bluttransfusion in Studien kaum nachgewiesen werden [1–4]. Dazu kommen noch logistische Komplikationen wie Verwechslungen oder Fehlbestimmungen, aber auch die mittlerweile selten gewordene Übertragung von Krankheitserregern [5].

- Diese Probleme der Fremdbluttransfusion sind dem Risiko einer vorbestehenden oder neu auftretenden Anämie und dem Risiko eines Blutverlustes gegenüberzustellen [6–8].

> Die nichtindizierte Bluttransfusion ist mit erhöhter Infarkt- und Infektionsrate, tranfusionsassoziierter Volumenüberladung (TACO) oder tranfusionsassoziiertem Lungenversagen (TRALI) sowie einer erhöhten Letalität verbunden.

Engpässe zu erwarten Geht man in Mitteleuropa vom derzeitigen Verbrauch an Erythrozytenkonzentraten aus, werden durch Verringerung des Blutspendeaufkommens und durch fortschreitende Überalterung der Bevölkerung künftig vermehrt Engpässe in der Fremdblutversorgung prognostiziert [9, 10]. Derzeit erhalten Patienten

- zwischen 0–19 Lebensjahren 5,7 und
- über 80 Jahre etwa 239,8 Erythrozytenkonzentrate pro 1000 Einwohner und Jahr.

Demnach verbrauchen über 65-Jährige etwa 62% aller verfügbaren Erythrozytenkonzentrate [11].

Hoher Kostenanteil Die Nichteinhaltung existierender Richtlinien stellt neben dem erhöhten Gesundheitsrisiko für die Patienten eine zusätzliche Belastung für das ohnehin angespannte Gesundheitsbudget dar [12–15].

- Immerhin machen die Kosten für Blutprodukte einschließlich Testung und Bereitstellung etwa 20% des pharmazeutischen Budgets allgemeiner Krankenhäuser aus (Berechnung am Allgemeinen Krankenhaus Linz).

Prozesskostenanalysen zeigten außerdem, dass die Behandlung mit Blutprodukten zu den teuersten Therapieformen zählt [16, 17].

- Werden alle transfusionsbezogenen Kosten einschließlich der kurz-, mittel- und langfristigen Komplikationen summiert, betragen diese bis zu 5% des Gesundheitsbudgets hochentwickelter Länder [18].

> Die Behandlung mit Blutprodukten zählt heute zu den teuersten Therapieformen und macht bis zu 20% des Medikamentenbudgets der Krankenhäuser aus.

Das Modell „Patient Blood Management"

Multidisziplinär „Patient Blood Management (PBM)" ist ein multidisziplinäres, evidenzbasiertes Behandlungsmodell, das zum Ziel hat, durch

Patient Blood Management (Teil 2)

Praktisches Vorgehen: die 3 Säulen

Der Beitrag ist im Rahmen der 2. Österreichischen Benchmarkstudie entstanden, die vom Fonds der Bundesgesundheitsagentur finanziert wurde.

Hans Gombotz • Axel Hofmann • Peter Rehak • Johann Kurz

„Patient Blood Management" ist ein multidisziplinäres, evidenzbasiertes Behandlungskonzept mit dem Ziel, das patienteneigene Blutvolumen zu optimieren und damit Transfusionen zu reduzieren. Nach der allgemeinen Vorstellung des Konzepts in Teil 1 des Beitrags [1] gehen die Autoren nun detailliert auf das praktische Vorgehen ein: die Optimierung des Erythrozytenvolumens, die Minimierung des Blutverlustes sowie die Ausschöpfung und Erhöhung der individuellen Anämietoleranz.

Große Unterschiede Benchmarkuntersuchungen bei Standardoperationen weisen auf eine hohe Variabilität im Transfusionsaufkommen mit erheblichem Mehrverbrauch und damit deutlichem Einsparungspotenzial hin [2, 3]. In der elektiven Chirurgie können 90% aller perioperativen Transfusionen mit 3 Parametern vorhergesagt werden:

- Ausgangshämoglobinwert,
- Blutverlust und
- minimal akzeptabler Hämoglobinwert [2].

Demnach beruht das „Patient Blood Management (PBM)"-Konzept auf 3 Säulen:

1. Optimierung des (präoperativen) Erythrozytenvolumens
2. Minimierung des diagnostischen, interventionellen und operativen Blutverlustes
3. Ausnützung der individuellen Anämietoleranz mit strenger Indikationsstellung zur Bluttransfusion [1].

Vorteile für Patient und Klinik Nur eine Kombination aller 3 Säulen einschließlich der Anwendung verschiedener Methoden zur Einsparung von Blutkomponenten führt zu einem optimalen Ergebnis (●Tab. 1).

- Der bestmögliche Einsatz von Blut und Blutkomponenten begünstigt nicht nur den Krankheitsverlauf, sondern entlastet auch deutlich die angespannten Krankenhausbudgets [4, 5].

> Durch das Vermeiden unnötiger Bluttransfusionen gewinnen sowohl die Patienten als auch das Krankenhaus.

1. Säule: Optimierung des Erythrozytenvolumens

Ohne Vorliegen einer präoperativen Anämie

Eisenstatus und Hämoglobinspiegel Reicht das präoperative Erythrozytenvolumen bei nicht anämischen Patienten (z.B. bei Transfusionsverweigerung) für eine transfusionsfreie Behandlung nicht aus, können der Eisenstatus optimiert und unter Berücksichtigung aller Kontraindikationen der Hämoglobinspiegel mit Erythropoetin (EPO) angehoben werden [6].

Präoperative Eisentherapie Zur Feststellung eines (latenten) Eisenmangels sollten bei allen Patienten mit erhöhtem Blutungs- und/oder Transfusionsrisiko spätestens 4 Wochen vor der Operation folgende Werte bestimmt werden:

- Eisenstatus (Serumeisen, Ferritin, Ferritin-Index, Transferrinsättigung),
- C-reaktives Protein (CRP) und
- bei Patienten über 60 Jahre auch Vitamin B12 und Folsäure (●Tab. 2) [7].

Modernere Untersuchungen umfassen

- EPO-Spiegel,
- Retikulozytenhämoglobin,
- Prozentsatz hypochromer Erythrozyten,
- löslicher Transferrinrezeptor und
- Hepcidin [8].

Eisenmangel Ein Eisenmangel kann angenommen werden bei

- einem Ferritinspiegel <100 µg/l oder 100–300 µg/l mit Transferrinsättigung <20%.

Ebenso kann von Eisenmangel ausgegangen werden bei

- einem löslichen Transferrin-Rezeptor (Modular P®, Soluble Transferrin Receptor 2158315, Roche Diagnostics)
  - für Frauen >4,4
  - für Männer >5,5 oder
- einem Ferritinindex >3,2 (CRP <5) sowie
- einem Ferritinindex >2,0 (CRP ≥5) [9].

Sonderdruck für private Zwecke des Autors

Patient Blood Management

A 68-Year-Old Woman Contemplating Autologous Blood Donation Before Elective Surgery

Lynne Uhl, MD, Discussant

Globally, more than 81 million units of red blood cells are transfused annually. Of the 15 million red blood cell components transfused annually in the United States, approximately 40% are transfused to patients undergoing elective surgical procedures. Because of concerns about limited blood availability as well as risks of transfusion-related adverse events, blood products should be used judiciously. Using the case of Ms C, a 68-year-old woman considering autologous blood donation prior to knee replacement surgery, the concept of patient blood management is discussed. This approach entails a complete evaluation of the patient in the preoperative period to assess for bleeding risks and anemia, with a goal to optimize a patient's condition prior to surgery; use of various strategies in the operative period to mitigate the need for allogeneic blood transfusion; and meticulous postoperative care to again avoid the need for blood transfusion.

JAMA. 2011;306(17):1902-1910 www.jama.com

DR TESS: Ms C is a 68-year-old woman who presented with progressive right knee pain and swelling. She first developed pain and swelling in her right knee in 2003 and was diagnosed as having osteoarthritis. She underwent arthroscopy and bursectomy in 2006, but in the last few years, she has experienced worsening of her pain as well as significant physical limitations. Joint injections with steroids have resulted in little improvement, and now she is planning to undergo knee replacement surgery in 8 weeks.

Ms C's medical history includes osteoarthritis, hypertension, hyperthyroidism, hypercholesterolemia, and uterine fibroids in addition to the arthroscopy in 2006. Her medications include hydrochlorothiazide, levothyroxine, simvastatin, and aspirin. She has no known drug allergies.

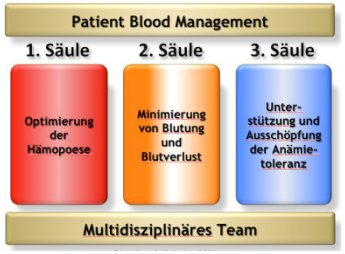
On examination, Ms C is a healthy-appearing woman with normal vital signs. Her physical examination results were normal except for pain on palpation of her medial right knee, an antalgic gait, and difficulty with toe and heel walking due to pain. A routine complete blood cell count revealed a white blood cell count of 7900/μL, hemoglobin level of 15.1 g/dL,

World Health Organization

Sixty-third World Health Assembly

Date: 17–21 May 2010
Location: Geneva, Switzerland

The Sixty-third session of the World Health Assembly took place in Geneva during 17–21 May 2010. At this session, the Health Assembly discussed a number of public health issues, including:



WHA63.12 adopted by resolution May 21, 2010:

„Bearing in mind that **patient blood management means** that before surgery every reasonable measure should be taken to **optimize the patient's own blood volume, to minimize the patient's blood loss and to harness and optimize the patient-specific physiological tolerance of anaemia** following WHO's guide for optimal clinical use **(three pillars of patient blood management)**"

United States

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The Daily Journal of the United States Government

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Notice

Meeting of the Advisory Committee on Blood Safety and Availability

A Notice by the Health and Human Services Department on 05/06/2011

On June 8, 2011, the Committee will be asked to review and comment on WHA 63.12 regarding the availability, safety and quality of blood products. *http://apps.who.int/gb/ebwha/pdf_files/WHA63/A63_R12-en.pdf* Specifically the Committee will be asked to review the current status of safe and rational use of blood products in patient blood management and assess the current status in the U.S.

Australia

National Blood Authority Australia

About Us | Blood Sector Policy | Ensuring Supply | Blood Sector Risk Management | Appropriate Blood Use | Blood Sector Data | Factsheets

- Patient Blood Management Guidelines Development
- Progress Updates
- Public Consultation

PATIENT BLOOD MANAGEMENT GUIDELINE DEVELOPMENT

The review of the 2001 NHMRC/ASBT Clinical Practice Guidelines for the Use of Blood Components is being undertaken with funding and project management provided by the National Blood Authority (NBA) on behalf of all governments. The NBA has facilitated the formulation of a Steering Committee, Expert Working Group, and Clinical/Consumer Reference Groups.

ent.

NHMRC Guidelines Development:

Module 1 - Critical Bleeding/Massive Transfusion
Module 2 - Peri operative
Module 3 – Medical
Module 4 - Intensive Care
Module 5 – Obstetric
Module 6 - Paediatric/Neonates

http://www.nba.gov.au/guidelines/review.html

Frankfurter Allgemeine
ZEITUNG FÜR DEUTSCHLAND

09.11.2011, F.A.Z., Natur und Wissenschaft (Natur und Wissenschaft), Seite N1 - Ausgabe D1, D1N, D2, D3, R - 1101 Wörter

Tut etwas Blut immer gut?

Ärzte kritisieren den verschwenderischen Umgang mit Blutkonserven, die längst nicht nur für Notfallpatienten verwendet werden. Dabei ist die Übertragung nicht ohne Risiko.

Von Nicola von Lutterotti

Blutkonserven werden weithin zu bedenkenlos eingesetzt. In welchem Ausmaß dies geschieht, lässt sich aufgrund des Mangels an einschlägigen Daten zwar nicht genau benennen. Etlichen Beobachtungen zufolge dürfte der verschwenderische Umgang mit dem roten Lebenssaft gleichwohl erheblich sein. So gibt es beispielsweise von einem Krankenhaus zum nächsten extreme Schwankungen, was den Verbrauch von Fremdblut anbelangt - ohne erkennbaren medizinischen Grund. Diese Ungereimtheiten haben österreichische Ärzte um den Anästhesisten Hans Gombotz vom Allgemeinen Krankenhaus in Linz in vielzitierten Erhebungen wiederholt angeprangert.

In Deutschland ist die Situation keineswegs anders, wie Bernhard Zwißler von der Klinik für Anästhesiologie der Ludwig-Maximilians-Universität München betont. Das hätten eigene Untersuchungen ergeben. Für einen zu sorglosen Verbrauch von Blutkonserven spricht ferner, dass diese - anders als man vermuten möchte - nicht vorwiegend zur Akutversorgung von Unfallopfern und anderen Notfällen dienen. Ein beträchtlicher Anteil entfällt vielmehr auf die Behandlung von Personen, die sich einem geplanten Eingriff unterziehen. Von diesen benötigen viele aber nur deshalb eine Zufuhr von Frischblut, weil sie bereits vor der Operation blutarm waren und eingriffsbedingte Blutverluste daher schlechter tolerieren. So leidet rund ein Drittel aller Personen, die ein neues Knie oder eine neue Hüfte erhalten, schon vor dem Eingriff an teilweise ausgeprägter Blutarmut, einer Anämie. In anderen Bereichen der Chirurgie soll der entsprechende Anteil noch weitaus höher liegen ("Anästhesiologie-Intensivmedizin-Notfallmedizin-Schmerztherapie", Bd. 46, S. 466).

Rationale for PBM

- Blood supply issues
- Cost of blood
- Transfusion practice variability
- Transfusion safety and effectiveness

Rationale for PBM

- **Blood supply issues**
- Cost of blood
- Transfusion practice variability
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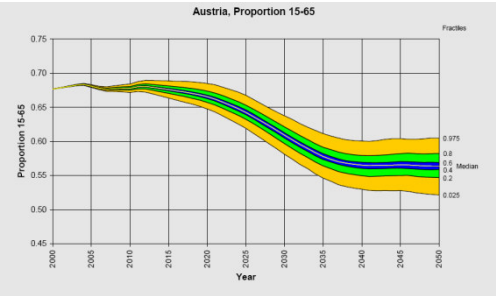
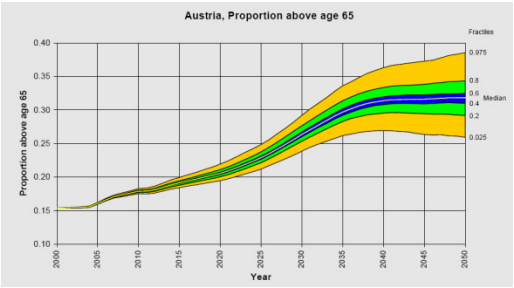
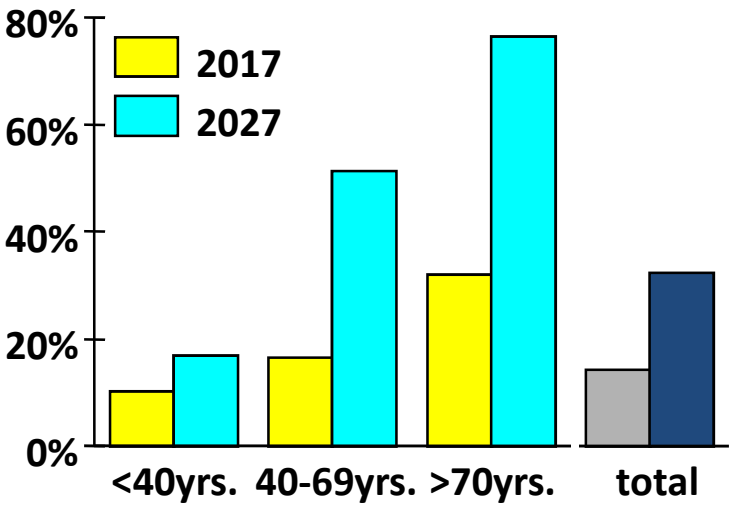
Blood supply issues

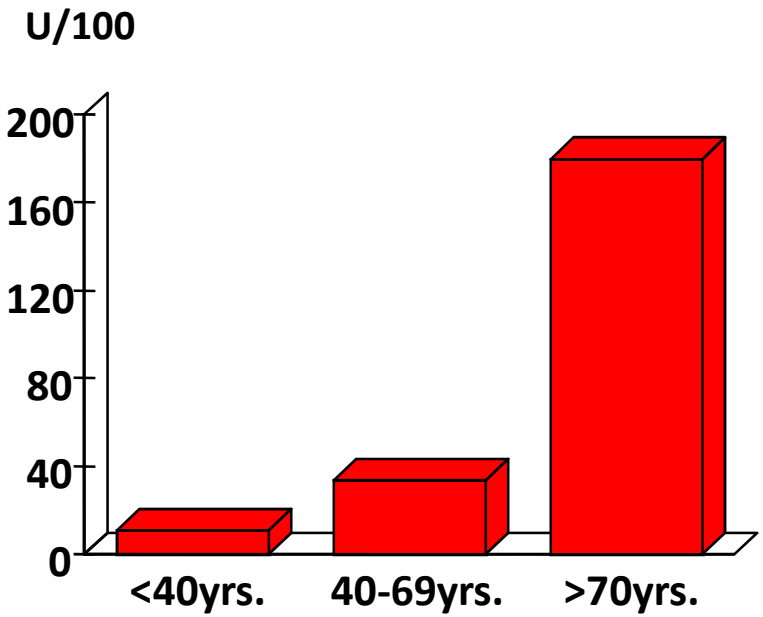


Red cell transfusion and age of population





% pts. and age



Units transfused/1000 inhabitants

Source: Compiled from WA Tomorrow

Impact of the Ageing Population on Blood Demand

584 TRANSFUSION Volume 50, March 2010

BLOOD DONORS AND BLOOD COLLECTION

ALI ET AL.

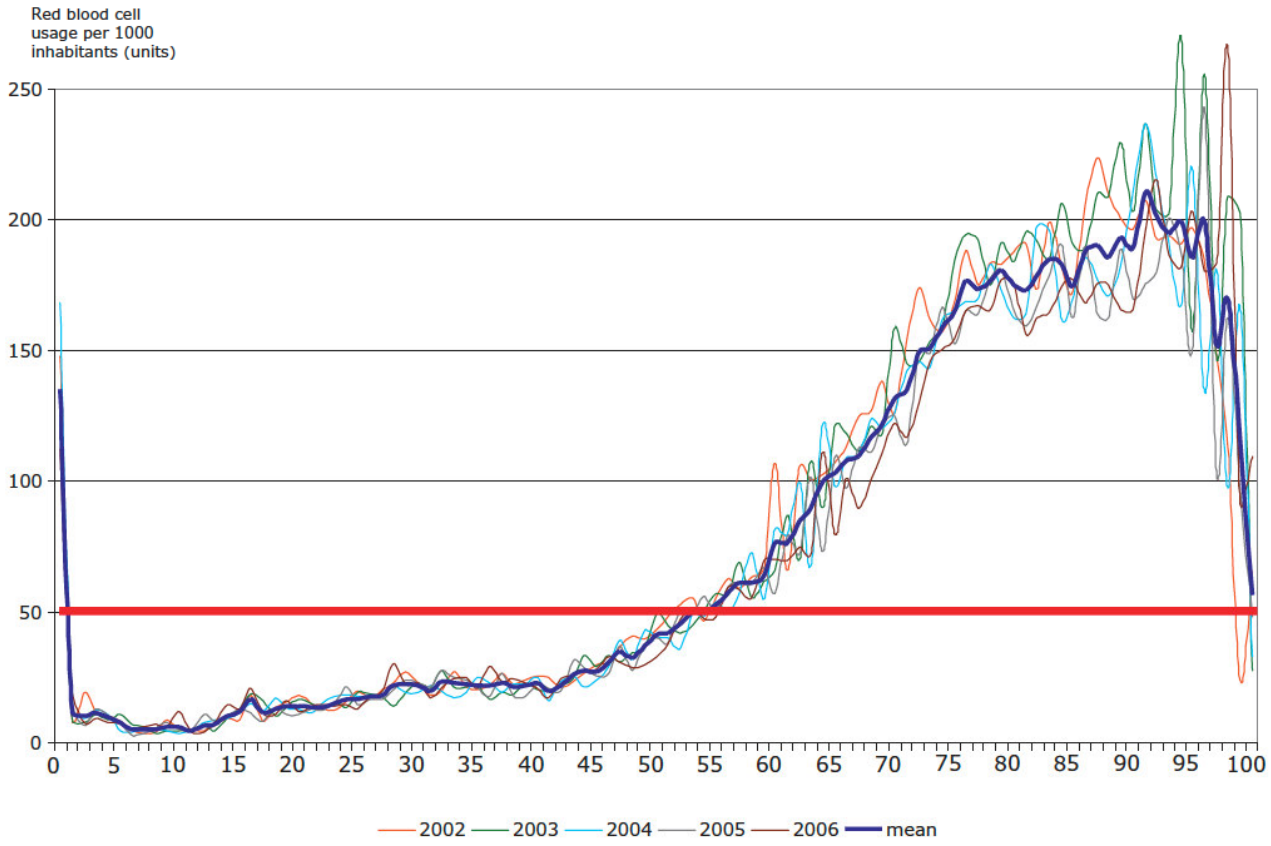


Fig. 2. RBC usage per capita by age in Finland 2002 to 2006. Current annual RBC usage in Finland is 50 units per 1000 inhabitants.

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Rationale for PBM

- Blood supply issues
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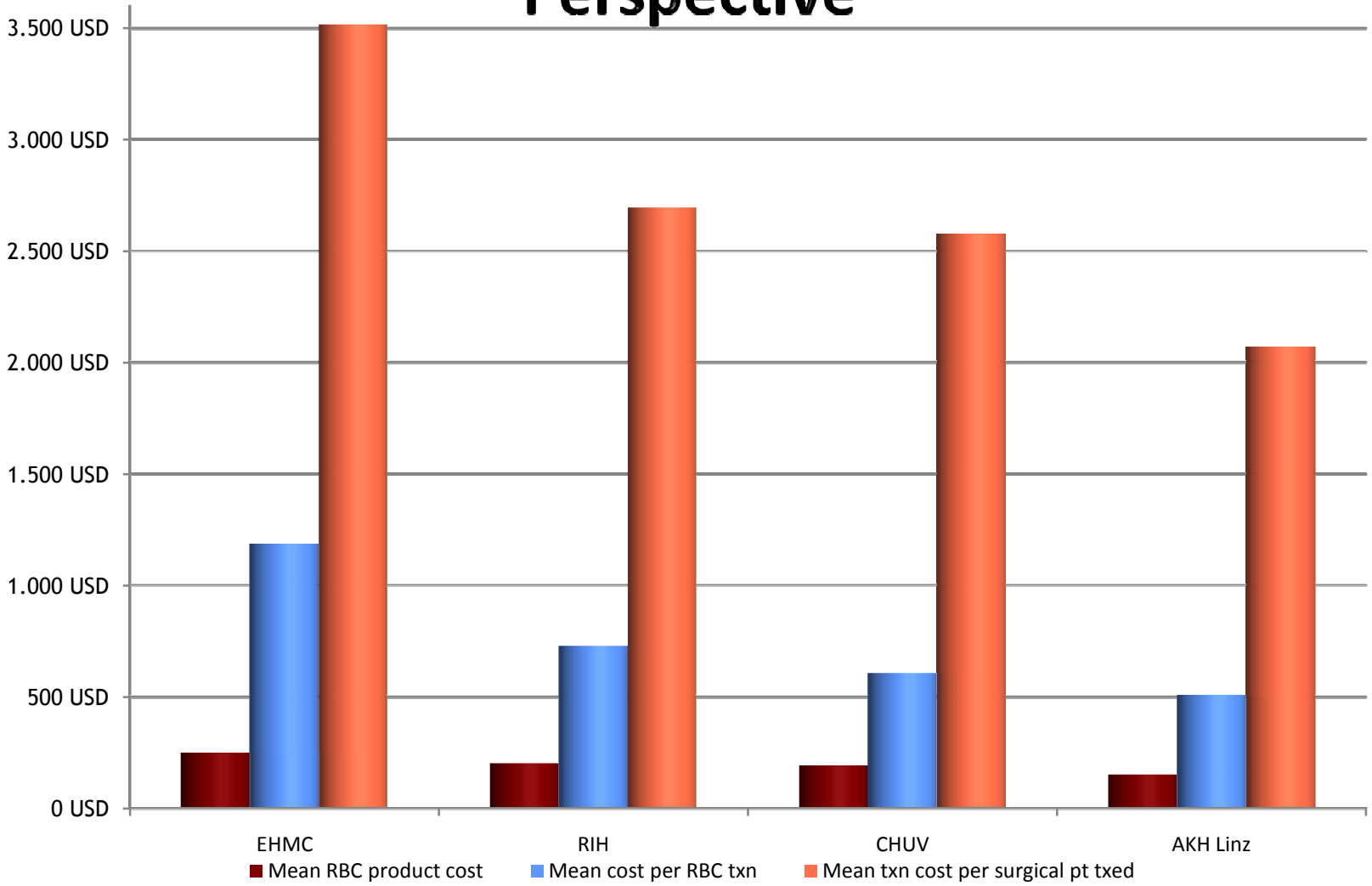
Activity Based Cost of Transfusion from a Provider's Perspective



Shander A, Hofmann A, Ozawa S, Theusinger O, Gombotz H, Spahn D.
Activity-Based Costs of Blood Transfusions in Surgical Patients at Four Hospitals. Transfusion Vol. 50, April 2010

The cost of blood transfusion inWestern Europe as estimated from six studies

TABLE 2. Costs per 2 units of transfused blood In Europe according to the studies

Authors	Country	Year of data	Cost provided by the study	Converted EUR*	2011 EUR†	Population in 2011‡	Coefficient	Weighted cost
Agrawal et al. (2006)[11]	United Kingdom	2004	£546.12	€804.86	€969.73	62,435,709	0.2179	€211.35
Glenngard et al. (2005)[14]	Sweden	2003	€702.00	€702.00	€784.05	9,415,570	0.0329	€25.77
Shander et al. (2010)[15]	Switzerland and Austria	2007	$1,222.88	€893.68	€904.48	7,866,500	0.0275	€24.84
			$1,044.90	€763.61	€817.08	8,404,252	0.0293	€23.97
Van Bellinghen et al. (2003)[16]	France and Austria	2002	€792.00	€792.00	€915.96	65,075,310	0.2272	€208.07
			€722.00	€722.00	€858.39	8,404,252	0.0293	€25.18
Varney and Guest (2003)[12]	United Kingdom	2000-2001	£470.00	€763.22	€972.56	62,435,709	0.2179	€211.97
Hadjianastassiou et al. (2002)[13]	United Kingdom	1998-1999	£351.04	€517.52	€672.38	62,435,709	0.2179	€146.54
Total						286,473,011	1.0000	€877.69

* Exchange rates source: http://www.oanda.com/currency/historical-rates/.
† CPI source: http://www.global-rates.com.
‡ Population source: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tps00001&tableSelection=1&footnotes=yes&labeling=labels&plugin=1.

Ivo Abraham and Diana Sun doi: 10.1111/j.1537-2995.2011.03532.x
TRANSFUSION **;**:**-**.

Cost of transfusion outcome

Frequency and outcomes of blood products transfusion across procedures and clinical conditions warranting inpatient care: an analysis of the 2004 healthcare cost and utilization project nationwide inpatient sample database.

- Retrospective cohort study of all hospitalisations in the US in 2004 (n=38.66 million) to assess in-hospital outcomes associated with blood transfusion.
- 5.8% (2.33 million) transfused
- After adjustment for age, gender, comorbidities, admission type or DRG transfusion associated with:
  - 1.7 increased odds of death (P<0.0001)
  - 1.9 increased odds of infection (P<0.0001)
  - 2.5 days longer LOS
  - $17,194 higher charges (P<0.0001)

→ $40.1 billion more charges for txed pts!

Morton et al: **Am J Med Qual. 2010 Jul-Aug;25(4):289-96. Epub 2010 Jun 7,2010**

Rationale for PBM

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- Transfusion safety and effectiveness

JAMA®

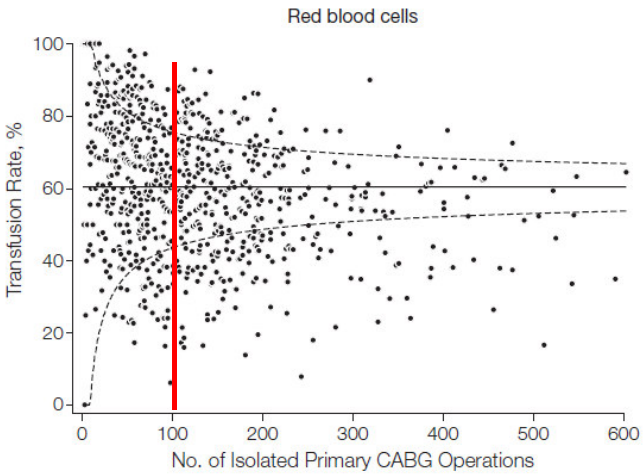
Online article and related content current as of October 16, 2010.

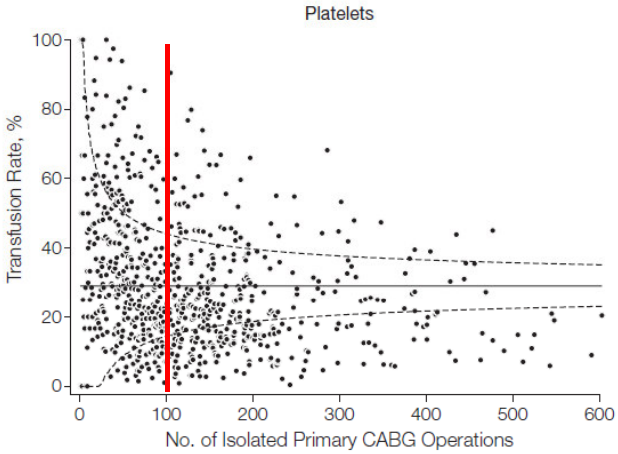
Variation in Use of Blood Transfusion in Coronary Artery Bypass Graft Surgery

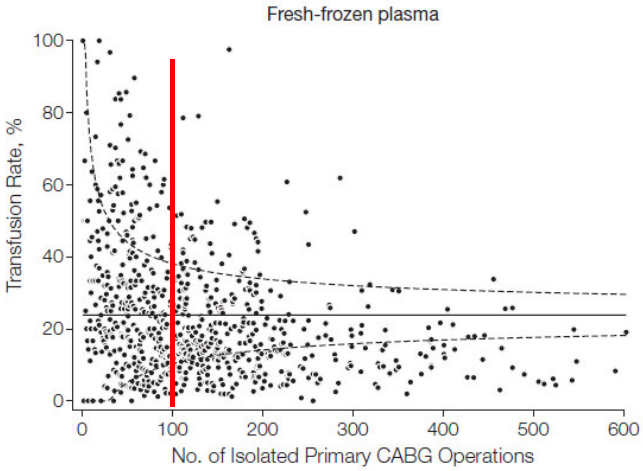
Elliott Bennett-Guerrero; Yue Zhao; Sean M. O'Brien; et al.

JAMA. 2010;304(14):1568-1575 (doi:10.1001/jama.2010.1406)

http://jama.ama-assn.org/cgi/content/full/304/14/1568



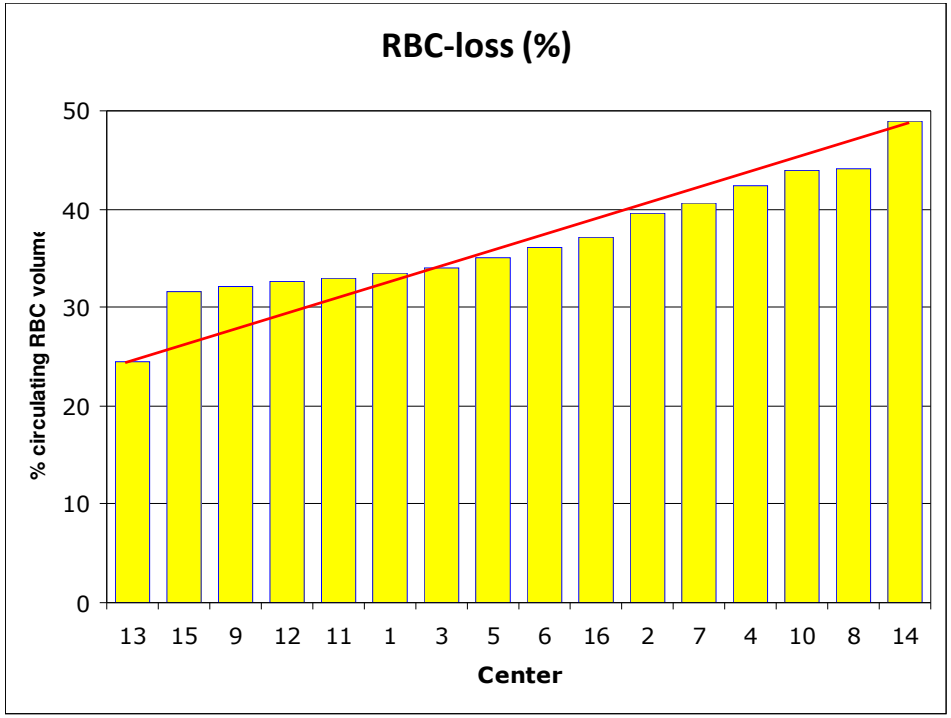


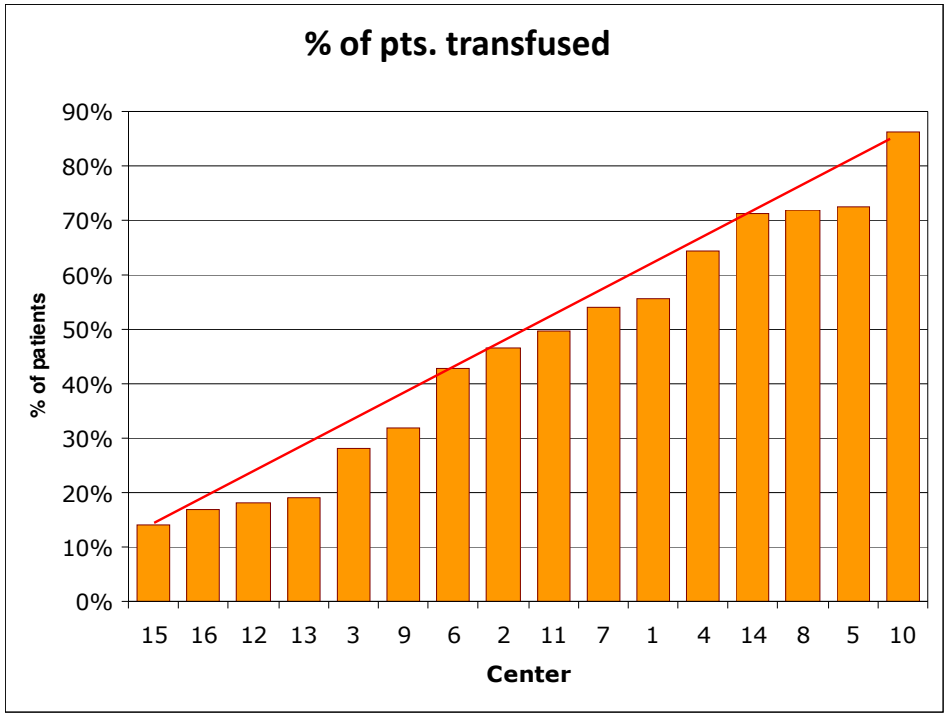


Observed Variation in Hospital-Specific Transfusion Rates for Primary Isolated CABG Surgery With Cardiopulmonary Bypass During 2008 (N=798 Sites)

Measures to optimize the use of blood components in selected surgical procedures in Austrian hospitals

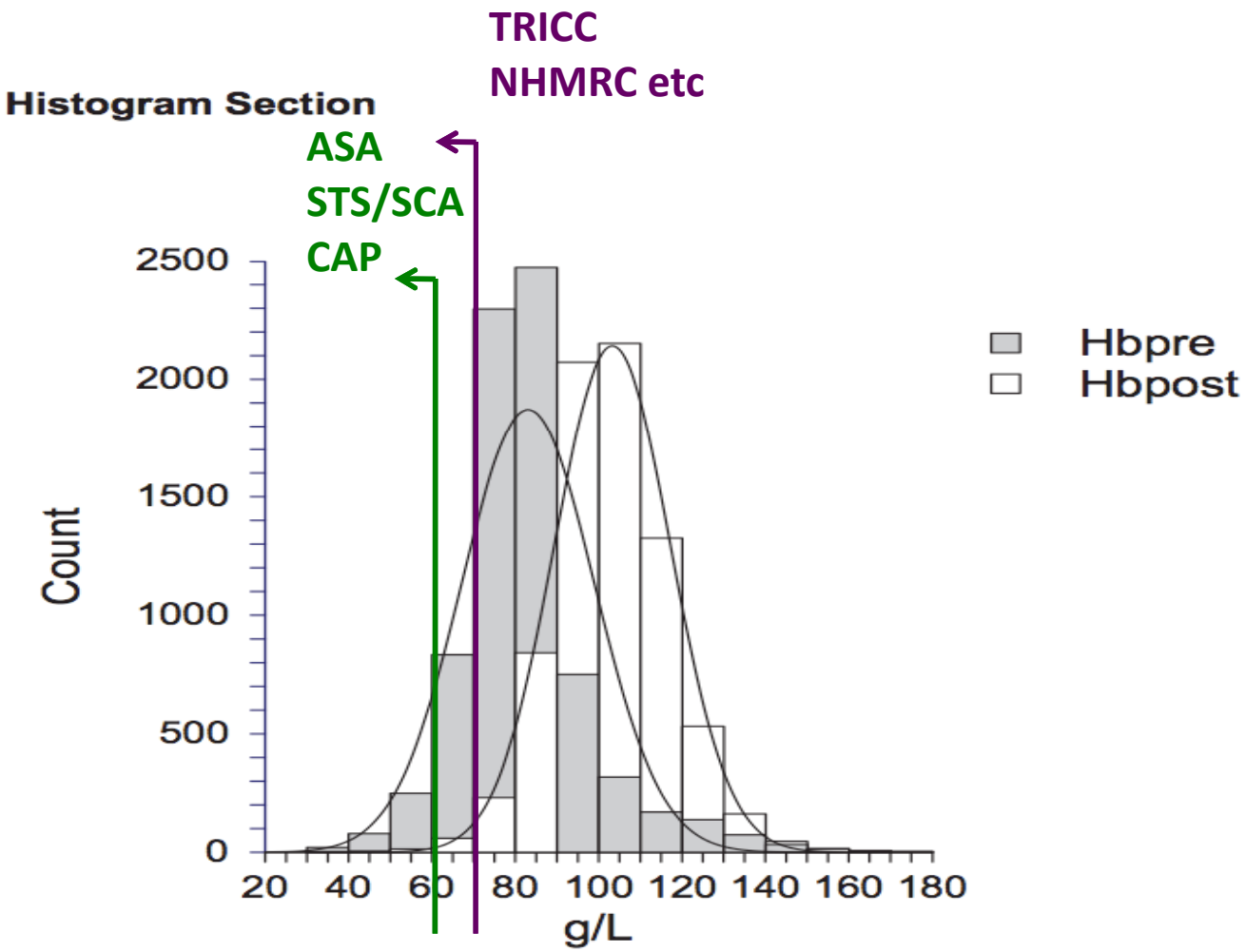
RBC loss (%) and % patients transfused in THR and TKR





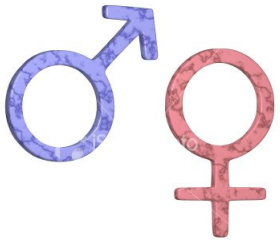
Gombotz et al: TRANSFUSION 2007;47:1468-1480.

Practice against guidelines/literature (WA-Blood Project)

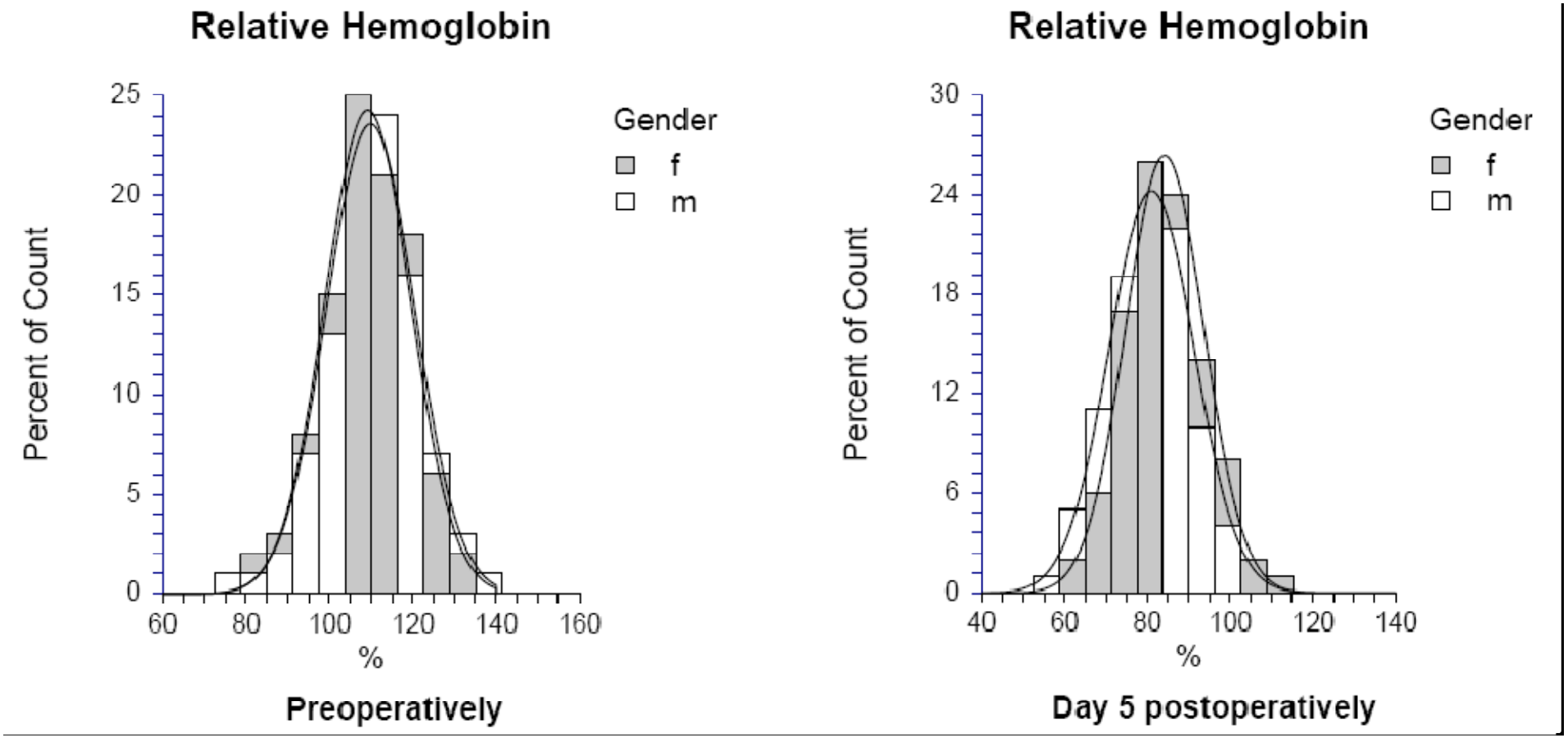


Practice guidelines for perioperative blood transfusion and adjuvant therapies: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Anesthesiology 2006;105:198-208.
Ferraris et al. Perioperative Blood Transfusion and Blood Conservation in Cardiac Surgery: The Society of Thoracic Surgeons and The Society of Cardiovascular Anesthesiologists Clinical Practice Guideline. Ann Thorac Surg 2007;83:S27– 86
Simon TL, Alverson DC, AuBuchon J, et al. Practice parameter for the use of red blood cell transfusions: developed by the Red Blood Cell Administration Practice Guideline Development Task Force of the College of American Pathologists. Arch Pathol Lab Med 1998;122:130-8.
Hebert PC, Wells G, Blajchman MA, et al. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion Requirements in Critical Care Investigators, Canadian Critical Care Trials Group. N Engl J Med 1999;340:409-17.
National Health and Medical Research Council and Australasian Society of Blood Transfusion. Clinical Practice Guidelines on the Use of Blood Components (red blood cells, platelets, fresh frozen plasma, cryoprecipitate).Commonwealth of Australia 2002:34,35

Red cell transfusion and gender



Orthopedic Surgery



Absolute hemoglobin values in females were significantly lower throughout the perioperative course, whereby relative hemoglobin values were nearly identical before surgery but considerably higher on postoperative day 5 ($p<0.001$)

ESA 2008

Rationale for PBM

- Blood supply issues
- Cost of blood
- Transfusion practice variability
- **Transfusion safety and effectiveness**


Source of swine flu discovered!!

Pathogens – Costly Fear

The **AUSTRALIAN RED CROSS discarded 33,600 liters** of donated **blood** as the result of fears that it was contaminated with **dengue** fever following an outbreak of the disease in northern Queensland in late 2009 and 2010, according to a report in the *Sunday Herald Sun*.

That loss ... accounted for about 7% of its overall blood supply.

Ansteckungsweg über das Blut können Bluttransfusionen Alzheimer übertragen?

Alzheimerforscher haben Hinweise darauf gefunden, dass die Demenzerkrankung via Bluttransfusionen übertragen werden könnte. Unklar ist, in welcher Konzentration die mutmaßlichen Erreger ansteckend sein könnten.

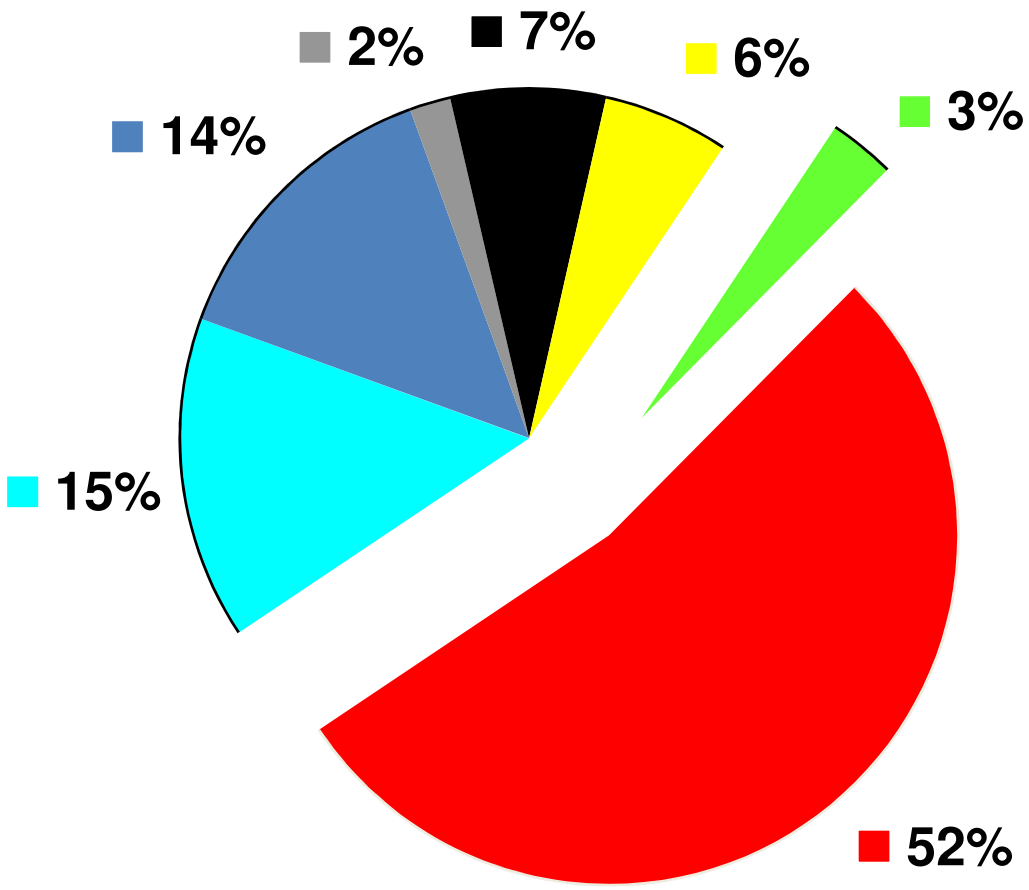
Amerikanischen Neurowissenschaftlern soll es in einem Tierversuch gelungen sein, Alzheimer auf dem Blutweg von einer kranken Maus auf eine gesunde zu übertragen. Die Ergebnisse wurden allerdings noch nicht in einem seriösen Fachblatt veröffentlicht. Der Molekularbiologe Christian Haass von der Universität München sagte FOCUS, es könnte möglich sein, dass die Ansteckung über Eiweißmoleküle im Blut verlaufe. …
Allerdings sei eine Altersbegrenzung für Blutspender „vielleicht sinnvoll“.

Der Präsident des Robert Koch-Instituts, Reinhard Burger, forderte im FOCUS, die Ergebnisse der Studie rasch zu überprüfen. Noch sei unbekannt, in welcher Konzentration die mutmaßlichen Erreger zur Ansteckung führen könnten. Voreilig ältere Menschen von der Blutspende auszuschließen, hält Burger für unlogisch und riskant, da sonst **Versorgungsengpässe** drohten. Patienten würden dann womöglich **ohne lebensrettende** Bluttransfusion bei Operationen oder nach

Focus online Sonntag, 12.02.2012, 11:0

Risks of Blood Transfusion

Overview of SHOT reports (366) 1996-1998



- Incorrect blood/component transfused (191)
- Acute transfusion reaction (55)
- Delayed transfusion reaction (51)
- Graft versus host disease (8)
- Acute lung injury (27)
- Post transfusion purpura (22)
- Transfusion transmitted infections (12)

A Multicenter, Randomized, Controlled Clinical Trial of Transfusion Requirements in Critical Care (Complications during ICU-stay)

	Restrictive (n=418)	Liberal (n=420)	p-value
Cardiac	55 (13.2%)	88 (21.0%)	<0.001
Pulmonary	106 (25.4%)	122 (29.0%)	0.22
Infectious	42 (10.0%)	50 (11.9%)	0.38
Gastrointestinal	13 (3.1%)	19 (4.5%)	0.28
Neurologic	25 (6.0%)	33 (7.9%9	0.28
Shock	67 (16%)	55 (13.1%)	0.23
Any	205 (49.0%	228 (54.3%)	0.12

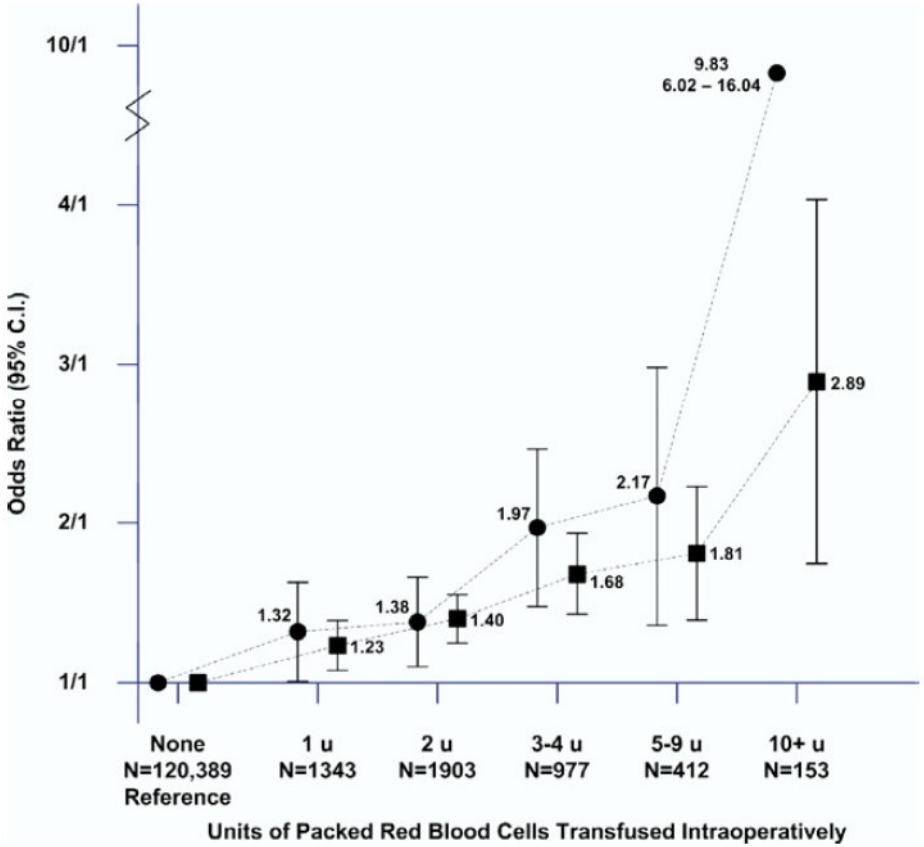
Hebert P.C. et al: NEJM 340, 409-17, 1999

Table 2. Frequencies of Composite Infection and Ischemic Outcomes

	Not Transfused			Transfused		
Outcome	N	n	%	N	n	%
Infection*	3674	...	...	4842	...	...
Nadir hematocrit <21	52	1	1.9	982	120	12.2
Nadir hematocrit ≥21 and <24	390	16	4.1	2164	243	11.2
Nadir hematocrit ≥24 and <27	1176	42	3.6	1385	200	14.4
Nadir hematocrit ≥27	2056	82	4.0	311	33	10.6
Ischemia†	3670	...	...	4848	...	...
Nadir hematocrit <21	52	1	1.9	982	132	13.4
Nadir hematocrit ≥21 and <24	390	13	3.3	2167	307	14.2
Nadir hematocrit ≥24 and <27	1175	40	3.4	1389	231	16.6
Nadir hematocrit ≥27	2053	72	3.5	310	36	11.6

Murphy G. J. et al. Circulation (2007) 116: 2544

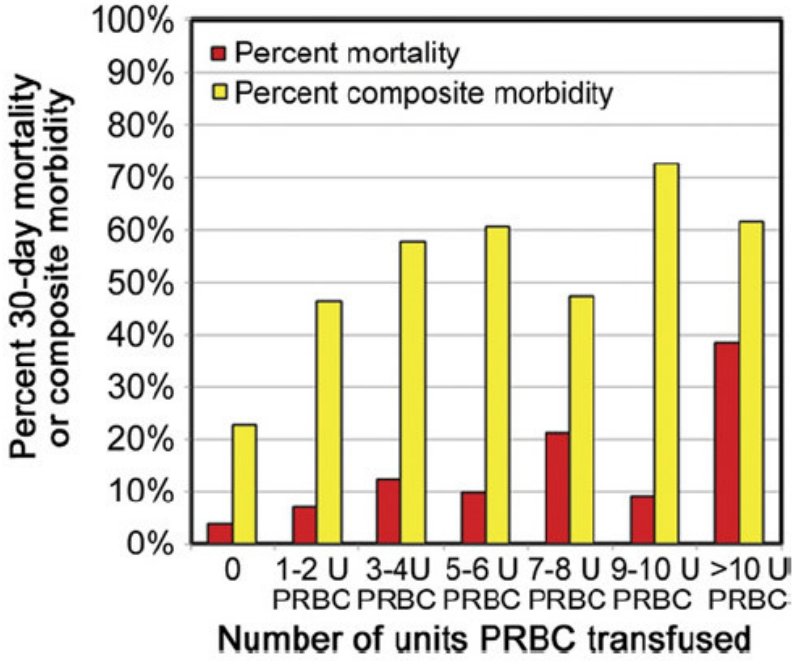
Intraoperative Transfusion of 1 U to 2 U Packed Red Blood Cells Is Associated with Increased 30-Day Mortality, Surgical-Site Infection, Pneumonia, and Sepsis in General Surgery Patients



Propensity and risk adjusted odds ratios (95% CI) for 30-day mortality and morbidity by level of intraoperative transfusion. Both morbidity and mortality risks were substantially increased after only 1 U RBC transfusion intraoperatively and continued to increasewith increasing units. Circles, mortality; squares, morbidity.

Bernard et al: J Am Coll Surg 2009;208:931–937

Intraoperative Transfusion of Small Amounts of Blood Heralds Worse Postoperative Outcome in Patients Having Noncardiac Thoracic Operations



Unadjusted mortality (red bars) and composite morbidity (yellow bars) are compared between patients who did not receive a transfusion and those who received varying amounts of intraoperative packed red blood cells (PRBC).

8728 nonvascular thoracic operations in patients from 173 hospitals. Of these, 7875
(90.2%) did not receive intraoperative transfusions.

Ferraris et al: Ann Thorac Surg 2011;91:1674–

Association of RBC transfusions with mortality and morbidity in critically ill in observational studies

Study: first author, year	Population	Design	Number	Outcomes
Ciesla, 2005[113]	Trauma	Prospective cohort	1,344	Increased multiorgan failure
Gong, 2005[106]	ICU patients	Prospective cohort	688	Increased risk of ARDS*
Lebron, 2005[109]	Liver transplant	Retrospective cohort	241	Increased early postoperative renal failure
Shorr, 2005[107]	ICU patients	Prospective cohort	3,502	Increased ICU acquired bacteremia
Silverboard, 2005,[112]	Trauma	Prospective cohort	102	Increased risk of ARDS
Smith, 2004[108]	Subarachnoid hemorrhage	Prospective cohort	441	Worse outcome with intraoperative transfusions
Vincent, 2004[5]	ICU patients	Prospective cohort	1,136	Increased ICU, hospital and 28-day mortality Increased organ dysfunction
Leal-Noval, 2003[104]	Cardiac surgery	Prospective cohort	103	Increased ICU LOS, mechanical ventilation, and pneumonia
Malone, 2003[98]	Trauma	Prospective cohort	15,534	Increased mortality
Chelemer, 2002[100]	CABG	Prospective cohort	533	Increased bacterial infections
Claridge, 2002[110]	Trauma	Prospective cohort	1,593	Increased infection
Corwin, 2002[4]	ICU	Prospective cohort	4,892	Increased ICU and hospital LOS Increased complications
Taylor, 2002[95]	ICU	Retrospective cohort	1,717	Increased nosocomial infections, ICU LOS, and mortality
Vamvakas, 2002[111]	Cardiac surgery	Retrospective cohort	416	Increased postoperative ventilation associated with volume of RBC supernatant
Leal-Noval, 2001[96]	Cardiac surgery	Prospective cohort	738	Increased ICU LOS, mechanical ventilation, and pneumonia
Chang, 2000[97]	Colorectal surgery	Retrospective cohort	282	Increased postoperative infection Increased mortality
Carson, 1999[101]	Hip fracture	Retrospective cohort	9,598	Increased risk of serious bacterial infection and pneumonia
Offner, 1999[105]	Trauma	Prospective cohort	61	Increased infection
Vamvakas, 1999[103]	Cardiac surgery	Retrospective cohort	416	Increased postoperative infection (5% /unit)
Carson, 1998[141]	Hip fracture	Retrospective cohort		No change in mortality or morbidity
Moore, 1997[102]	Trauma	Prospective cohort	513	Increased multiorgan failure
Martin, 1994[99]	ICU	Retrospective cohort	698	Increased mortality

* ARDS = acute respiratory distress syndrome.

Tinmouth et al: TRANSFUSION 2006;46:2014-2027.

The

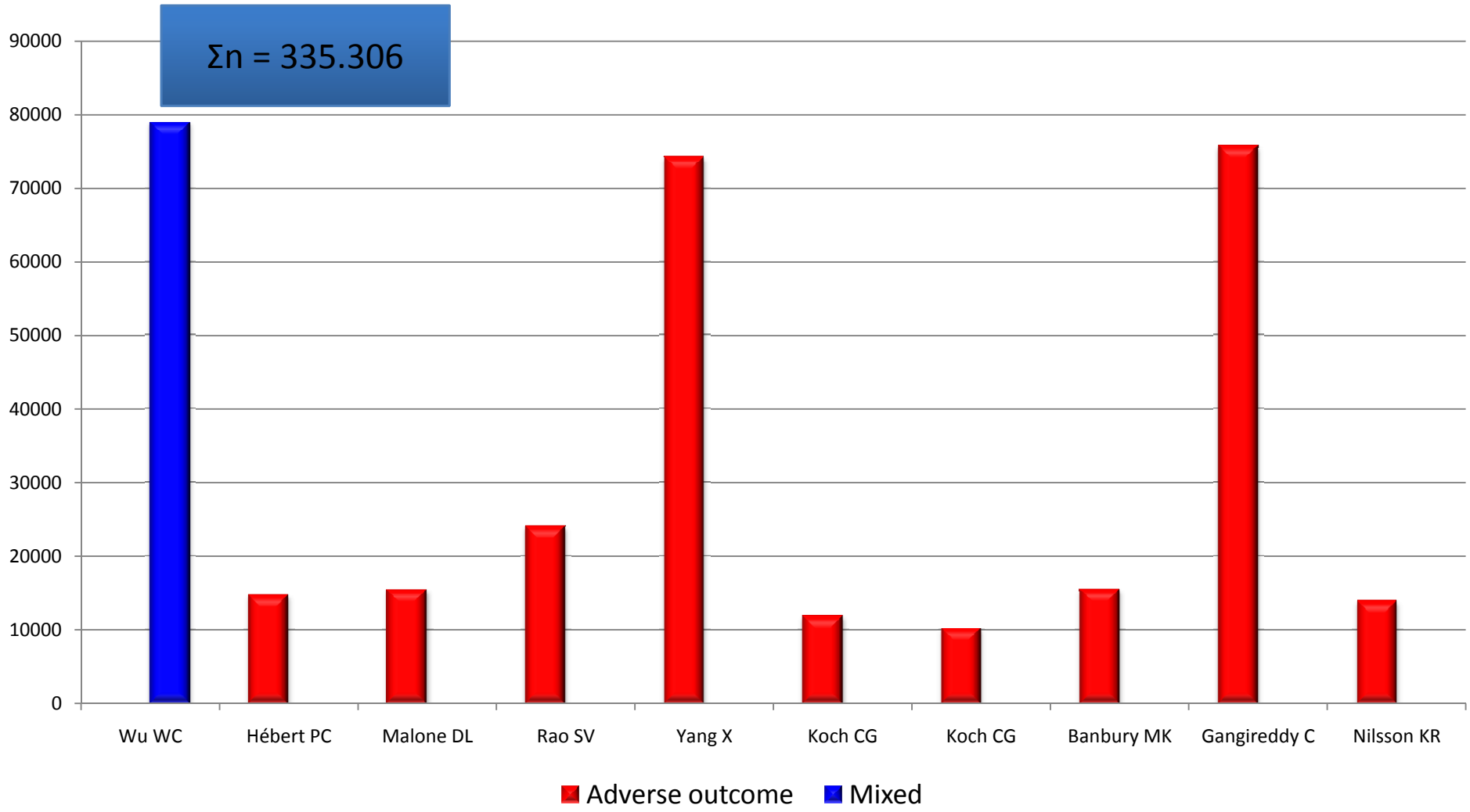
Adverse Blood Transfusion Outcomes: Establishing Causation

James P. Isbister, Aryeh Shander, Donat R. Spahn, Jochen Erhard, Shannon L. Farmer, and Axel Hofmann

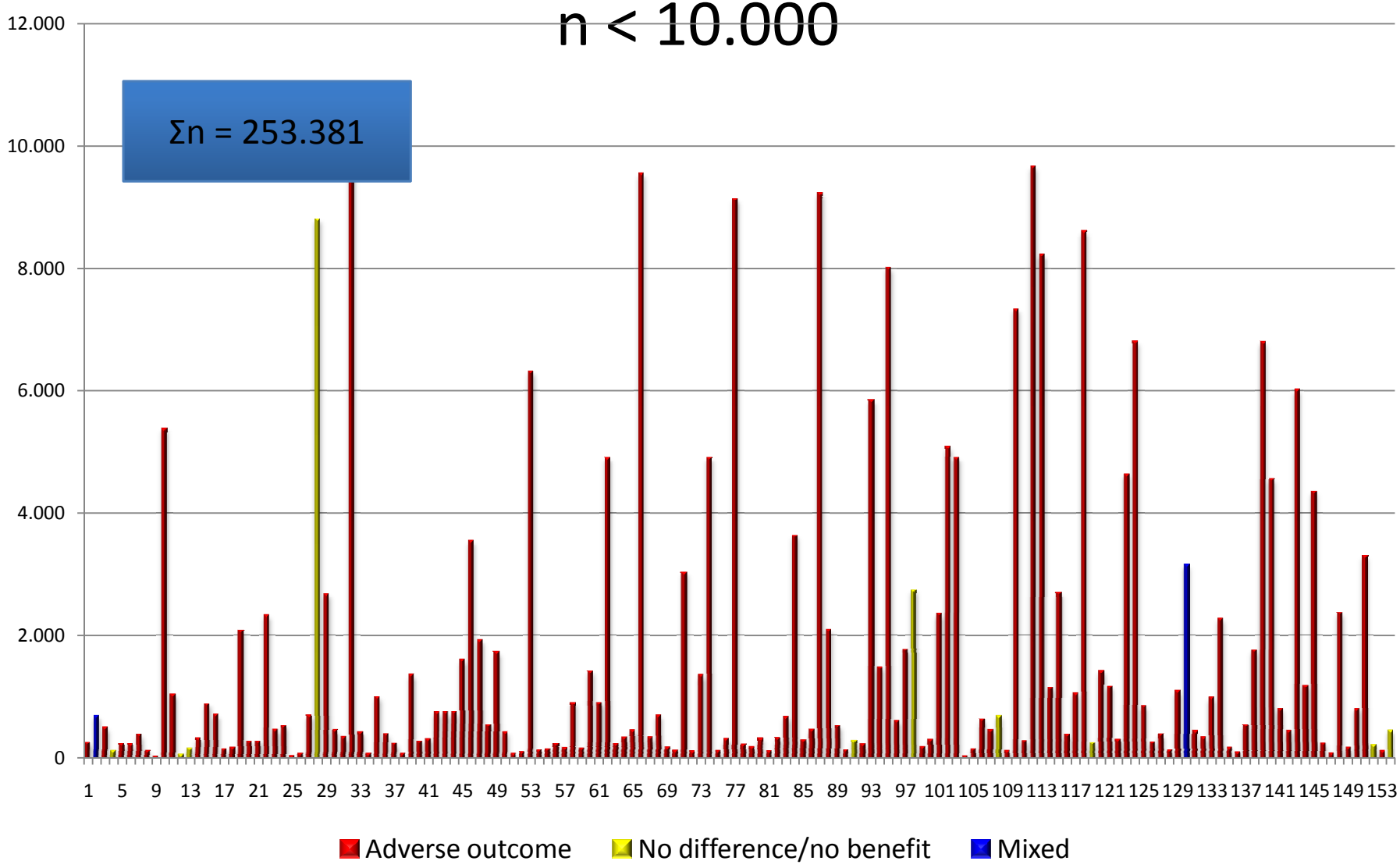
The transfusion of allogeneic red blood cells (RBCs) and other blood components is ingrained in modern medical practice. The rationale for administering transfusions is based on key assumptions that efficacy is established and risks are acceptable and minimized. Despite the cliché that, "the blood supply is safer than ever," data about risks and lack of efficacy of RBC transfusions in several clinical settings have steadily accumulated. Frequentist statisticians and clinicians demand evidence from randomized clinical trials (RCTs); however, causation for the recognized serious hazards of allogeneic transfusion has never been established in this manner. On the other hand, the preponderance of evidence implicating RBC transfusions in adverse clinical outcomes related to immunomodulation and the storage lesion comes from observational studies, and a broad and critical analysis to evaluate causation is overdue. It is suggested in several circumstances that this cannot wait for the design, execution, and conduct of rigorous RCTs. We begin by examining the nature and definition of causation with relevant examples from transfusion medicine. Deductive deterministic methods may be applied to most of the well-accepted and understood serious hazards of transfusion, with modified Koch's postulates being fulfilled in most circumstances. On the other hand, when several possible interacting risk factors exist and RBC transfusions are associated with adverse clinical outcomes, establishing causation requires inferential probabilistic methodology. In the latter circumstances, the case for RBC transfusions being causal for adverse clinical outcomes can be strengthened by applying modified Bradford Hill criteria to the plethora of existing observational studies. This being the case, a greater precautionary approach to RBC transfusion is necessary and equipoise that justifying RCTs may become problematic.

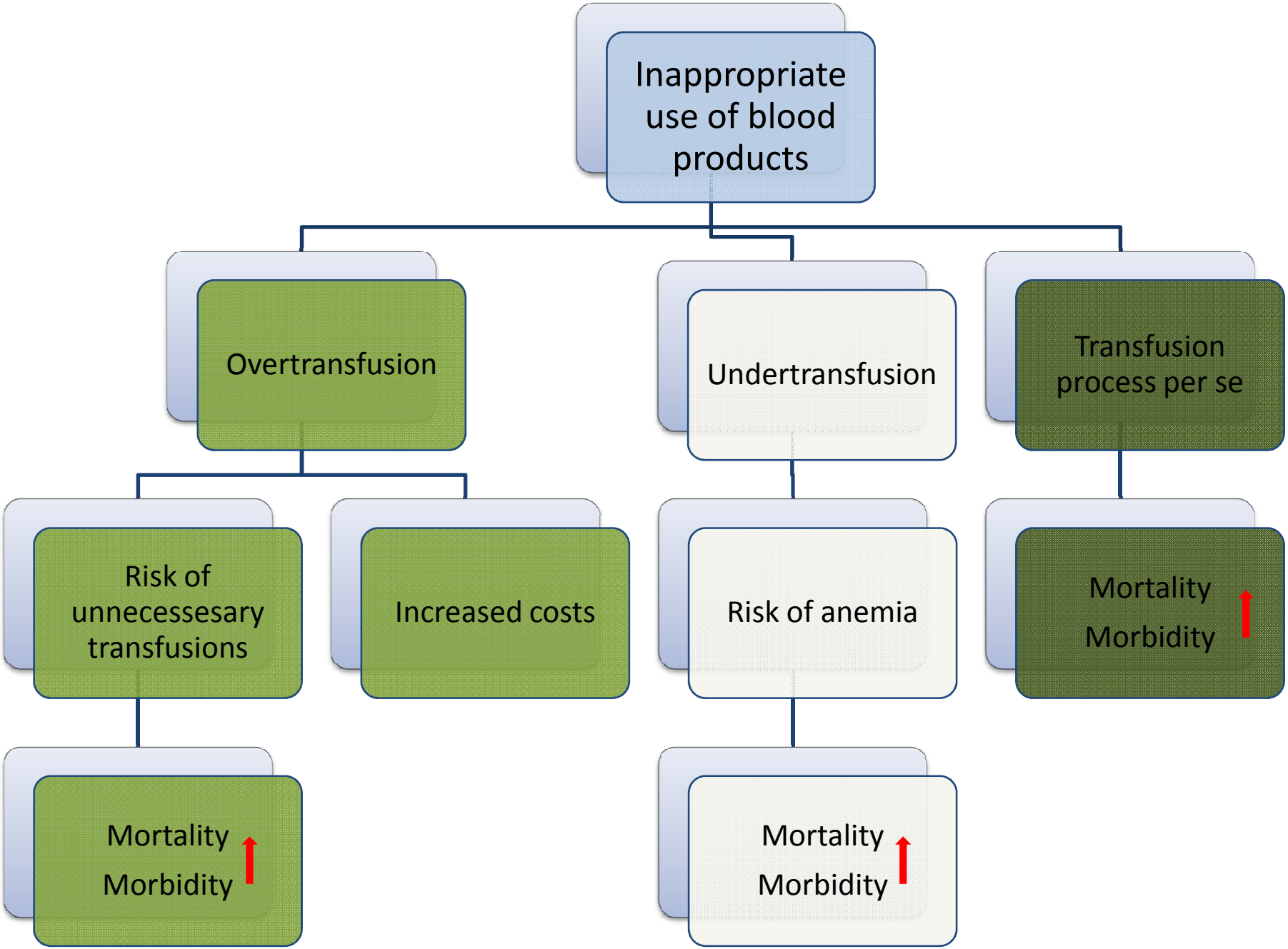
Isbister, J.P., A. Shander, D.R. Spahn, J. Erhard, S.L. Farmer, Hofmann, A. Adverse Blood Transfusion Outcomes: Establishing Causation. Transfus Med Rev, 2011.

Observational Studies by Outcome
n > 10.000

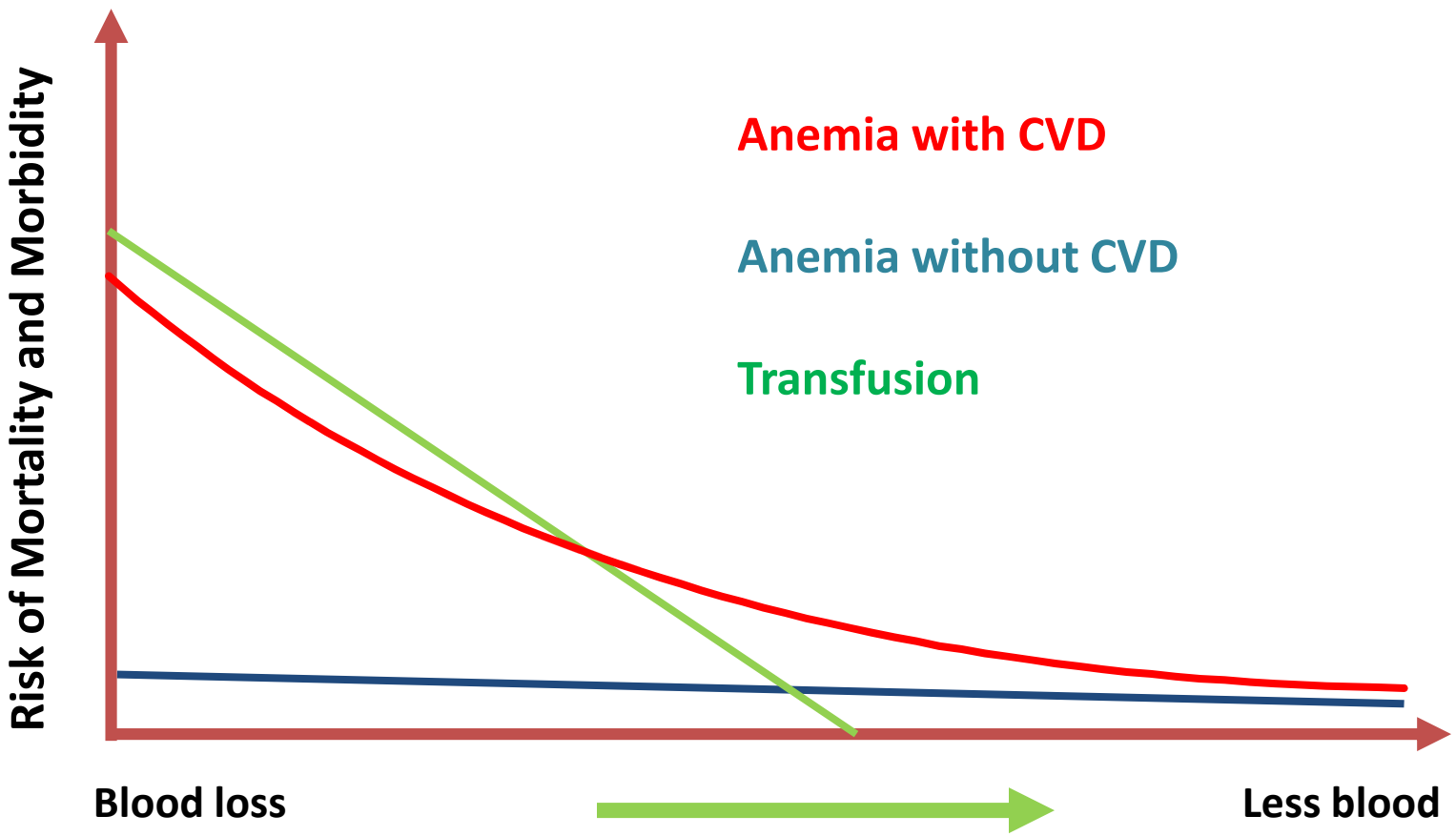


Observational Studies by Outcome
n < 10.000




Inappropriate use of blood products
Overtransfusion
Undertransfusion
Transfusion process per se
Risk of unnecessesary transfusions
Increased costs
Risk of anemia
Mortality
Morbidity
Mortality
Morbidity
Mortality
Morbidity

From “Blood loss“ to “Less blood“



Risk of anemia + Risk of blood loss + Risk of tranfusion = ????

Components of PBM

- Evaluation of the actual blood usage (data management)
- Optimising blood ordering schedules
- Increasing tolerance of anemia
- 3 pillar strategy
  - Optimising preoperative red cell mass
  - Minimising perioperative blood loss
  - Reducing transfusion trigger

Components of PBM

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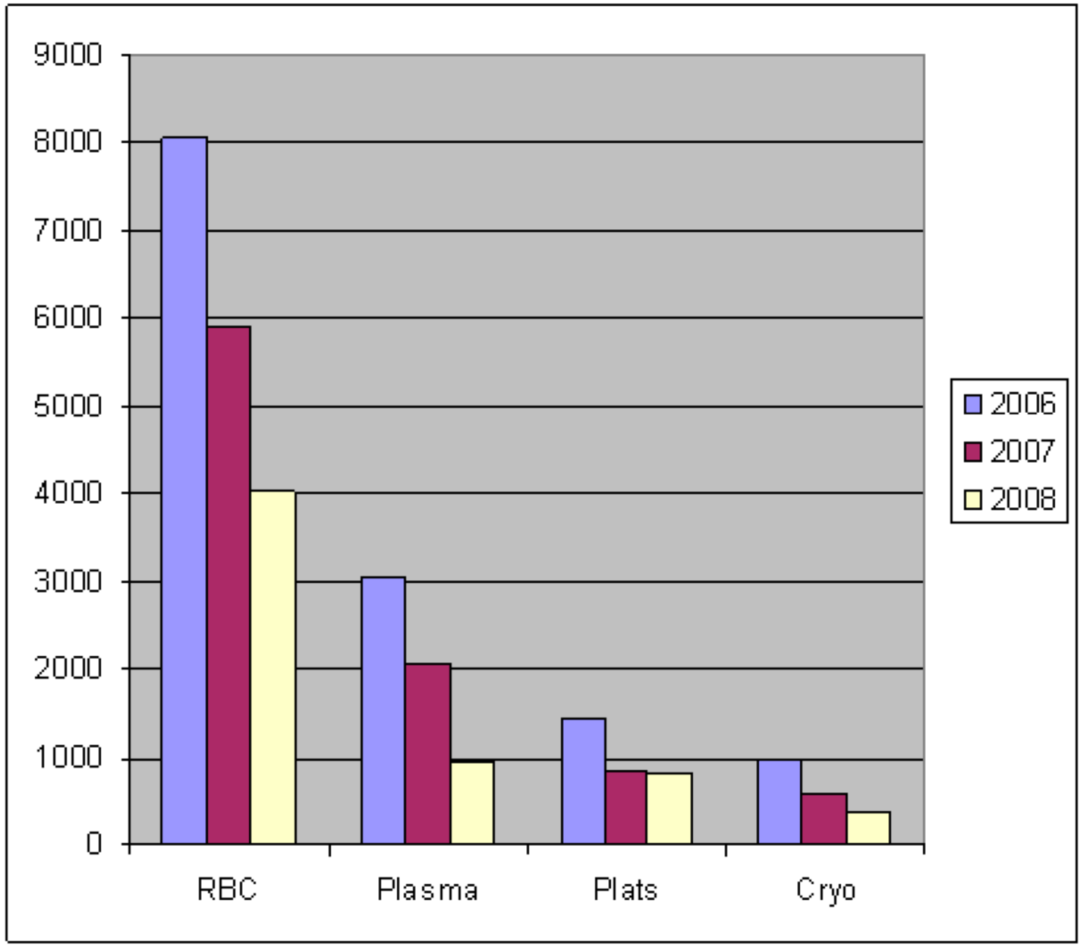
Data Management

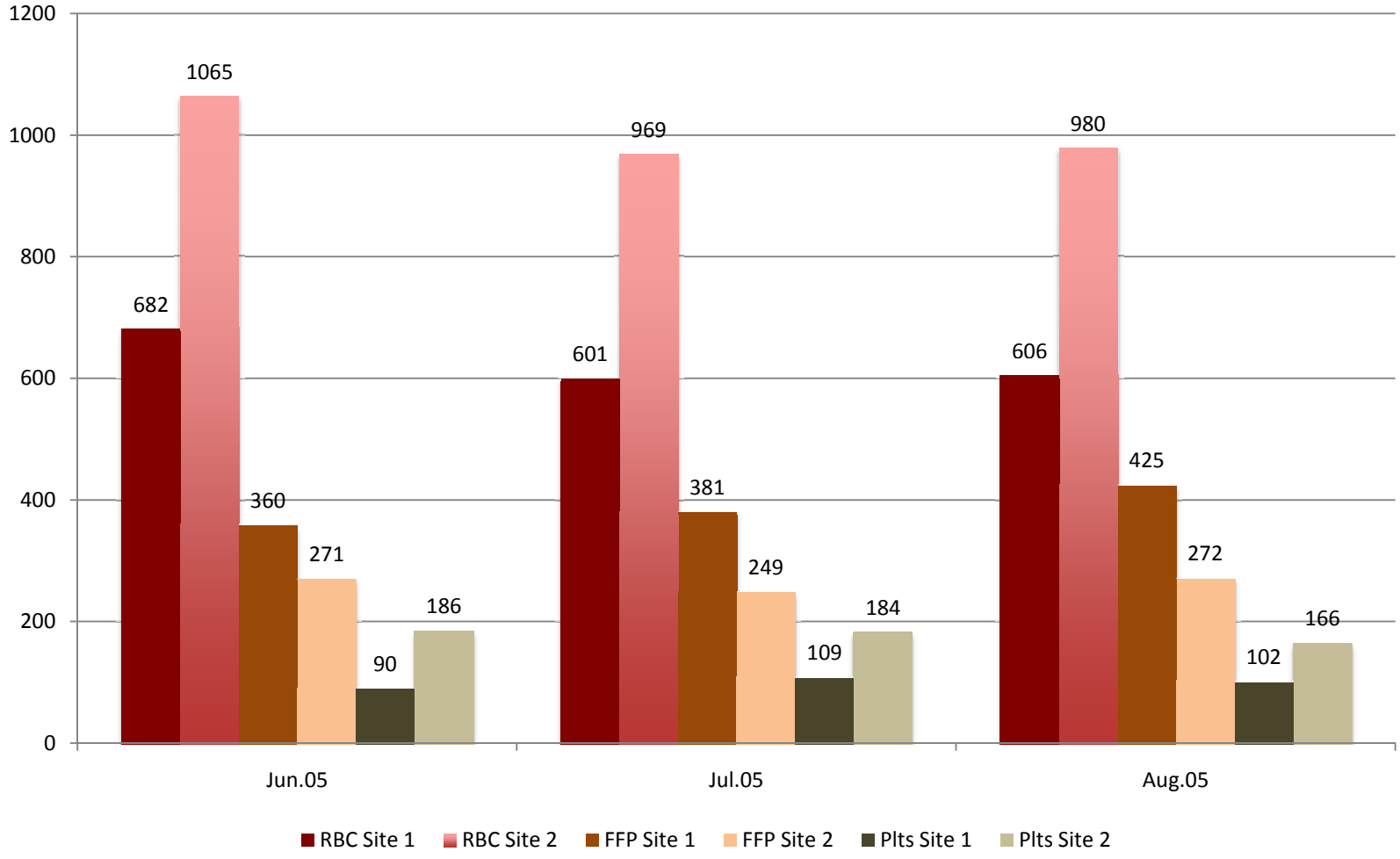
Total units transfused per year



Example from EMMC USA Total units transfused by year

Data Management

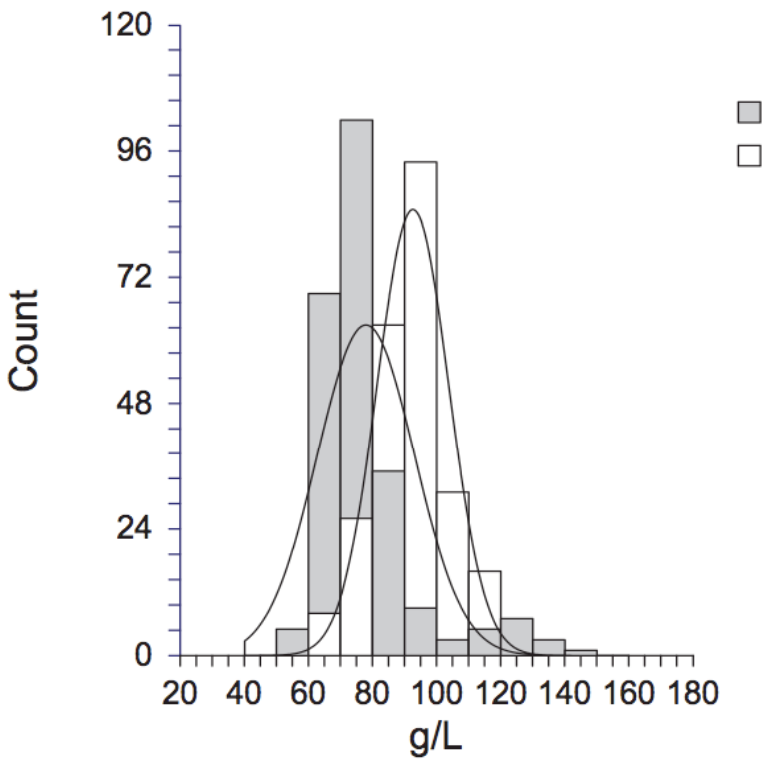
Total units transfused per month



Data Management

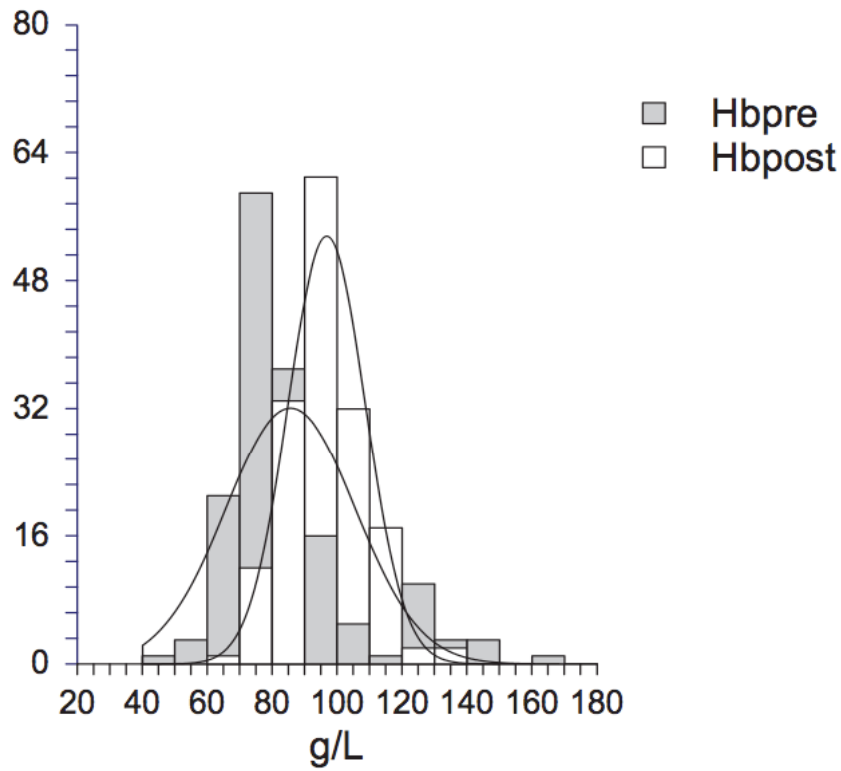
Pre & Post txn Hb

Centre # 1 ICU



	Pre txn Hb	Post txn Hb
Mean	78	93
Median	74	94
	Units txd	**Post txn Hb rise**
Mean	3.3	15 g/L
Median	2	19 g/L

Centre # 2 ICU

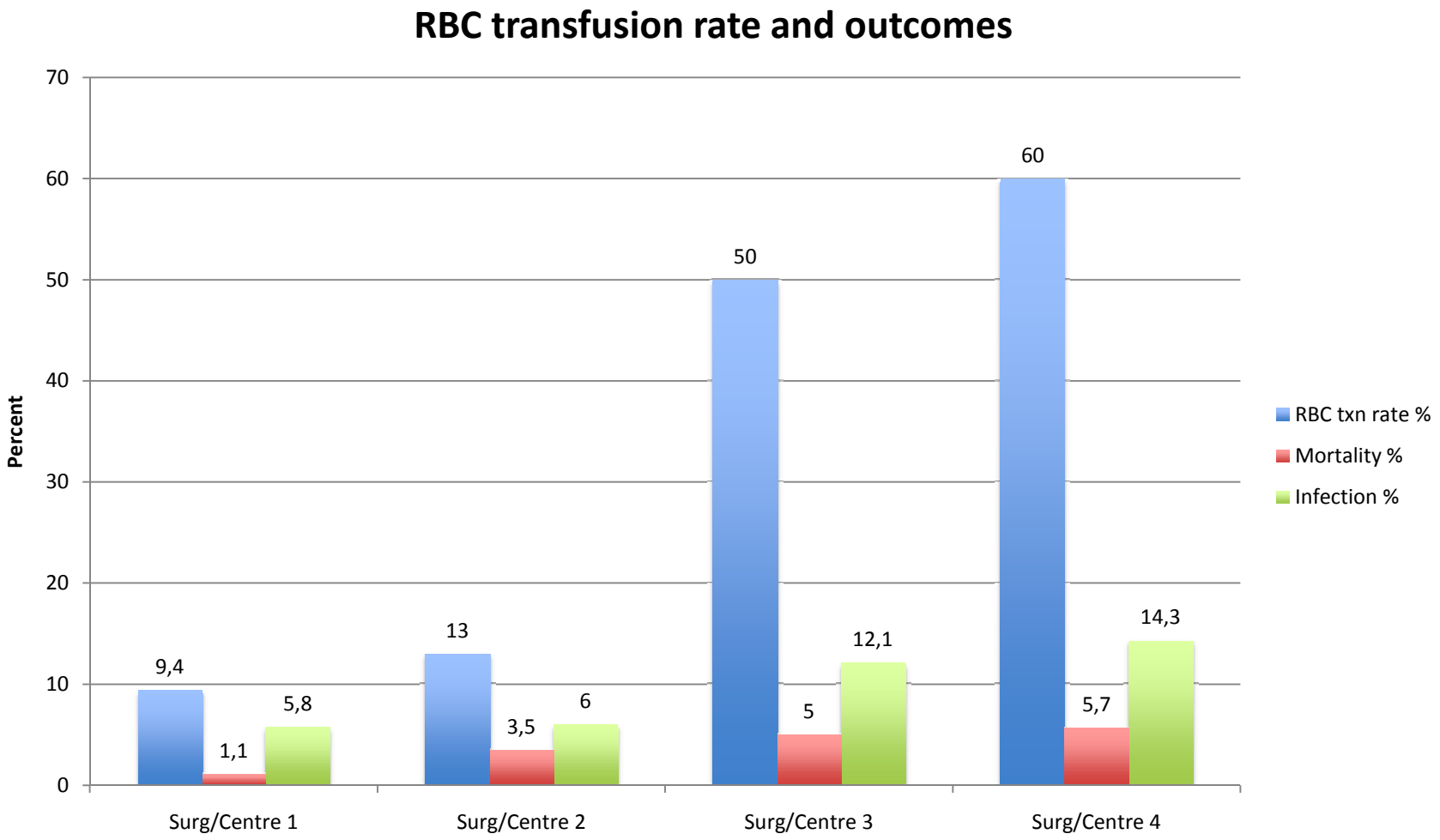


	Pre txn Hb	Post txn Hb
Mean	86	97
Median	79	97
	Units txd	**Post txn Hb rise**
Mean	3.4	11 g/L
Median	2	18 g/L

Data Management

RBC transfusion rate and outcomes

Column chart without data table



Continous benchmarking – a cost-effective PBM tool

PBM Reporter - [FrmMain : Form]

File Edit View Insert Format Records Tools Window Help Adobe PDF

Select Report

- Report Categories
  - Single Unit Policy
    - Product Usage by Quantity
    - Single or Multiple Units (RBC only)
  - Summary Statistics
    - Summary Statistics
  - Transfusion Proportions
    - Proportion of TX by Specialty

Select Specialty Include All Specialties ☑

Anaesthetics
Boarder
Burns
Cardiology
Cardiothoracic Surgery
Communicable Diseases
Dental Surgery
Dermatology
Ear, Nose and Throat
Emergency Medicine
Endocrinology
Gastroenterology
General Practitioner
General Surgery
General/Physicial Medicine
Gerontology
Gynaecology
Haematology
Hyperbaric Medicine
Immunology
Infectious/Tropical Medicine
Intensive Care Medicine

Targeted | Surgical | Heavy User

Procedure Groups

Abdominal Hystrectomy
Appendectomy
Caesarean Section
Cardiothoracic Surgery
Colon Surgery
Gallbladder Surgery
Gastric Surgery
Herniorrhaphy
Hip Prosthesis (Primary)
Hip Prosthesis (Revision)
Knee Prosthesis (Revision)
Knee Prothesis (Primary)
Small Bowel Surgery
Vaginal Hysterectomy

Select Date Range

Start Date: 01/07/2009

End Date: 30/06/2010

Last Financial Year

Reset Dates

Select Hospitals (max of 4)

- ☐ ARM
- ☐ BEN
- ☑ FH
- ☐ ROC
- ☑ RPH

Select Blood Product

○ RBC ○ FFP ○ CRYO ○ PLT ◉ All

Admission Type

- ○ Elective
- ○ Non Elective
- ◉ All Admissions

Pre and Post TX Hb Limits

Pre TX Hb Min [ ] Max [ ]

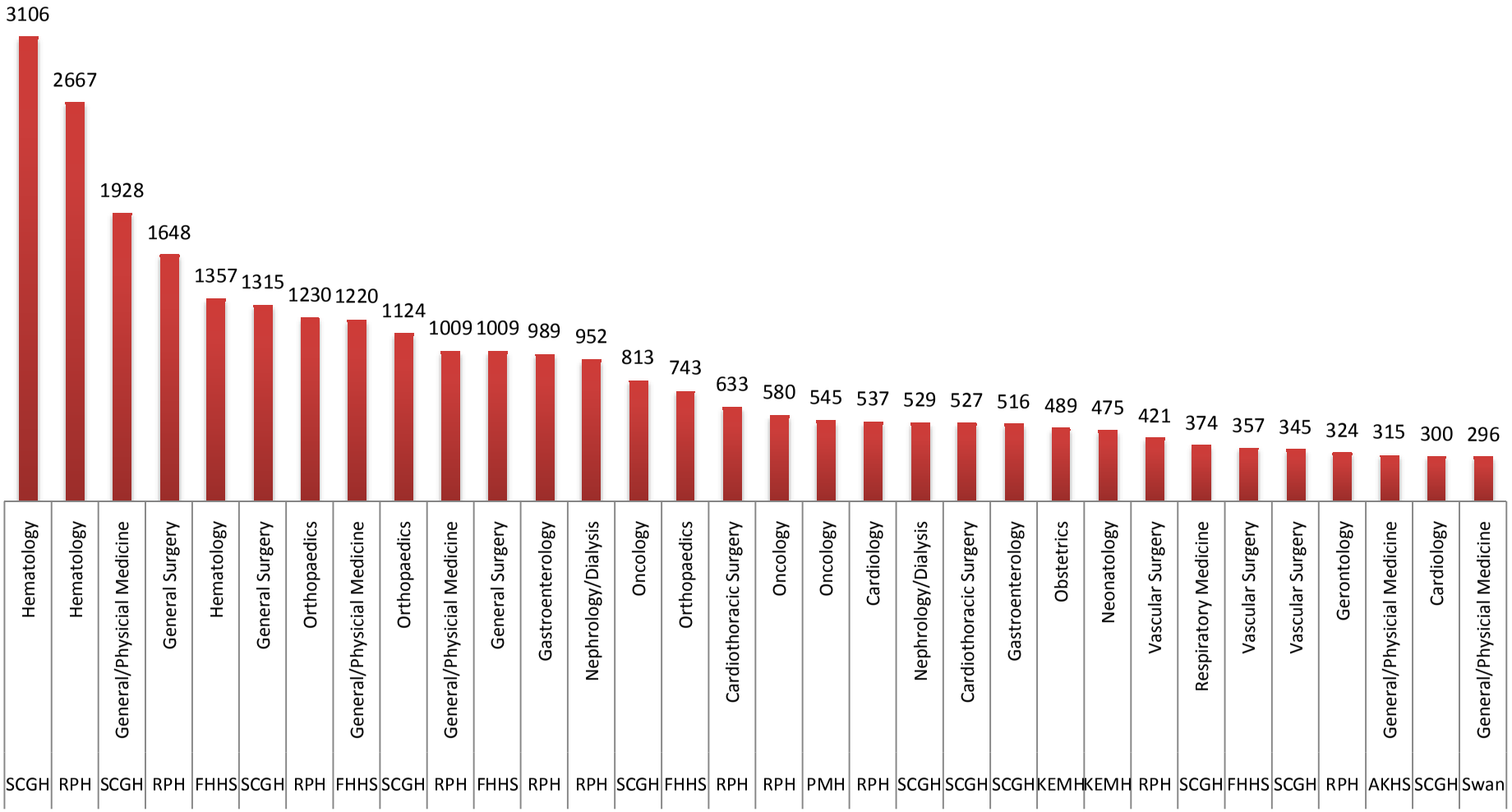
Post TX Hb Min [ ] Max [ ]

Chart Options

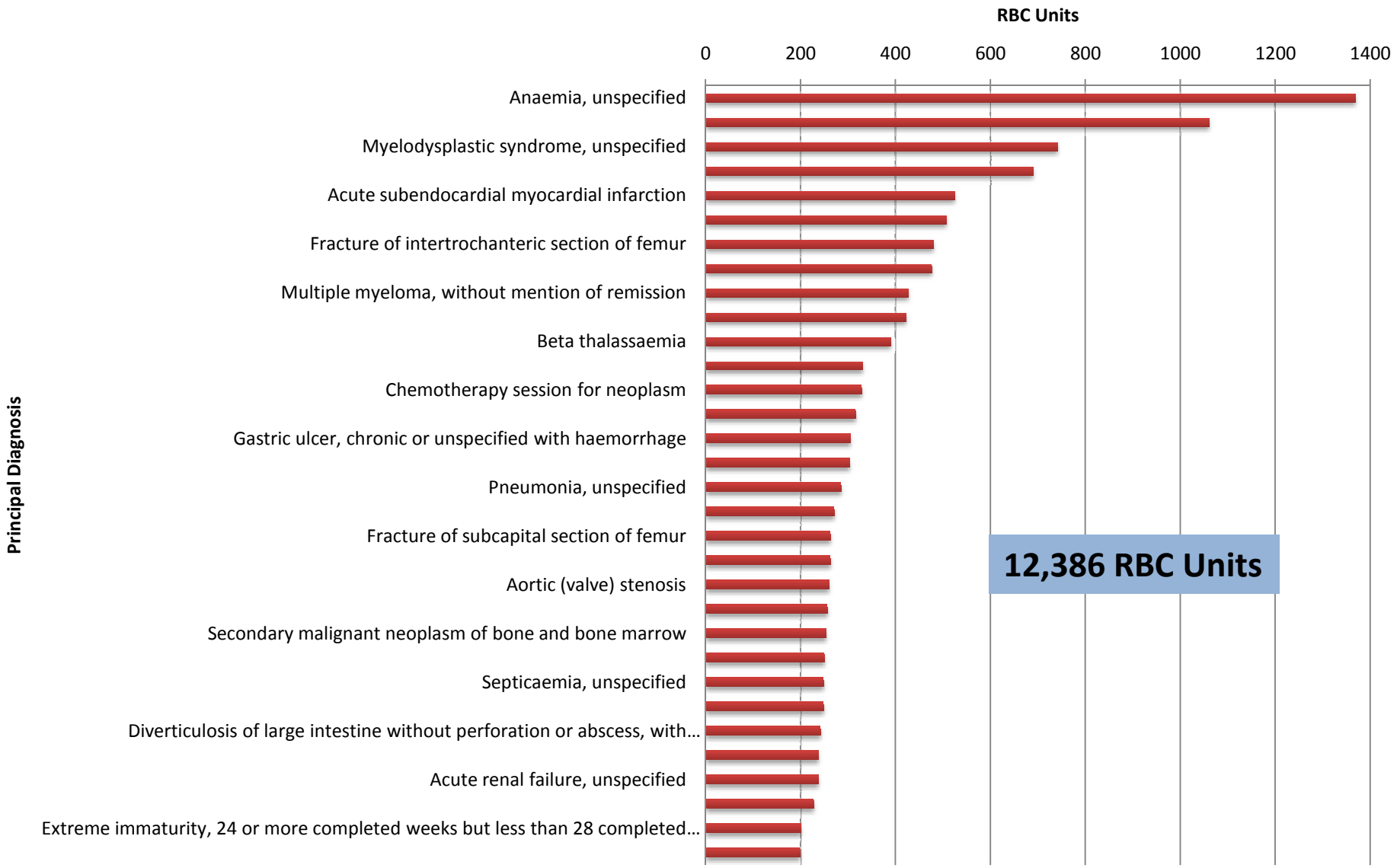
- ☑ Show Legends
- ☑ Show Data Labels

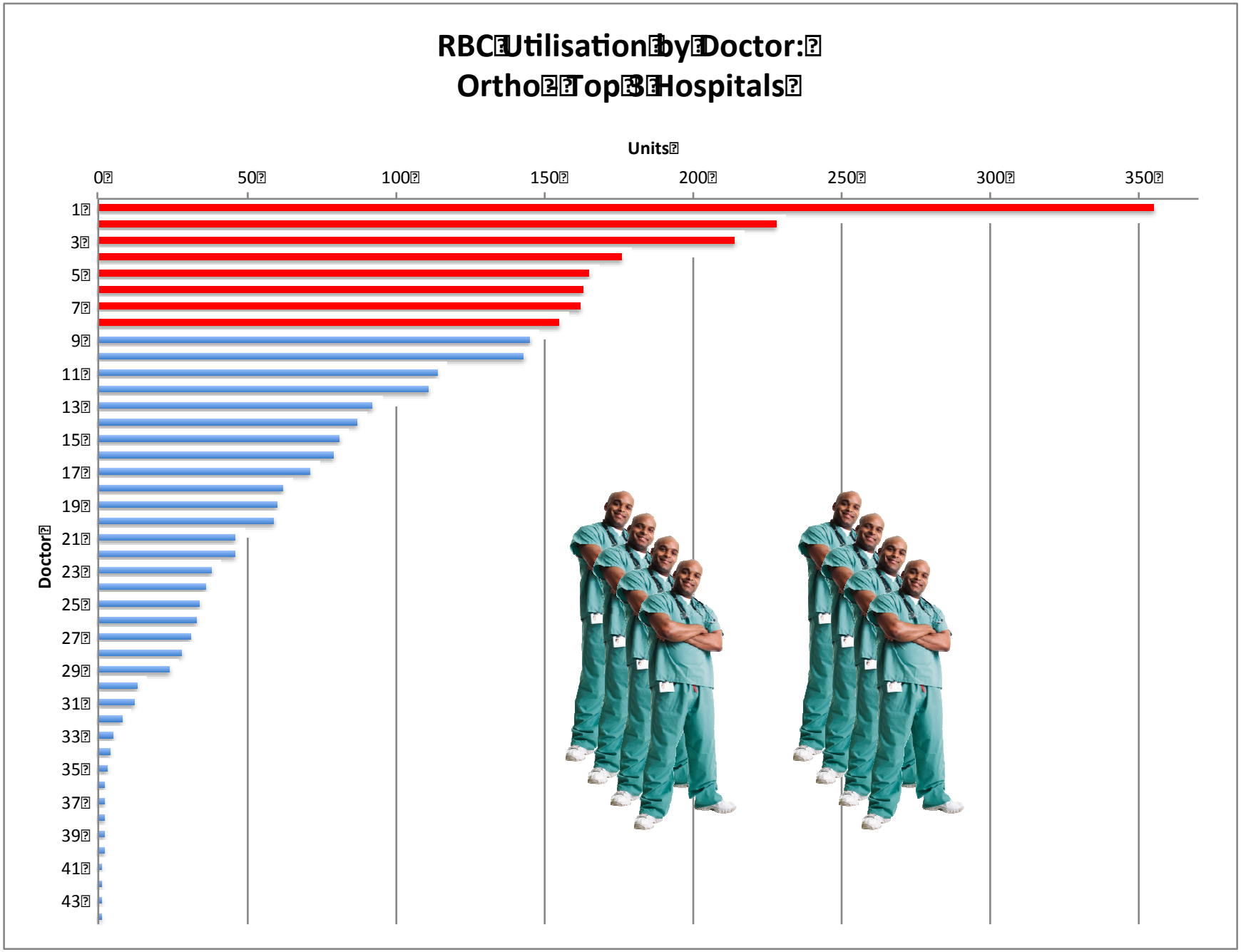
Run Report | Save Chart | Export Data | Reset Form | Quit

Top 80% of RBC Utilisation by Specialty and Hospital – Western Australia Metro 2010 (32 of 156 Departments)



Principal Diagnoses w/ +200 RBCs Transfused – Western Australia Metro 2010
(32 of 1,055 Principal Diagnoses w/ RBC Txns)




RBC Utilisation by Doctor:
Ortho - Top 3 Hospitals
Units
0
50
100
150
200
250
300
350
Doctor
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43

Components of PBM

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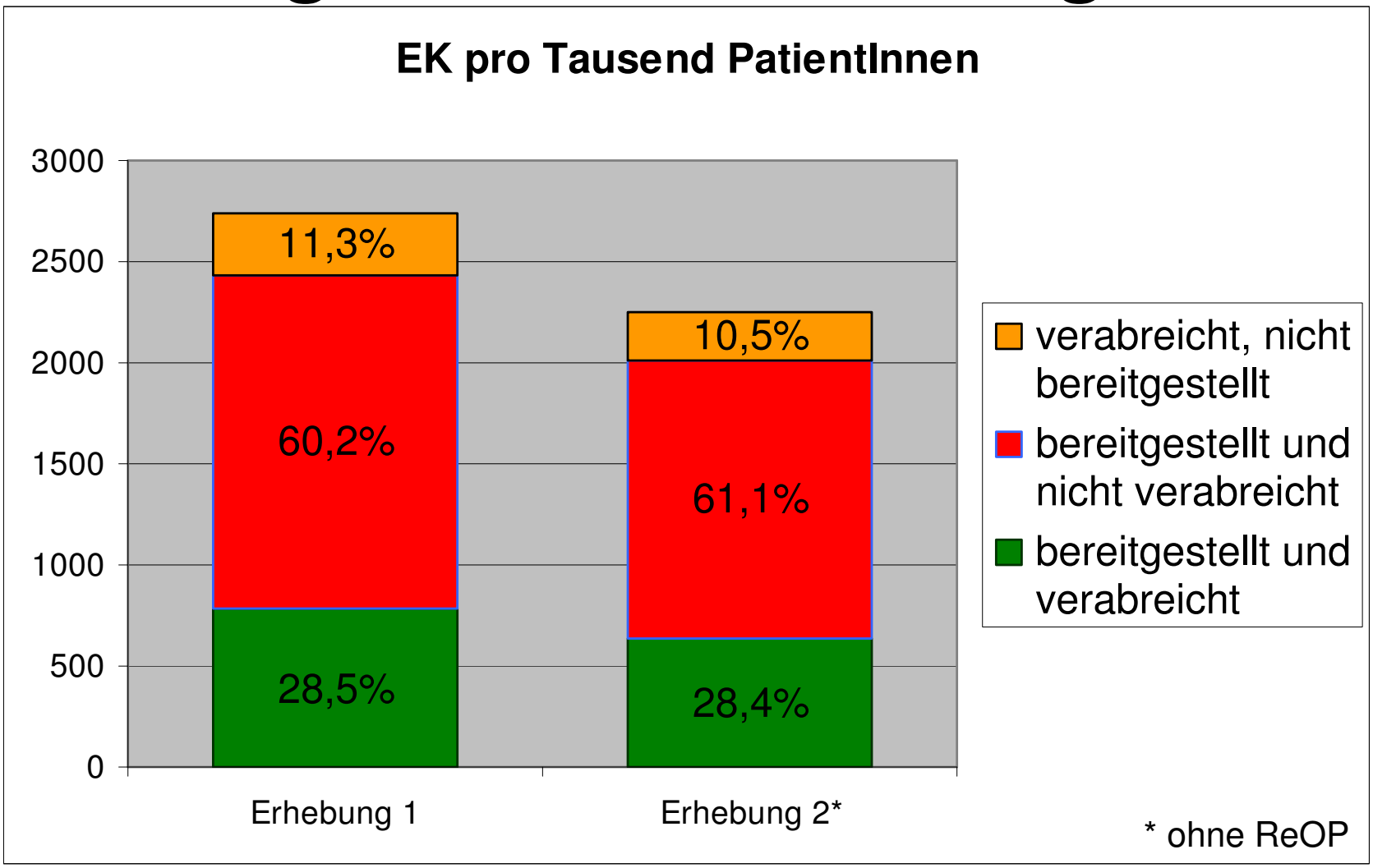
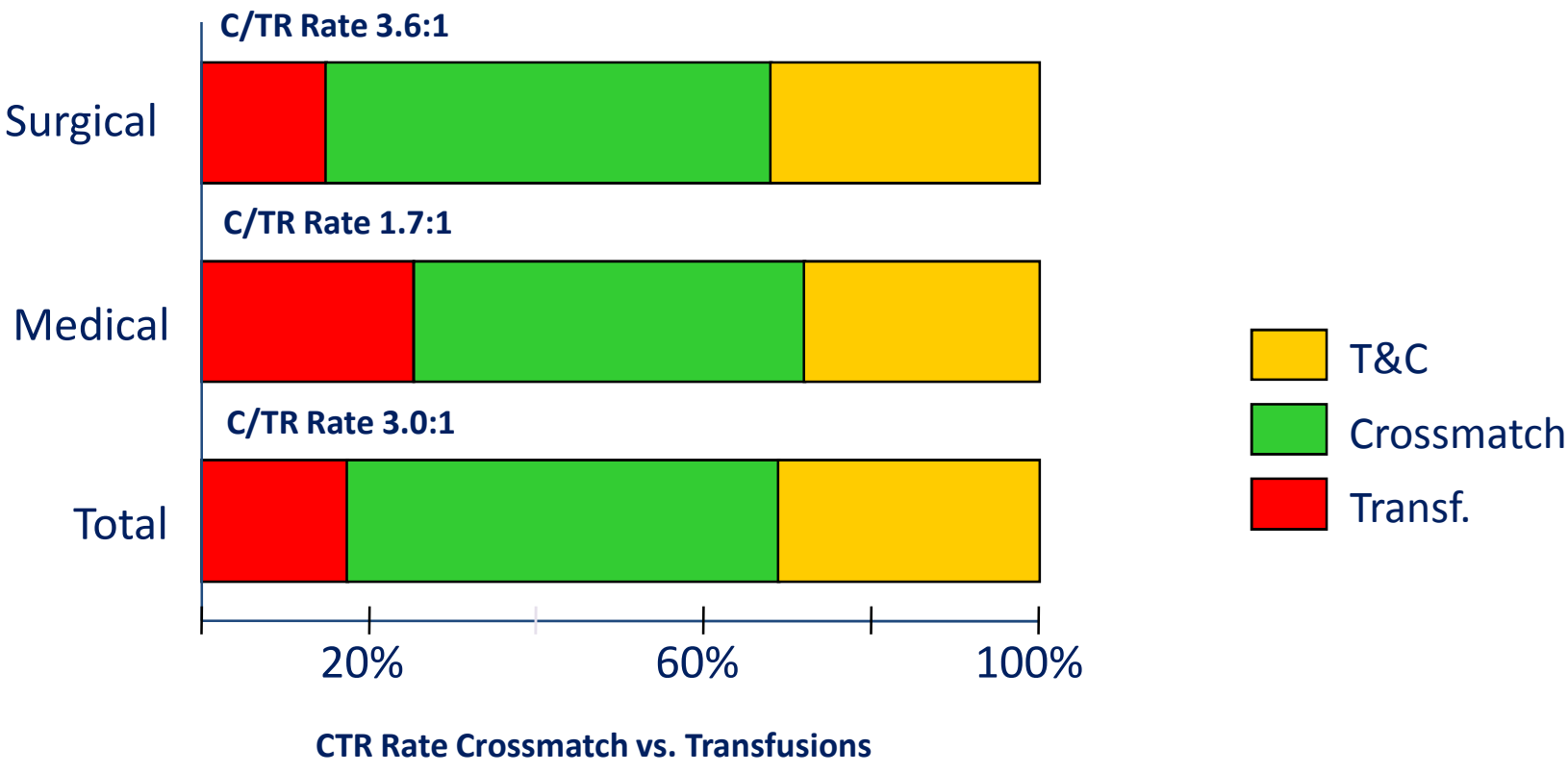
  - Reducing transfusion trigger

Vergleich: Bereitstellung EK



Quantity of Type and Screens, Crossmatches and RBC Transfused



Goal at least 1,8:1

MSBOS
Maximum Blood Ordering Schedule

Authors	Type of surgery	CTR before	CTR after
Rogers et al. 2006	Orthopedics	3.21 : 1	1.62 : 1
Mehra et al. 2004	Knee replacement	4.90 : 1	1.70 : 1
Foley et al. 2003	Gynecology	2.25 : 1	1.71 : 1
Richardson et al. 1998	Various	1.80 : 1	1.80 : 1

1.7: 1 = reduction of ....€

Reducing Unnecessary Cross-Matching: A Patient-Specific Blood Ordering System Is More Accurate in Predicting Who Will Receive a Blood Transfusion Than the Maximum Blood Ordering System

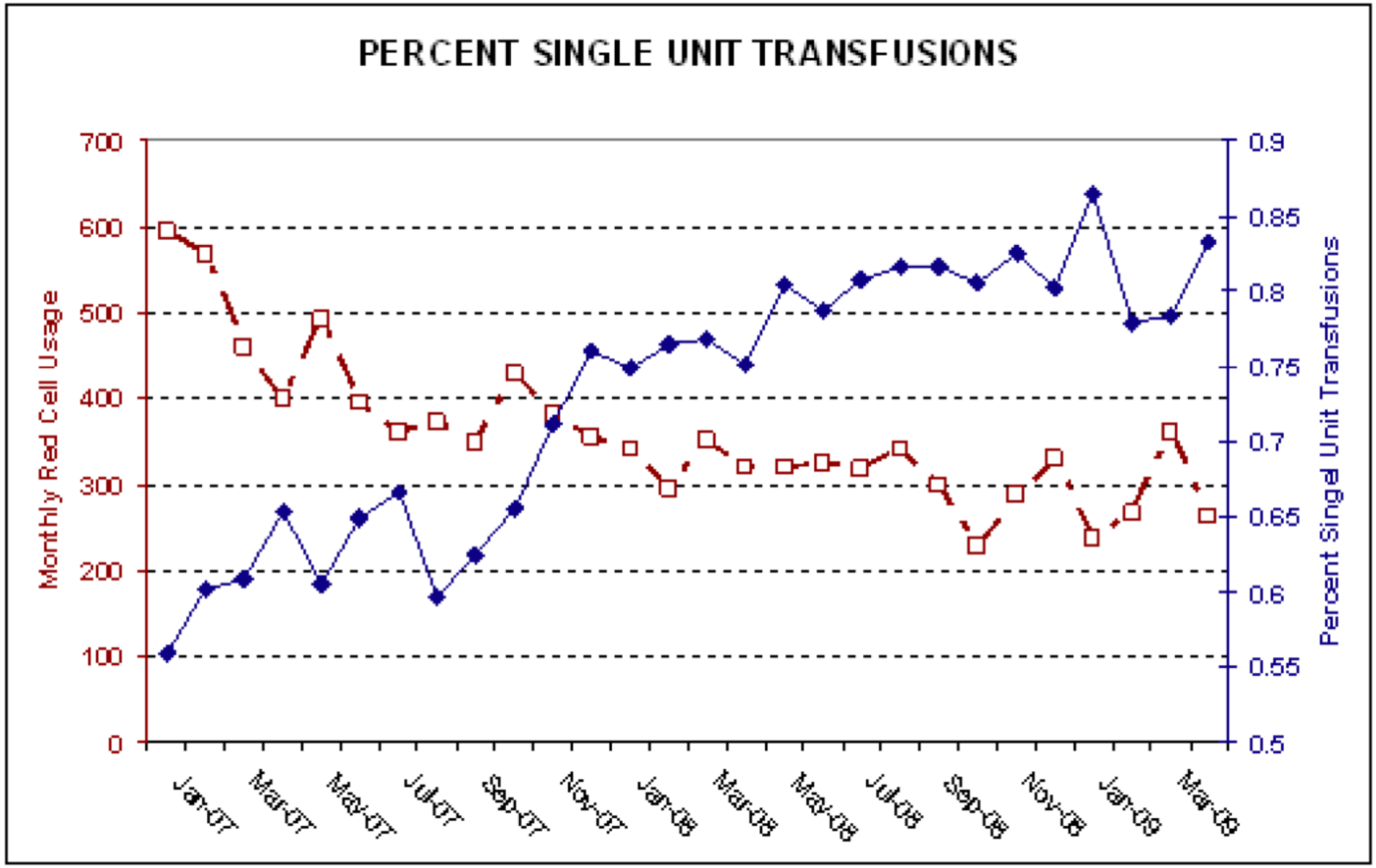
Thalia Palmer, BS, Joyce A. Wahr, MD, Michael O'Reilly, MD, and Mary Lou V.H. Greenfield, MPH, MS

Department of Anesthesiology, University of Michigan Health System, Ann Arbor

Anesth Analg 2003;96:369 –75

Data Management

Single RBC unit txns vs total units txd



Example from EMMC USA

Significant reduction of red blood cell transfusion requirements by changing from a double-unit to a single-unit transfusion policy in patients receiving intensive chemotherapy or stem cell transplantation

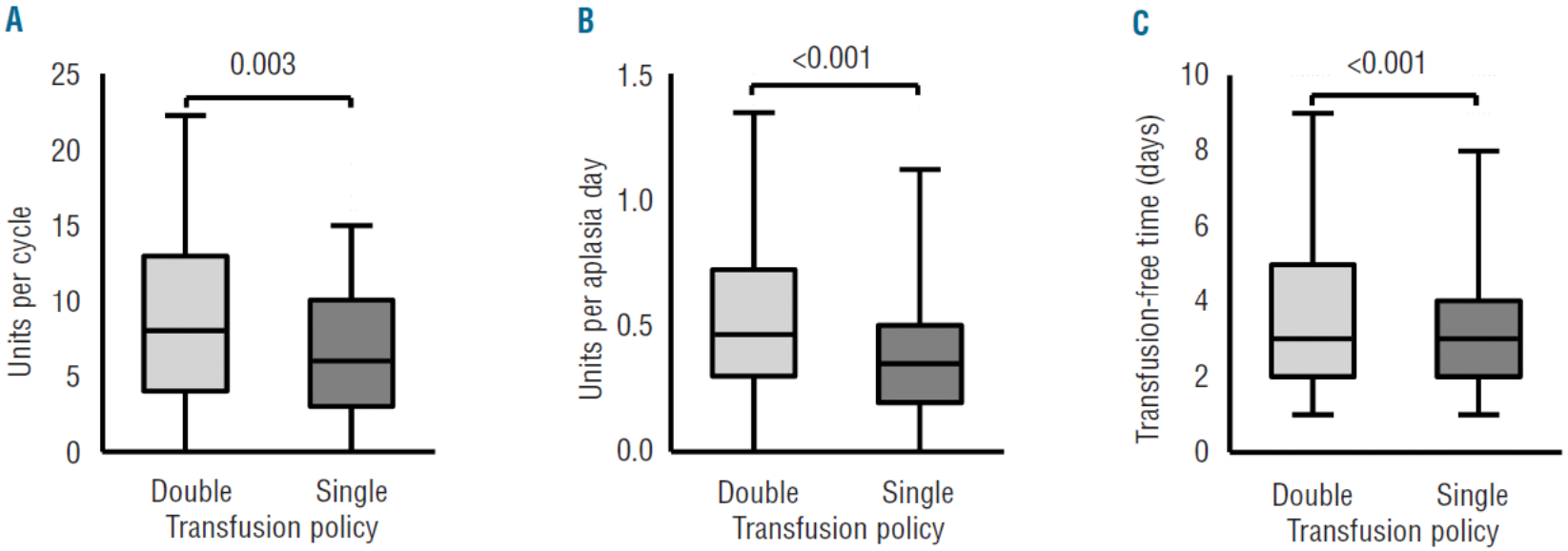


Figure 1. Reduction of RBC units per therapy and transfusion-free time. The box plots display medians, interquartile ranges, and 95% confidence intervals. The double RBC-unit period is represented in light gray and the single-unit period in dark gray. (A) Changing the transfusion policy led to a 25% reduction of the transfused RBC units per therapy cycle (P=0.003). (B) Normalization to one aplasia day resulted in a 24% reduction of the RBC transfusions in the single-unit period (P<0.001). (C) The mean time between two transfusions was 20% longer in the double-unit period (P<0.001).

Berger et al: Haematologica **2012;97(1)116-122.**