

Patient blood management - new perspectives



The Frankfurt PBM Team



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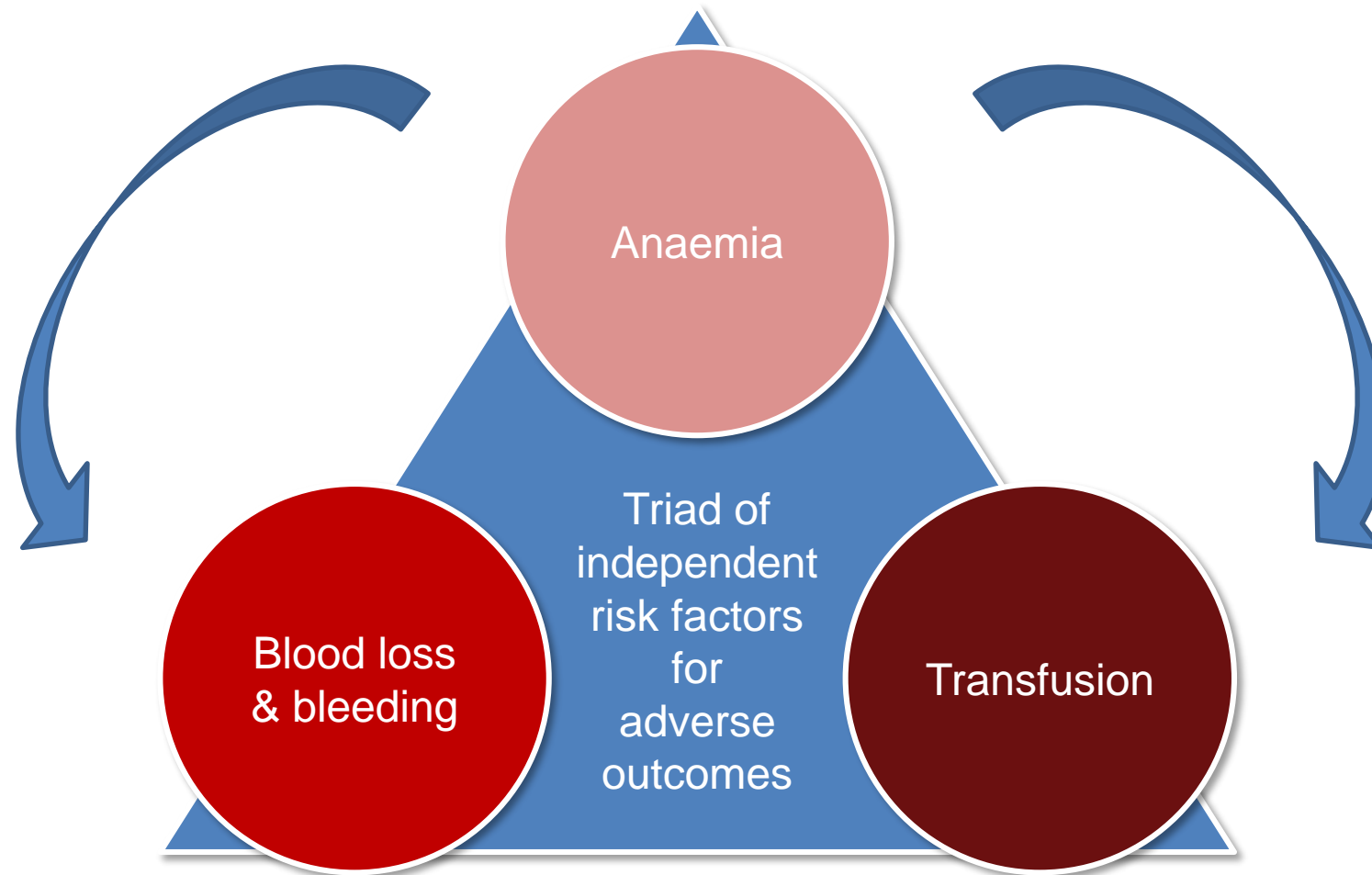
During the last 3 years I have received research grants, consultant/speaker honoraria as well as financial support for continuous education of my department :

German Research Foundation (ME 3559/1-1, ME 3559/3-1, SFB 834 B4, SFB 815 A17, KFO TP07), ECCPS, LOEWE TP 6, European Union

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Pulsion Medical Systems S.E.
Teflex Medical GmbH
TopMed Medizintechnik GmbH
Vifor Pharma GmbH

Anaemia is a disease in itself





Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study

Khaled M Musallam, Hani M Tamim, Toby Richards, Donat R Spahn, Frits R Rosendaal, Aida Habbal, Mohammad Khreiss, Fadi S Dahdaleh, Kaivan Khavandi, Pierre M Sfeir, Assaad Soweid, Jamal J Hoballah, Ali T Taher, Faek R Jamali

Summary

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See [Comment](#) page 1362

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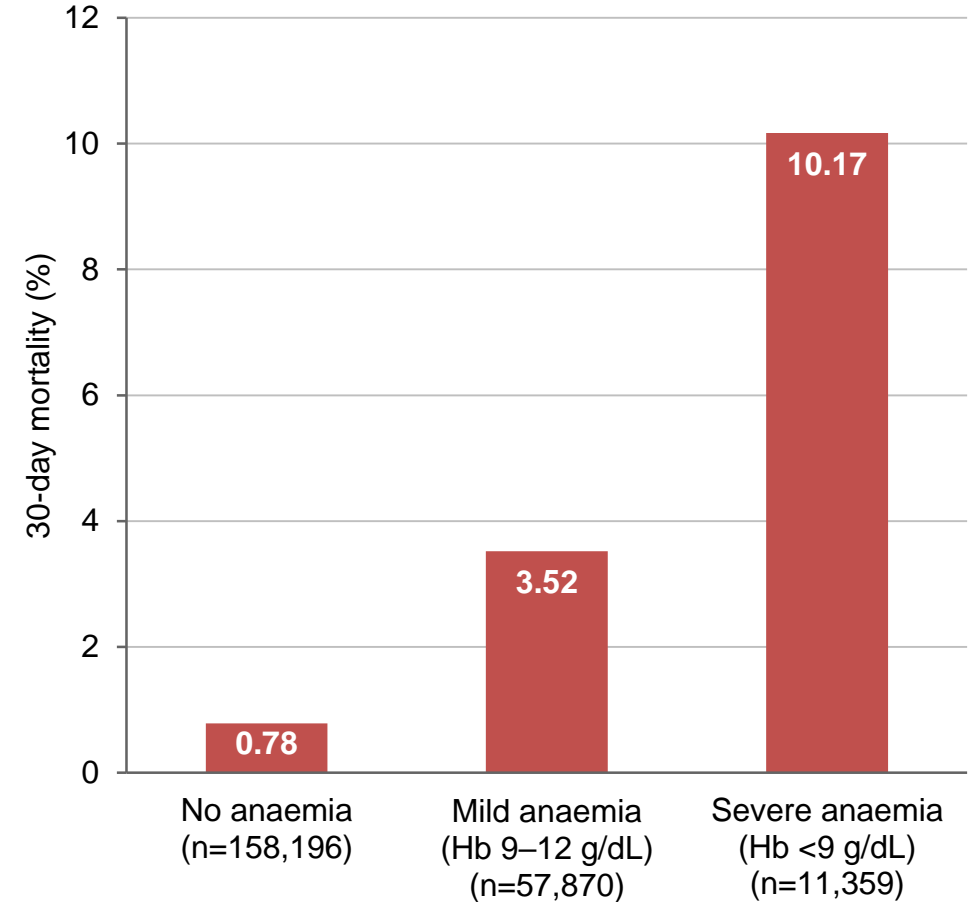
Background Preoperative anaemia is associated with adverse outcomes after cardiac surgery but outcomes after non-cardiac surgery are not well established. We aimed to assess the effect of preoperative anaemia on 30-day postoperative morbidity and mortality in patients undergoing major non-cardiac surgery.

Methods We analysed data for patients undergoing major non-cardiac surgery in 2008 from The American College of Surgeons' National Surgical Quality Improvement Program database (a prospective validated outcomes registry from 211 hospitals worldwide in 2008). We obtained anonymised data for 30-day mortality and morbidity (cardiac, respiratory, CNS, urinary tract, wound, sepsis, and venous thromboembolism outcomes), demographics, and preoperative and perioperative risk factors. We used multivariate logistic regression to assess the adjusted and modified (nine predefined risk factor subgroups) effect of anaemia, which was defined as mild (haematocrit concentration >29–<39% in men and >29–<36% in women) or moderate-to-severe (\leq 29% in men and women) on postoperative outcomes.

Findings We obtained data for 227 425 patients, of whom 69 229 (30.44%) had preoperative anaemia. After adjustment, postoperative mortality at 30 days was higher in patients with anaemia than in those without anaemia (odds ratio [OR] 1.42, 95% CI 1.31–1.54); this difference was consistent in mild anaemia (1.41, 1.30–1.53) and moderate-to-severe anaemia (1.44, 1.29–1.60). Composite postoperative morbidity at 30 days was also higher in patients with anaemia than in those without anaemia (adjusted OR 1.35, 1.30–1.40), again consistent in patients with mild anaemia (1.31, 1.26–1.36) and moderate-to-severe anaemia (1.56, 1.47–1.66). When compared with patients without anaemia or a defined risk factor, patients with anaemia and most risk factors had a higher adjusted OR for 30-day mortality and morbidity than did patients with either anaemia or the risk factor alone.

Interpretation Preoperative anaemia, even to a mild degree, is independently associated with an increased risk of 30-day morbidity and mortality in patients undergoing major non-cardiac surgery.

Funding Vifor Pharma.



➔ Retrospective study: 227,425 patients

Hb=haemoglobin

Musallam et al. Lancet 2011;378(9800):1396–1407

Bill Gates Foundation: leading 30 global health problems

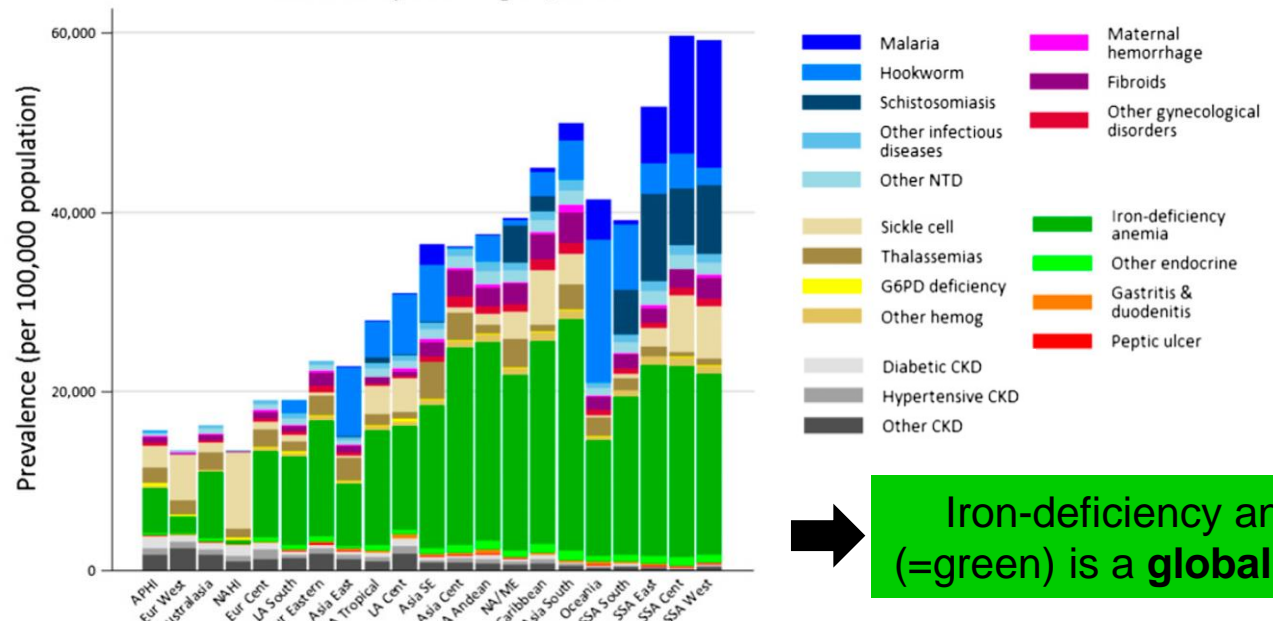
Leading causes 1990	Leading causes 2005	% change number of YLDs 1990-2005	% change all-age YLD rate 1990-2005	% change age-standardised YLD rate 1990-2005	Leading causes 2015	% change number of YLDs 2005-15	% change all-age YLD rate 2005-15	% change age-standardised YLD rate 2005-15
1 Lower back and neck pain	1 Lower back and neck pain	34.5	9.4	-1.8	1 Lower back and neck pain	18.6	4.9	-2.1
2 Iron-deficiency anaemia	2 Sense organ diseases	39.4	13.4	2.1	2 Sense organ diseases	25.2	10.8	0.6
3 Sense organ diseases	3 Iron-deficiency anaemia	14.8	-6.6	-0.6	3 Depressive disorders	18.2	4.5	1.0
4 Depressive disorders	4 Depressive disorders	32.9	8.0	0.6	4 Iron-deficiency anaemia	-3.8	-14.9	-11.6
5 Skin diseases	5 Skin diseases	21.9	-0.8	0.5	5 Skin diseases	11.7	-1.2	0.4
6 Migraine	6 Migraine	29.7	5.5	-0.3	6 Diabetes	32.5	17.2	5.4
7 Other musculoskeletal disorders	7 Other musculoskeletal disorders	51.8	23.4	13.5	7 Migraine	15.3	2.0	0.8
8 Anxiety disorders	8 Diabetes	69.2	37.6	20.7	8 Other musculoskeletal disorders	20.5	6.6	1.3
9 Diabetes	9 Anxiety disorders	26.1	2.6	-1.5	9 Anxiety disorders	14.8	1.5	1.0
10 Asthma	10 Asthma	2.6	-16.5	-15.5	10 Oral disorders	22.4	8.2	-0.2
11 Oral disorders	11 Oral disorders	33.9	8.9	-1.6	11 Asthma	9.4	-3.3	-2.3
12 Falls	12 Schizophrenia	36.1	10.7	0.7	12 Schizophrenia	19.5	5.7	0.3
13 Schizophrenia	13 Falls	13.4	-7.8	-13.9	13 Osteoarthritis	34.8	19.2	3.9
14 COPD	14 COPD	22.2	-0.6	-9.8	14 COPD	16.2	2.8	-5.9
15 Autistic spectrum	15 Osteoarthritis	53.0	24.4	6.3	15 Falls	11.3	-1.5	-8.6



- 20-30% of humans have anaemia
- 1/3 IDA
- 2/3 other causes

AP=Asia Pacific; Cent=central; CKD=chronic kidney disease; Eur=Europe; G6PD=glucose-6-phosphate dehydrogenase; hemog=hemoglobinemia; HI=high income; IDA=iron deficiency anaemia; LA=Latin America; NA=North America; NA/ME=North Africa/Middle East; NTD=neglected tropical diseases; South=Southern; SE=Southeast; SSA=sub-Saharan Africa; YLD=years lived with disability
 GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Lancet 2016;388(10053):1545-1602; Kassebaum et al. Blood 2014;123(5):615-624

Prevalence by GBD Region, 2010



Iron-deficiency anaemia (=green) is a global problem!

Three pillars of PBM

1. Management of pre-operative anaemia

- ▶ Screening and diagnosis
- ▶ Treatment

2. Minimising blood loss and bleeding

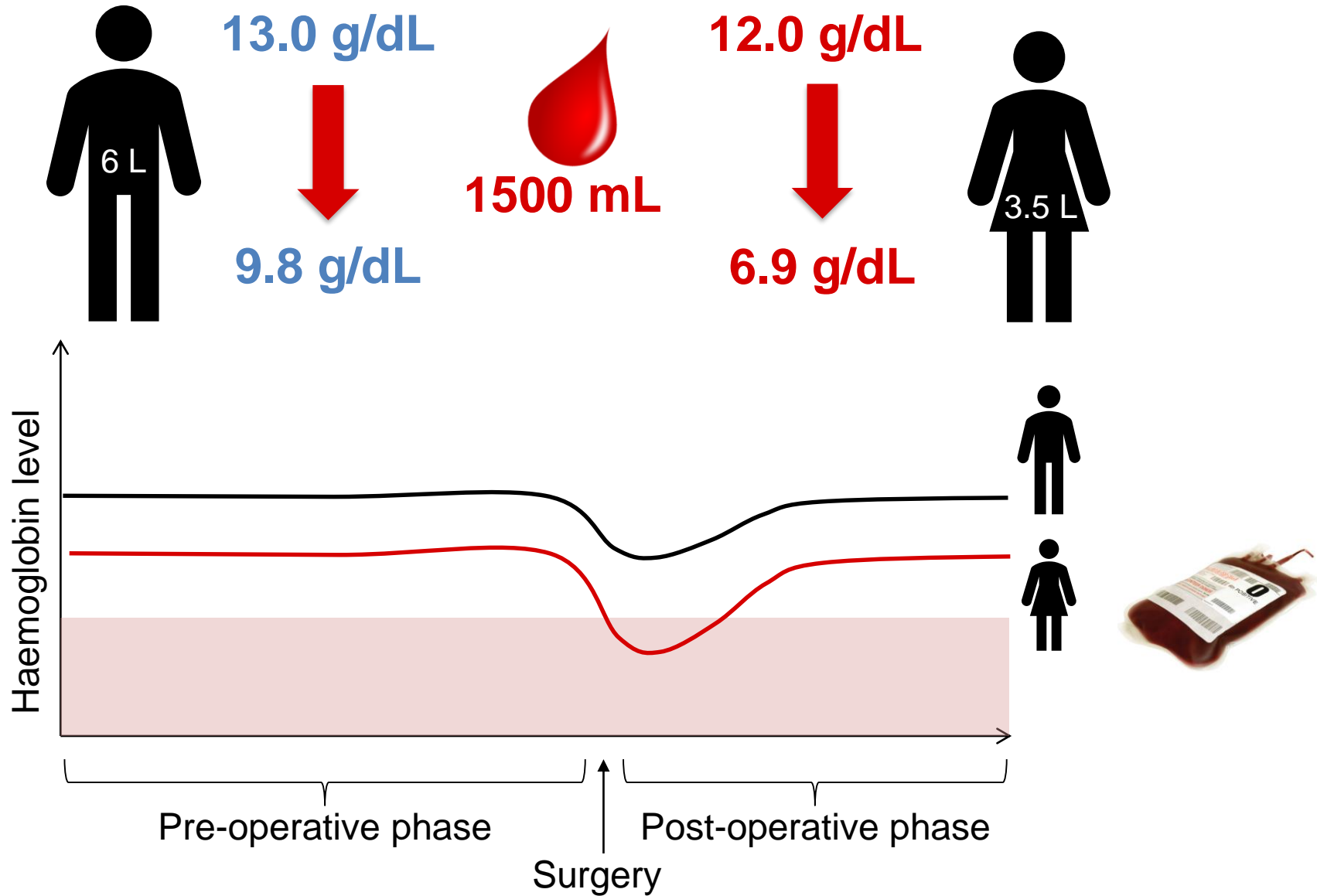
3. Restrictive use of blood units

Patient Blood Management Ambulanz

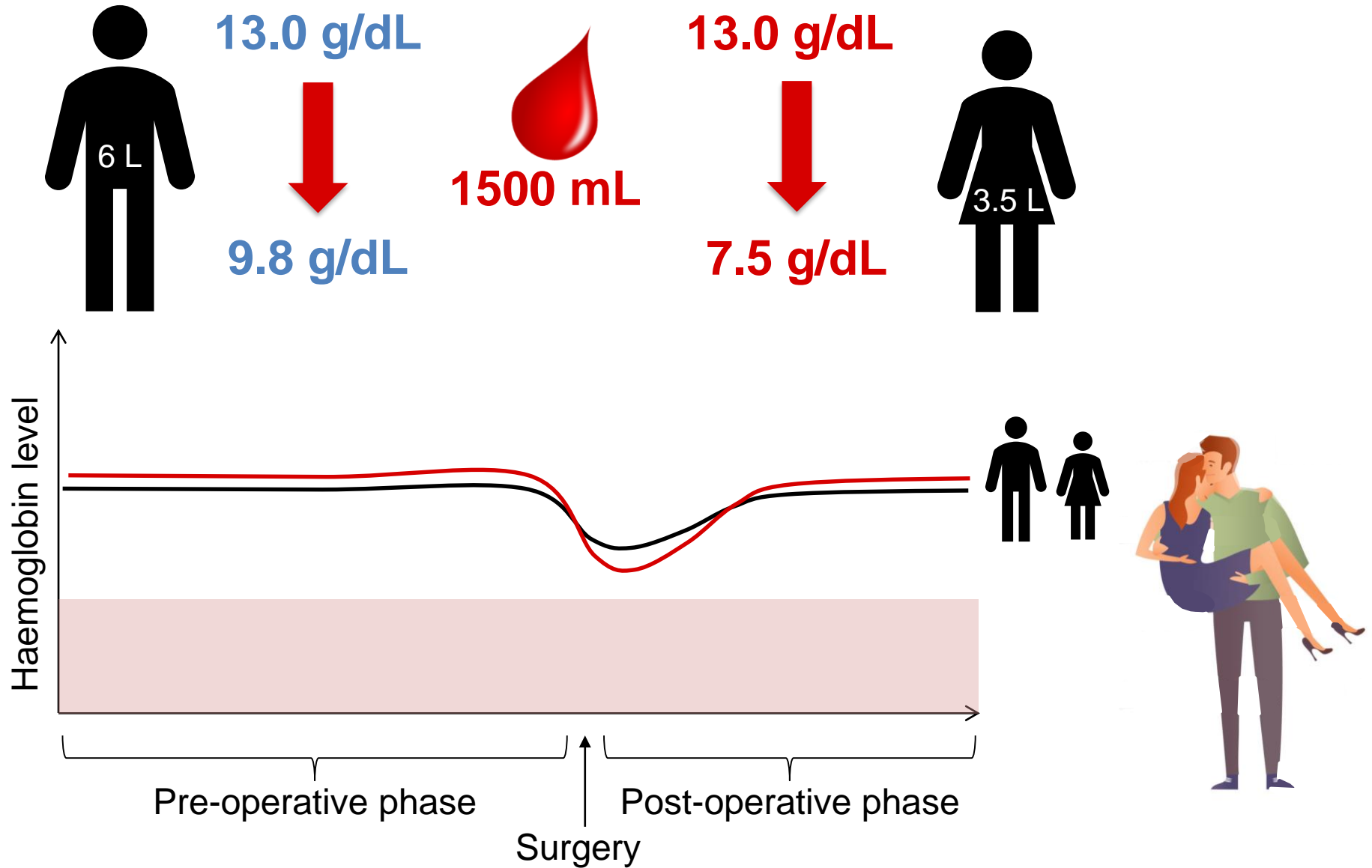
- Contact: Sabine Isik
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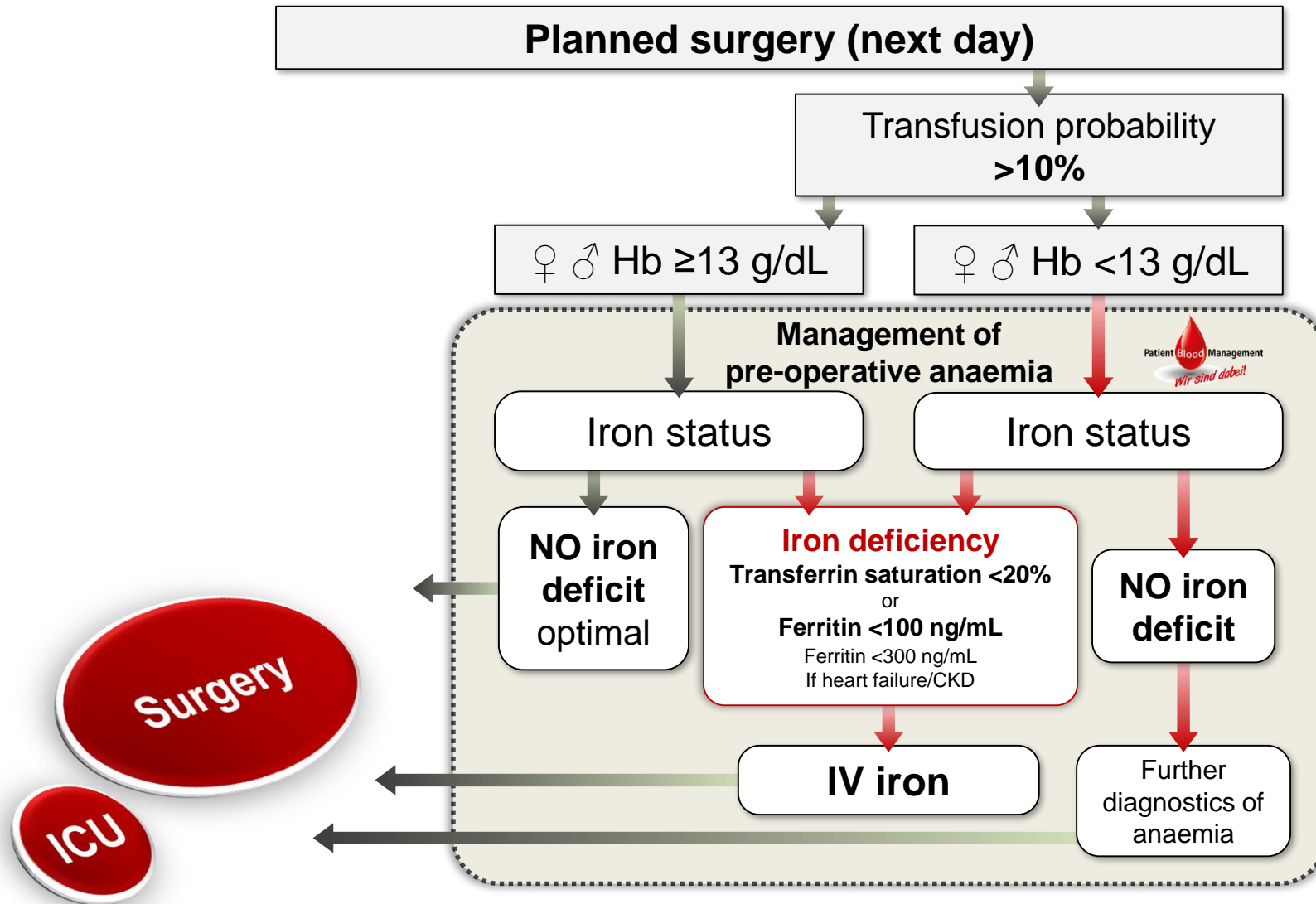
WHO anaemia definition



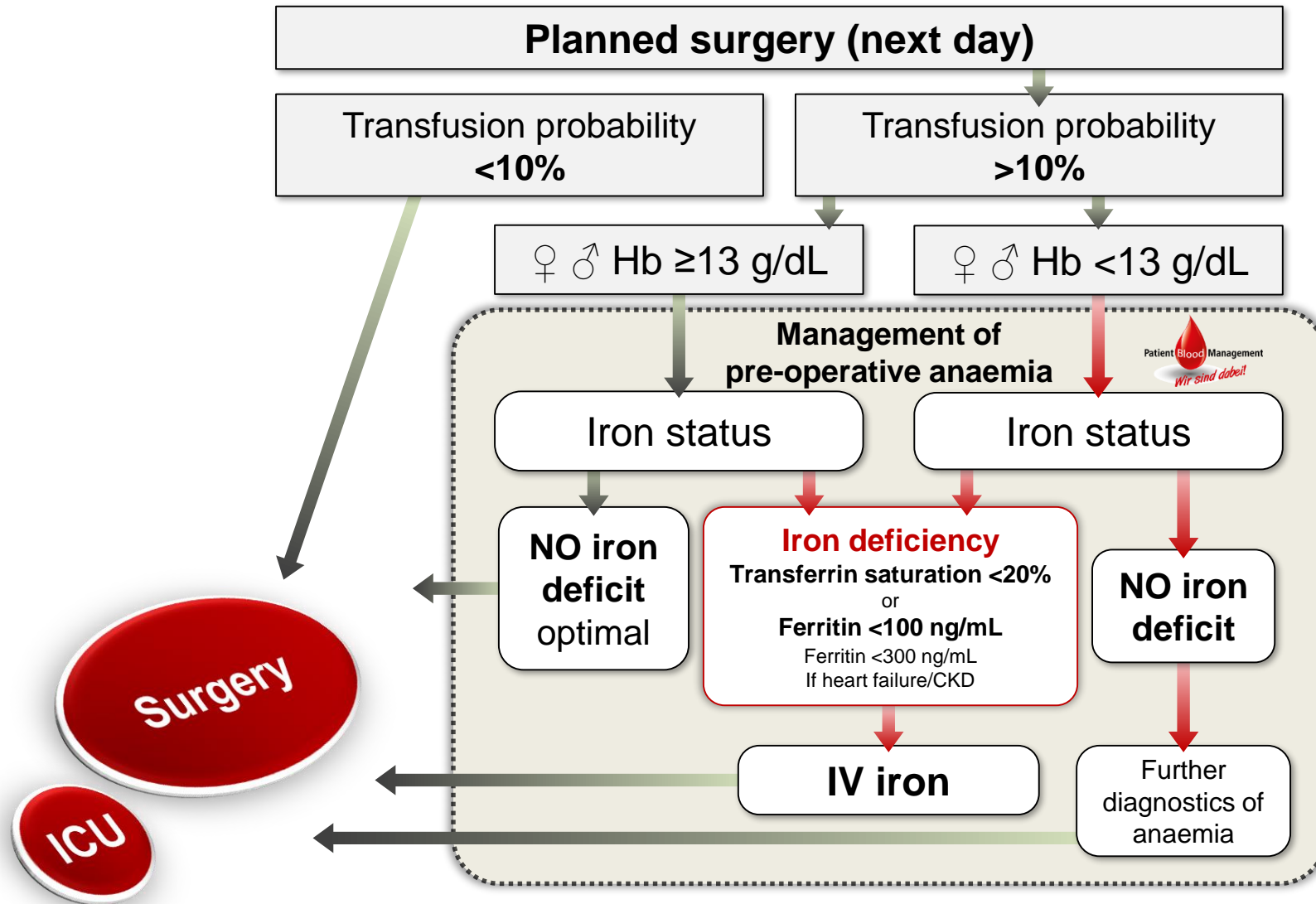
Frankfurt anaemia definition



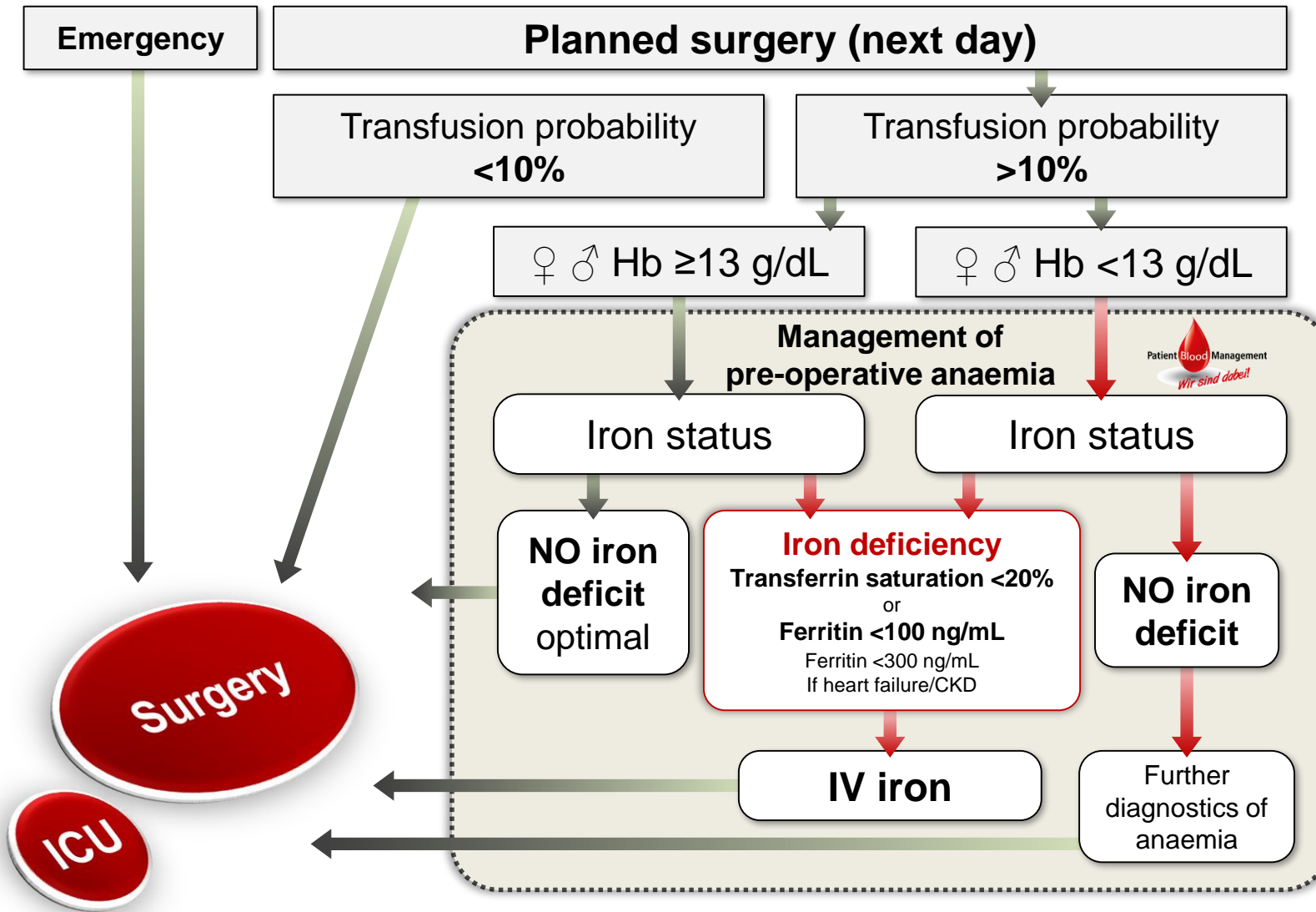
Pre-operative algorithm V4.0



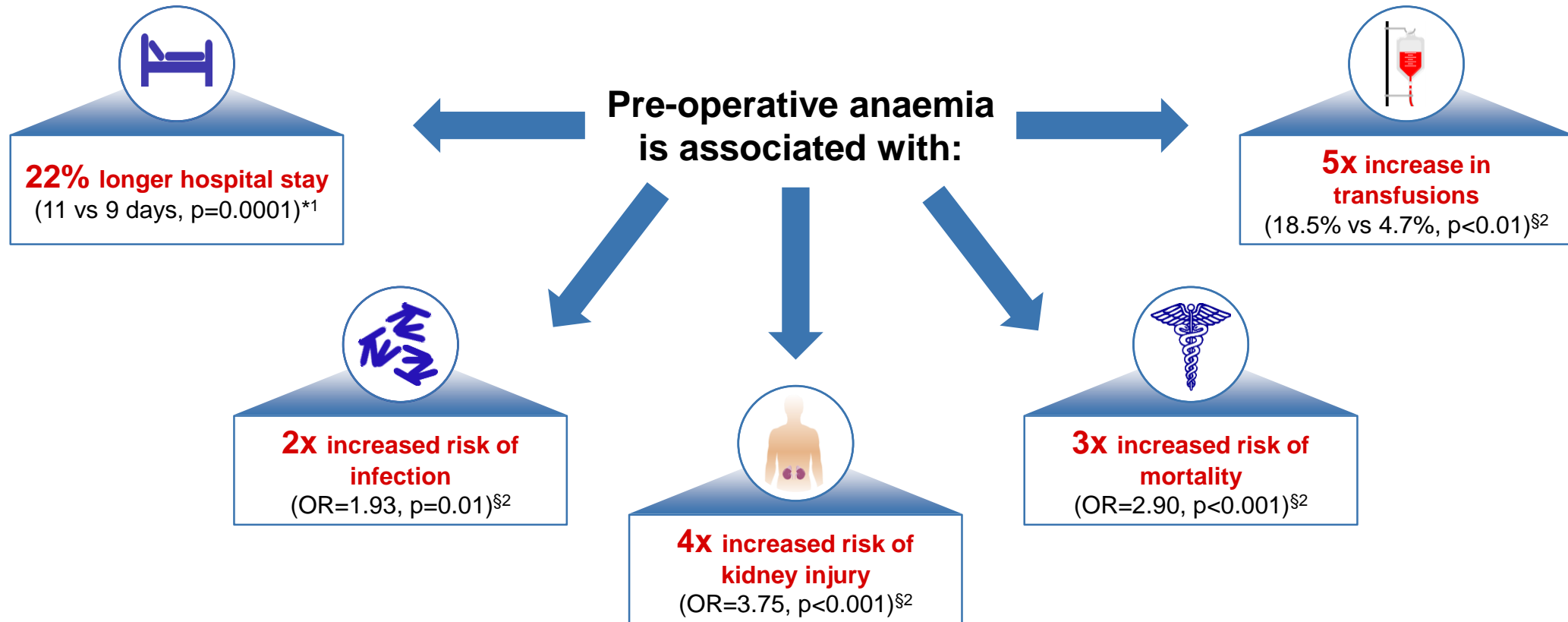
Pre-operative algorithm V4.0



Pre-operative algorithm V4.0



Pre-operative anaemia



*Retrospective single-centre cohort study of consecutive patients >18 years undergoing non-cardiac surgery between March 2003 and June 2006 (N=7,759). Shown are the propensity-matched values for variables that are potential confounders in the relationship between anaemia and post-operative mortality (N=2,090)¹

§Systematic review and meta-analysis of observational studies exploring associations between pre-operative anaemia and post-operative outcomes (24 studies; N=949,445)²

†Retrospective cohort study of major non-cardiac surgery in 2008 (a prospective validated outcomes registry from 211 hospitals worldwide, N=227,425). OR presented had an extended adjustment for a large number of clinically relevant variables³

OR=odds ratio

1. Management of pre-operative anaemia

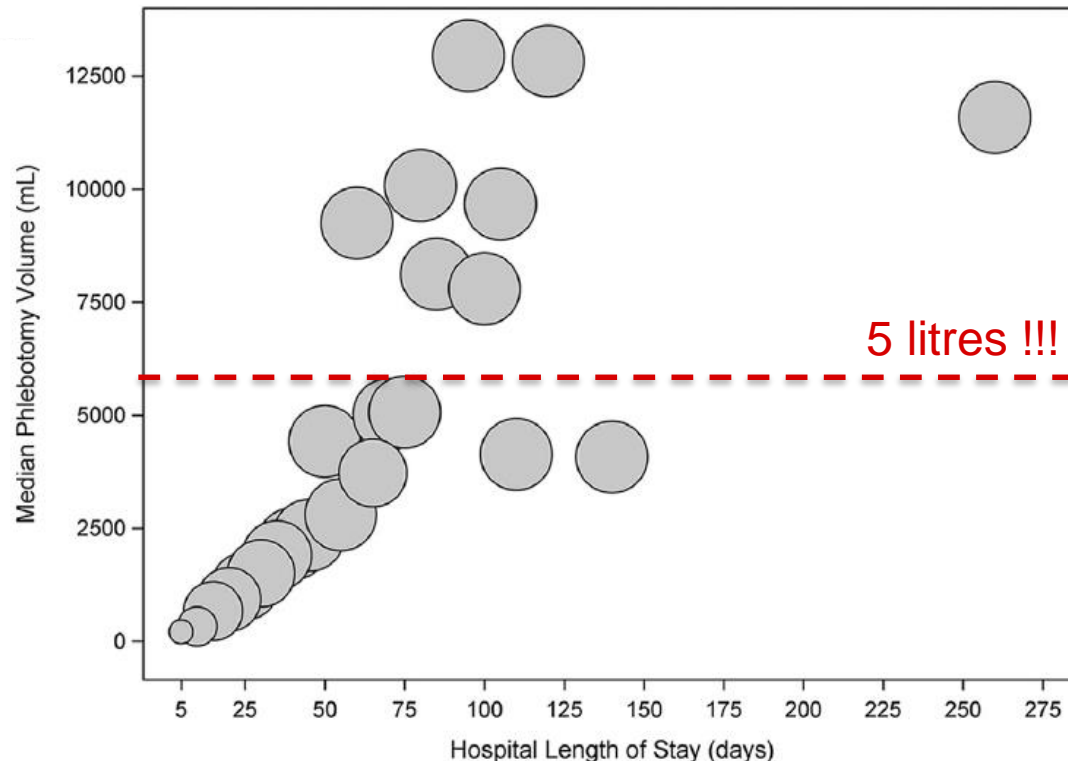
2. Minimising blood loss and bleeding

- ▶ Blood sparing techniques
- ▶ Haemostasis
- ▶ Intra-operative blood salvage
- ▶ Coagulation management

3. Restrictive use of blood units

Contemporary Bloodletting in Cardiac Surgical Care

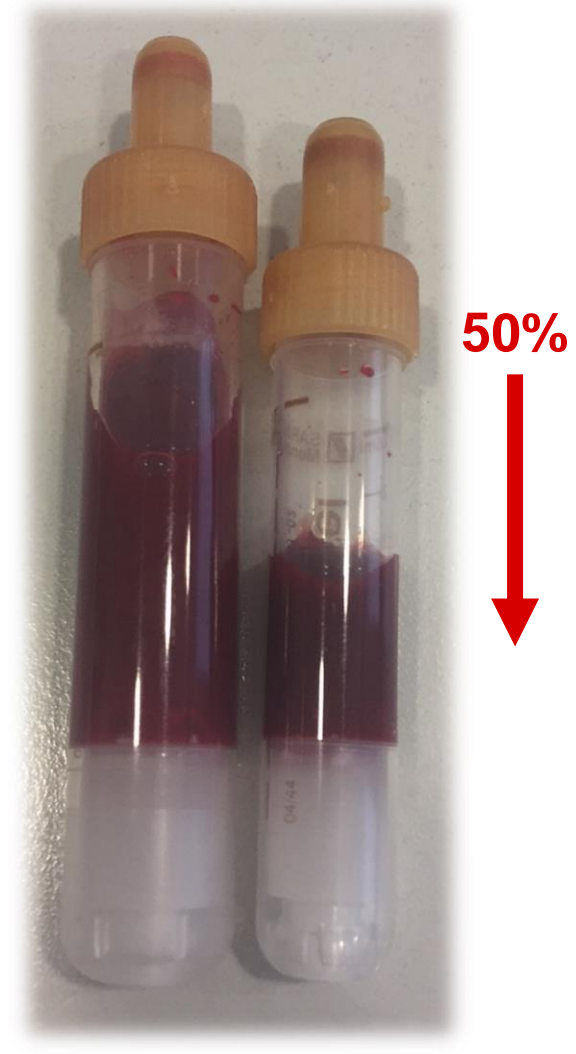
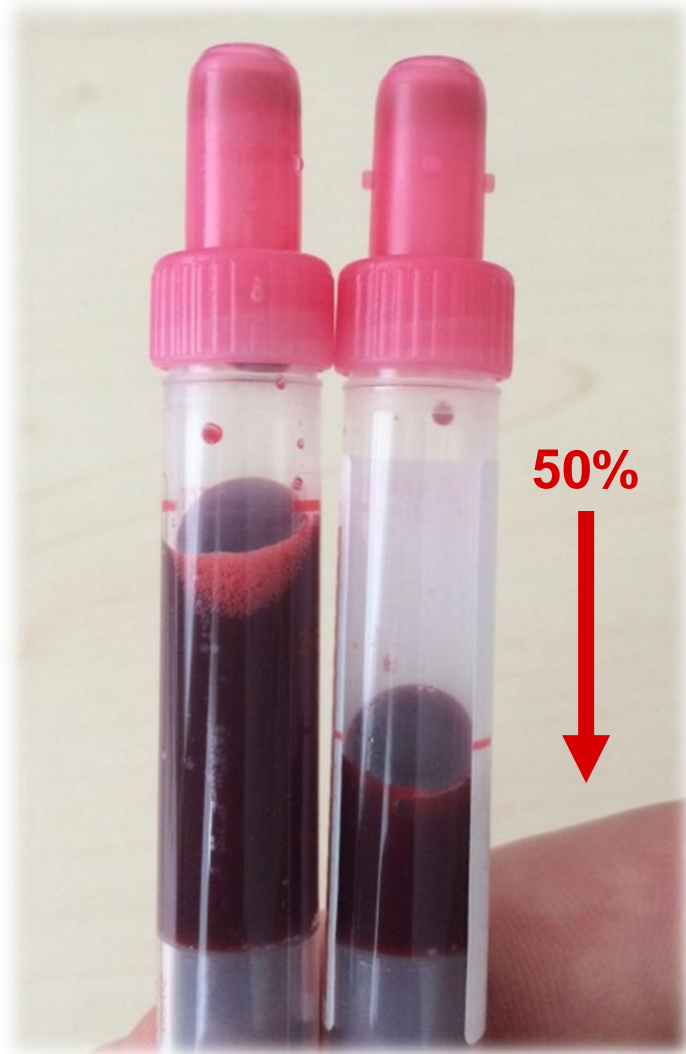
Colleen G. Koch, MD, MS, Edmunds Z. Reineks, MD, PhD, Anne S. Tang, MS, Eric D. Hixson, PhD, MBA, Shannon Phillips, MD, Joseph F. Sabik, III, MD, J. Michael Henderson, MD, and Eugene H. Blackstone, MD



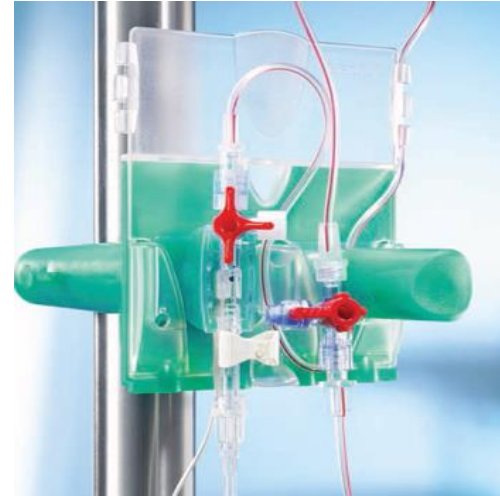
Data (N=1,867 cardiac surgery patients; 221,498 lab tests)

Restrictive blood sampling





Closed invasive pressure monitoring devices



1. Management of pre-operative anaemia

2. Minimising blood loss and bleeding

3. Restrictive use of blood units

- ▶ Monitoring tolerance of anaemia
- ▶ Restricted transfusion trigger

1. Carson JL, Grossman BJ, Kleinman S, et al. Red blood cell transfusion: a clinical practice guideline from the AABB*. *Ann Intern Med* 2012; 157 (1): 49–58.
2. Guidelines of the German Medical Association regarding the use of blood and blood components. 2014; 1–137.
3. Retter A, Wyncoll D, Pearse R, et al. Guidelines on the management of anaemia and red cell transfusion in adult critically ill patients. *Br J Haematol* 2013; 160 (4): 445–464.
4. Padhi S, Kemmis-Betty S, Rajesh S, et al.; Guideline Development Group. Blood transfusion: summary of NICE guidance. *BMJ* 2015; 351: h5832.
5. ...
6. ...

Transfusion trigger checklist

List has to be filled for each RBC unit
 (Exception: massive bleeding)

Hb <6 g/dL

- Independent of any compensation possibility

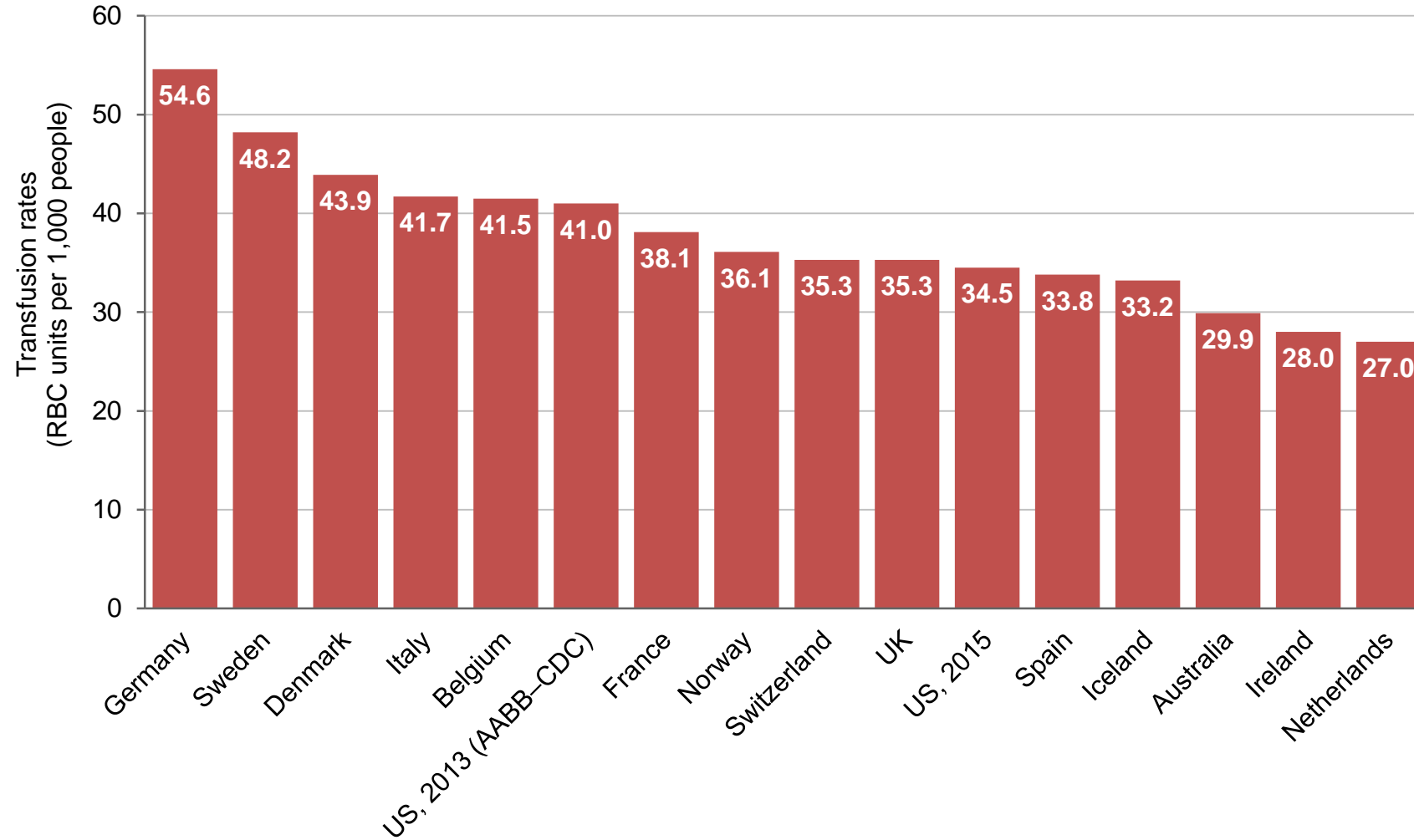
Hb 6–8 g/dL

- Clinical symptoms for anaemic hypoxia (tachycardia, hypotension, ischaemic ECG changes, lactate acidosis)
- Limited compensation, existing risk factors (e.g., coronary artery disease, heart failure, cerebrovascular insufficiency)
- (Other indication:)

Transfusion in case of Hb >8 g/dL are related to an unclear risk–benefit balance

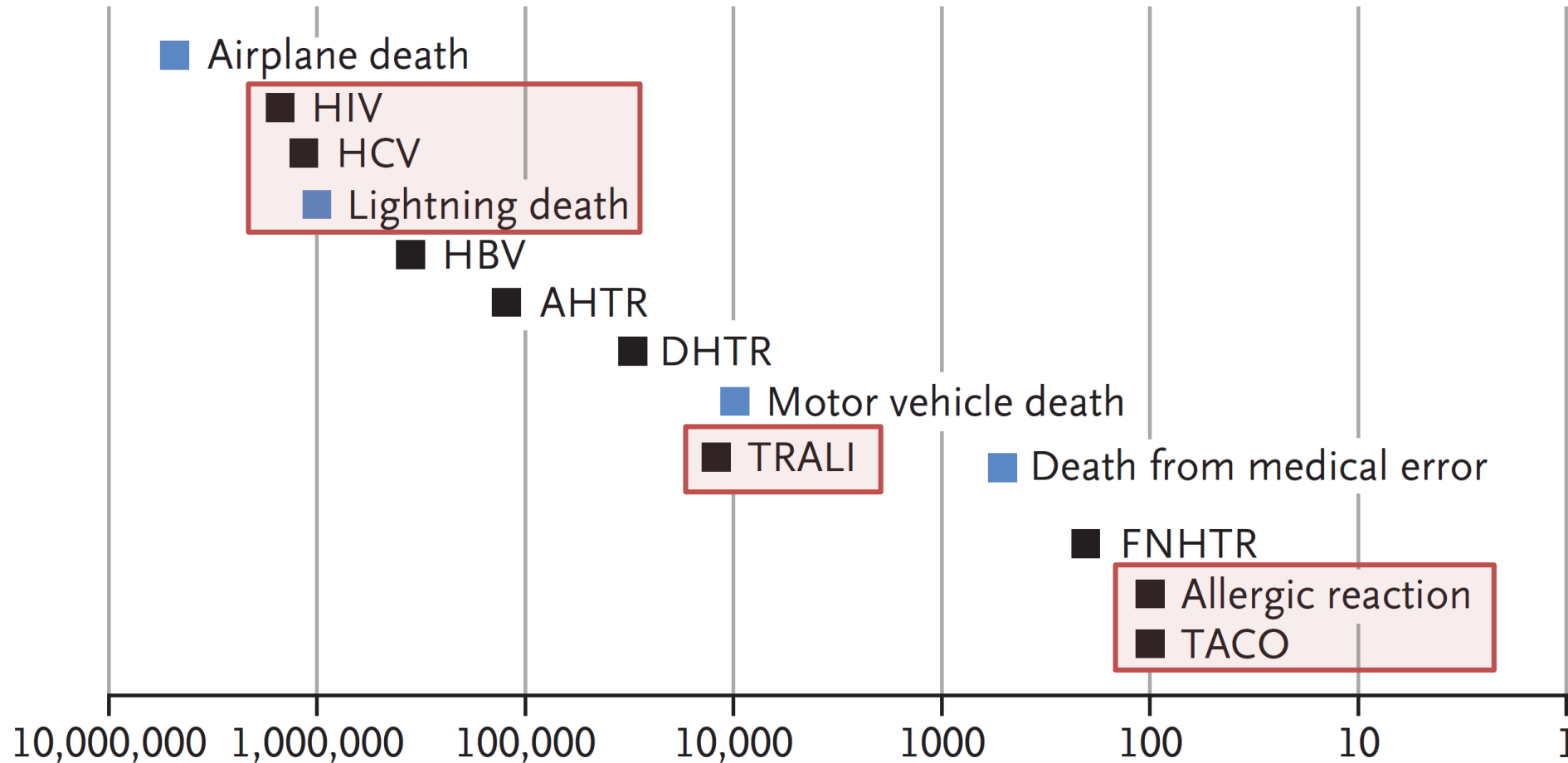
- Hb >8 g/dL (only indicated in individual cases; very low recommendation level [2C])

Most wanted treatment...



Risks of transfusion versus...

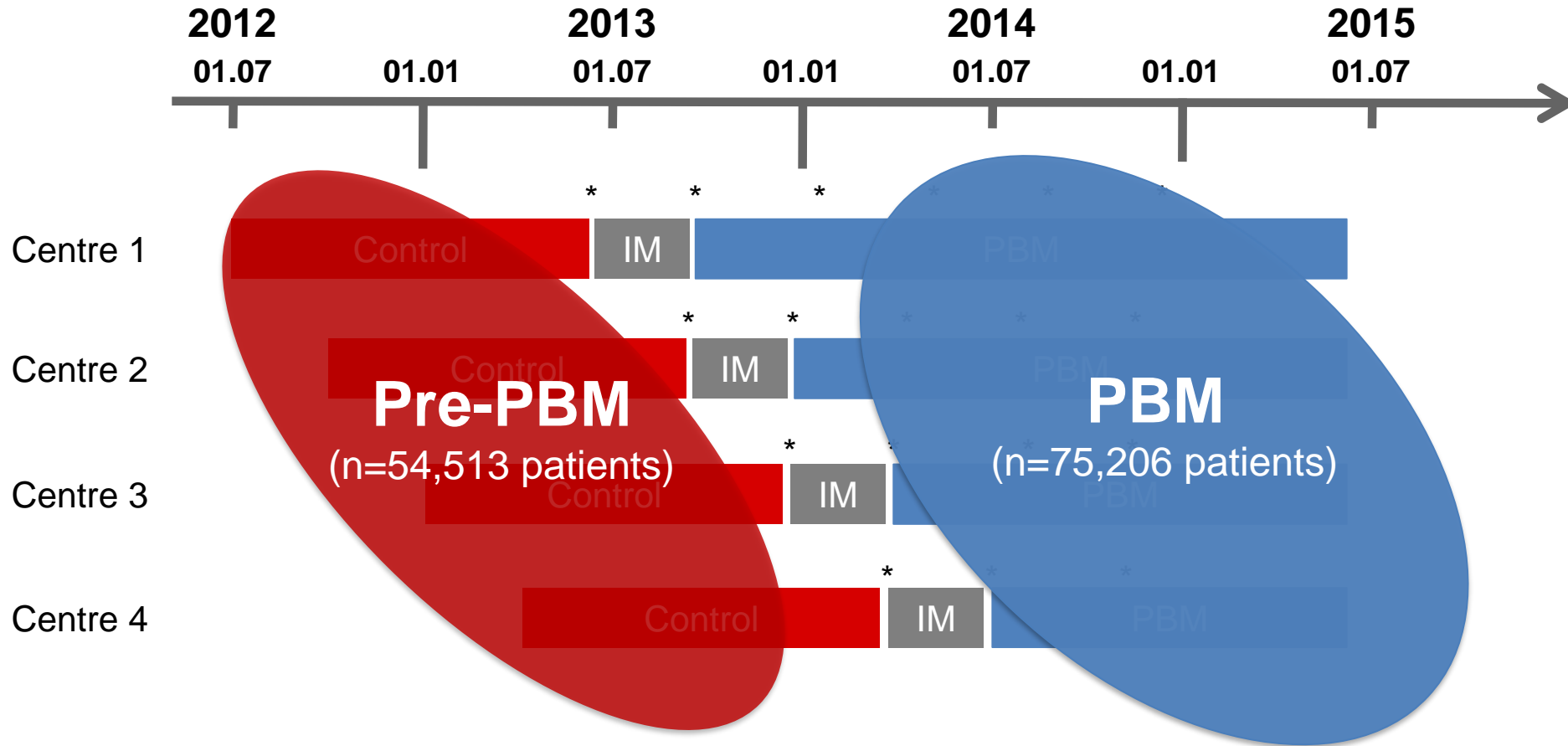
Infectious and non-infectious adverse effects of red-cell transfusions as compared with other, unrelated risks



AHTR=acute haemolytic transfusion reaction; DHTR=delayed haemolytic transfusion reaction; FNHTR=febrile non-haemolytic transfusion reaction; HBV=hepatitis B virus; HCV=hepatitis C virus; HIV=human immunodeficiency virus; TACO=transfusion-associated circulatory overload; TRALI=transfusion-related acute lung injury

Carson et al. N Engl J Med 2017;377(13):1261–1272

PBM study



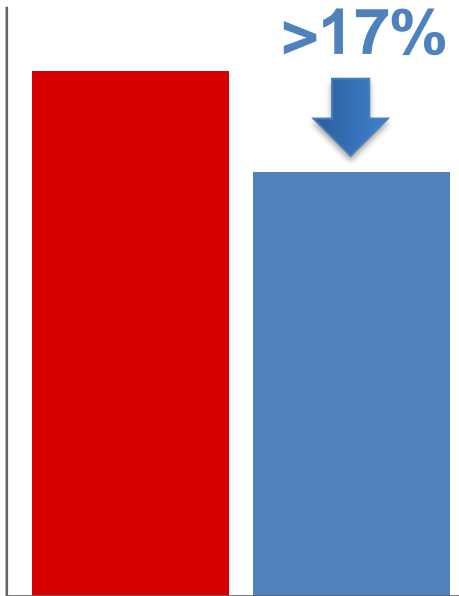
Patients from four University Hospitals (Bonn, Frankfurt, Kiel, Münster)

IM=implementation of PBM; PBM=patient blood management

Meybohm et al. Ann Surg 2016;264(2):203–211

PBM study results

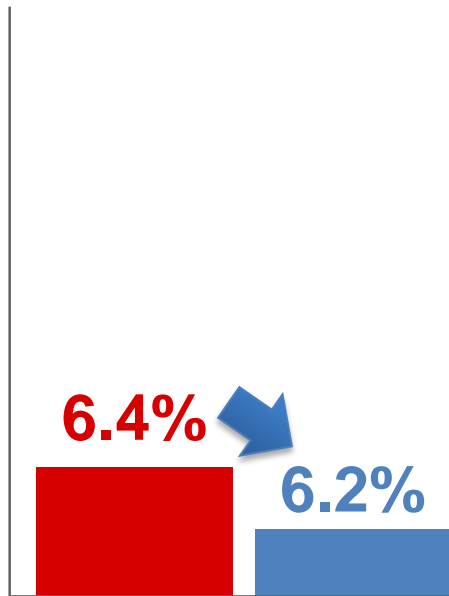
Transfusions



Pre-PBM



Complications



Pre-PBM



Costs



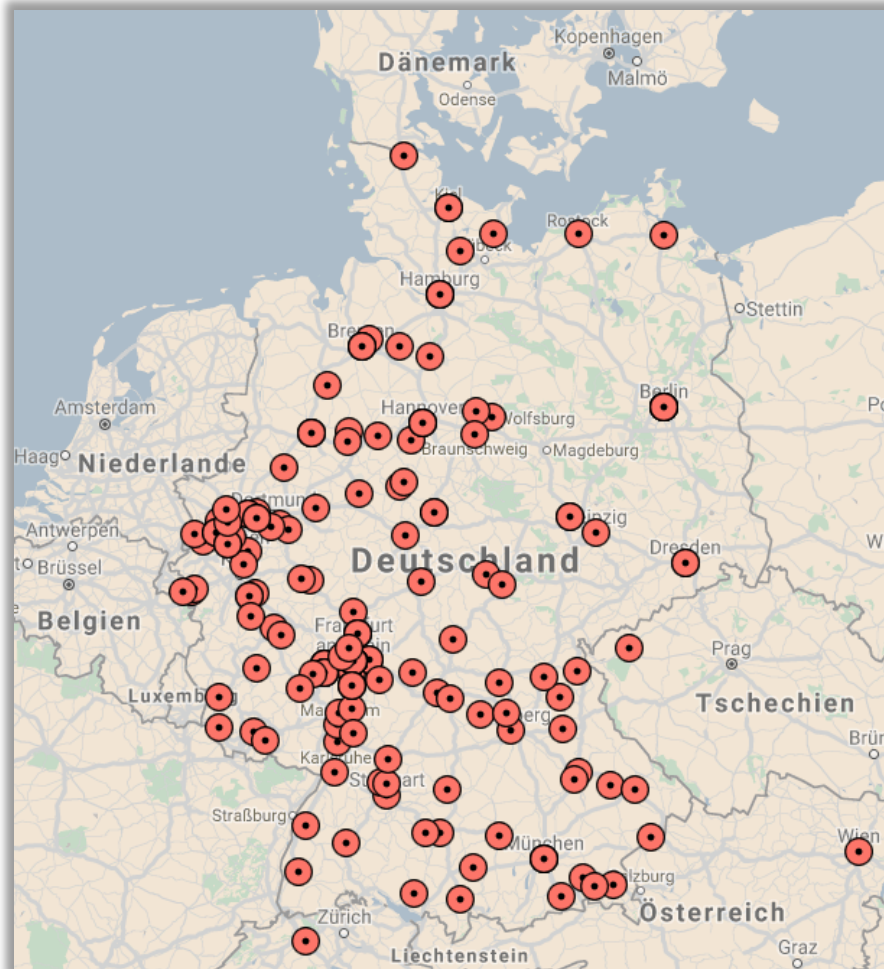
Pre-PBM



2019: >40%

German PBM network

(2014 founded)



European
PBM network
 Patient Blood Management
 (Founded 2016)



Wir sind dabei!



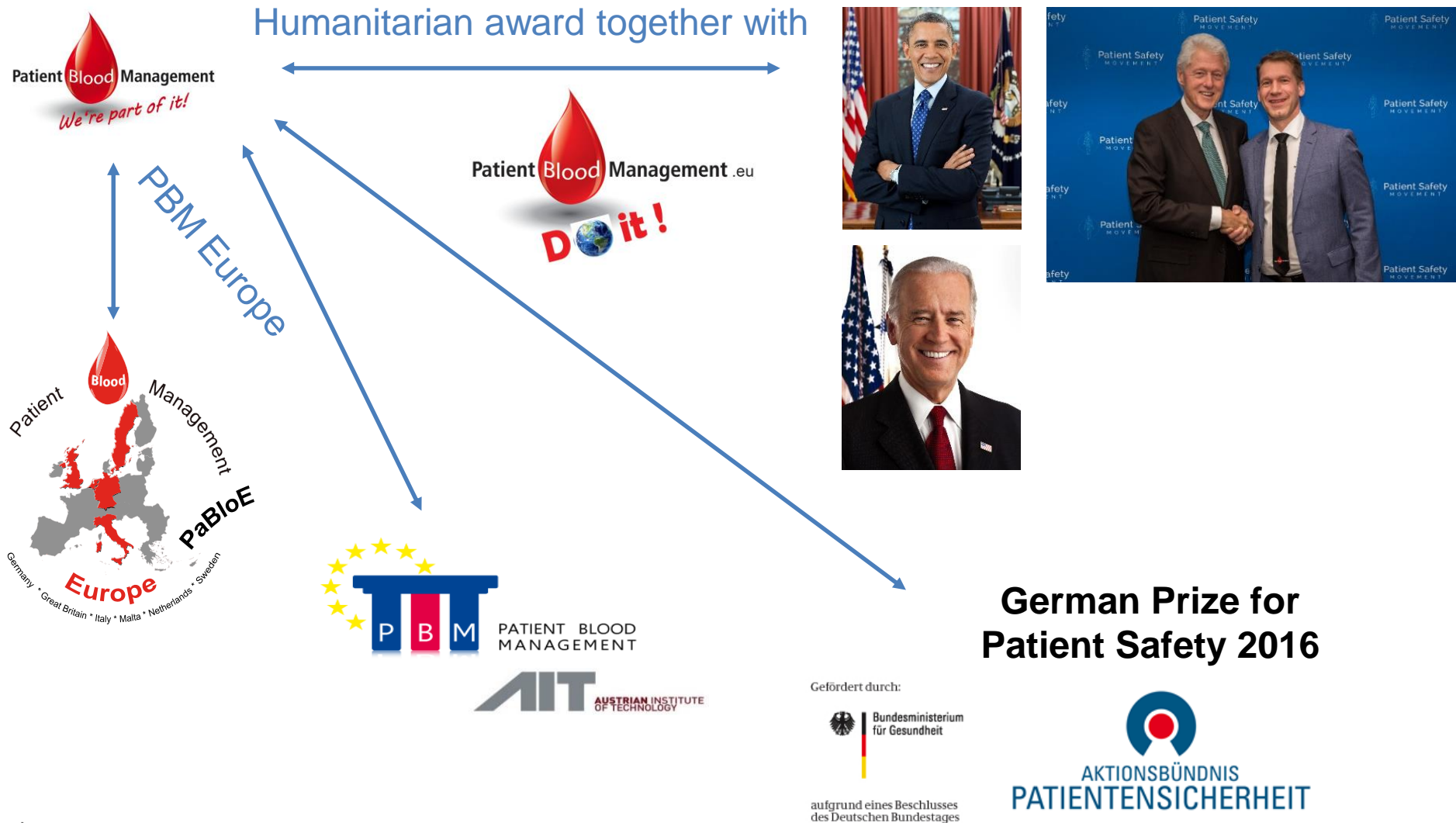
- ✓ Participation free
- ✓ Support with implementation
- ✓ Marketing & education

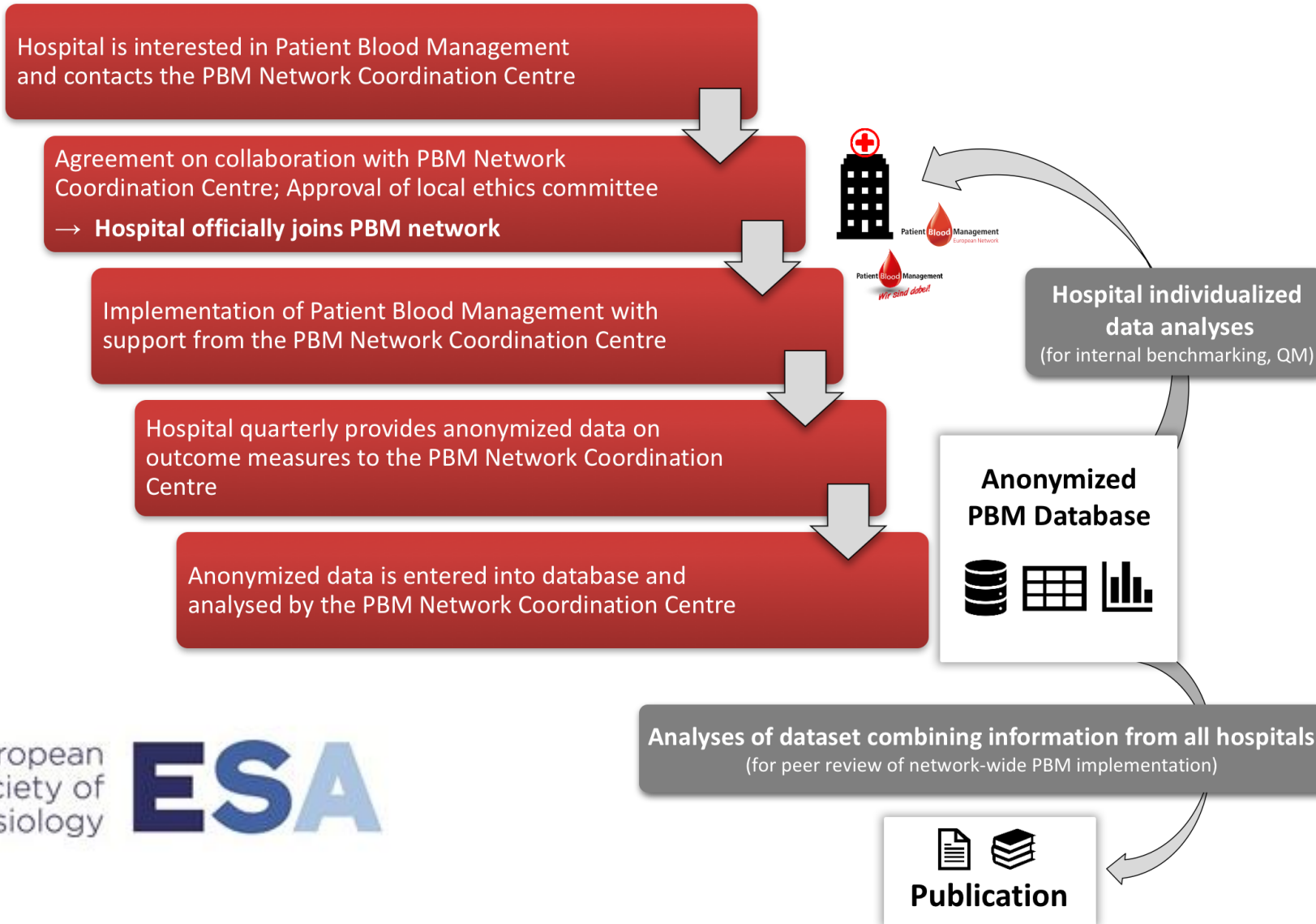
Global
PBM network
 (Founded 2017)



More than 160 hospitals worldwide

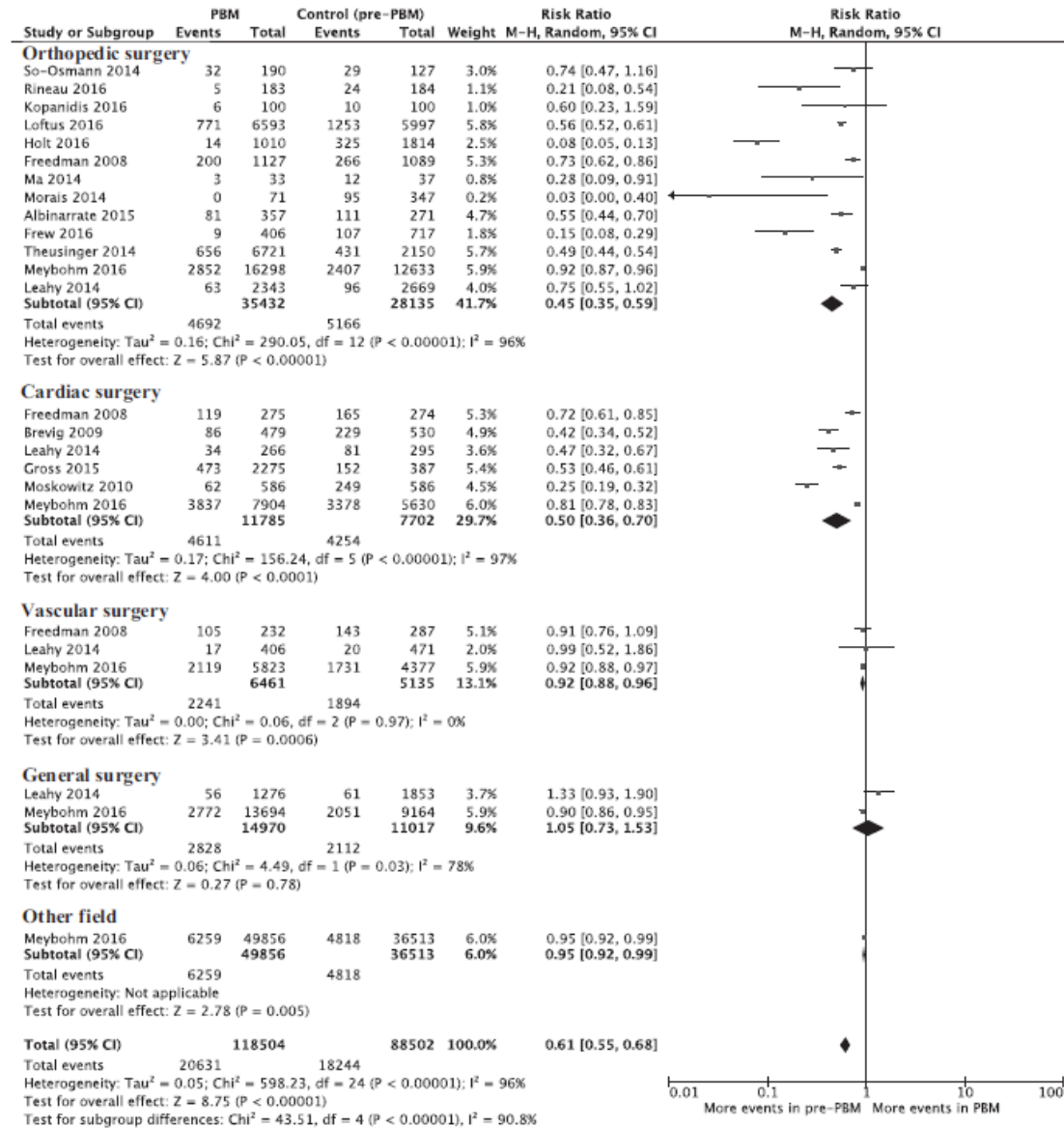
PBM international – patient safety





- Systematic review and meta-analysis
- Studies had to address each of the three PBM pillars with at least one measure per pillar, e.g., pre-operative anaemia management + cell salvage + rational transfusion strategy
- Study protocol: registered with PROSPERO (CRD42017079217)
- 17 studies with 235,779 surgical patients (100,886 pre-PBM group and 134,893 PBM group)

Transfusion rate



Orthopaedic surgery

Heart surgery

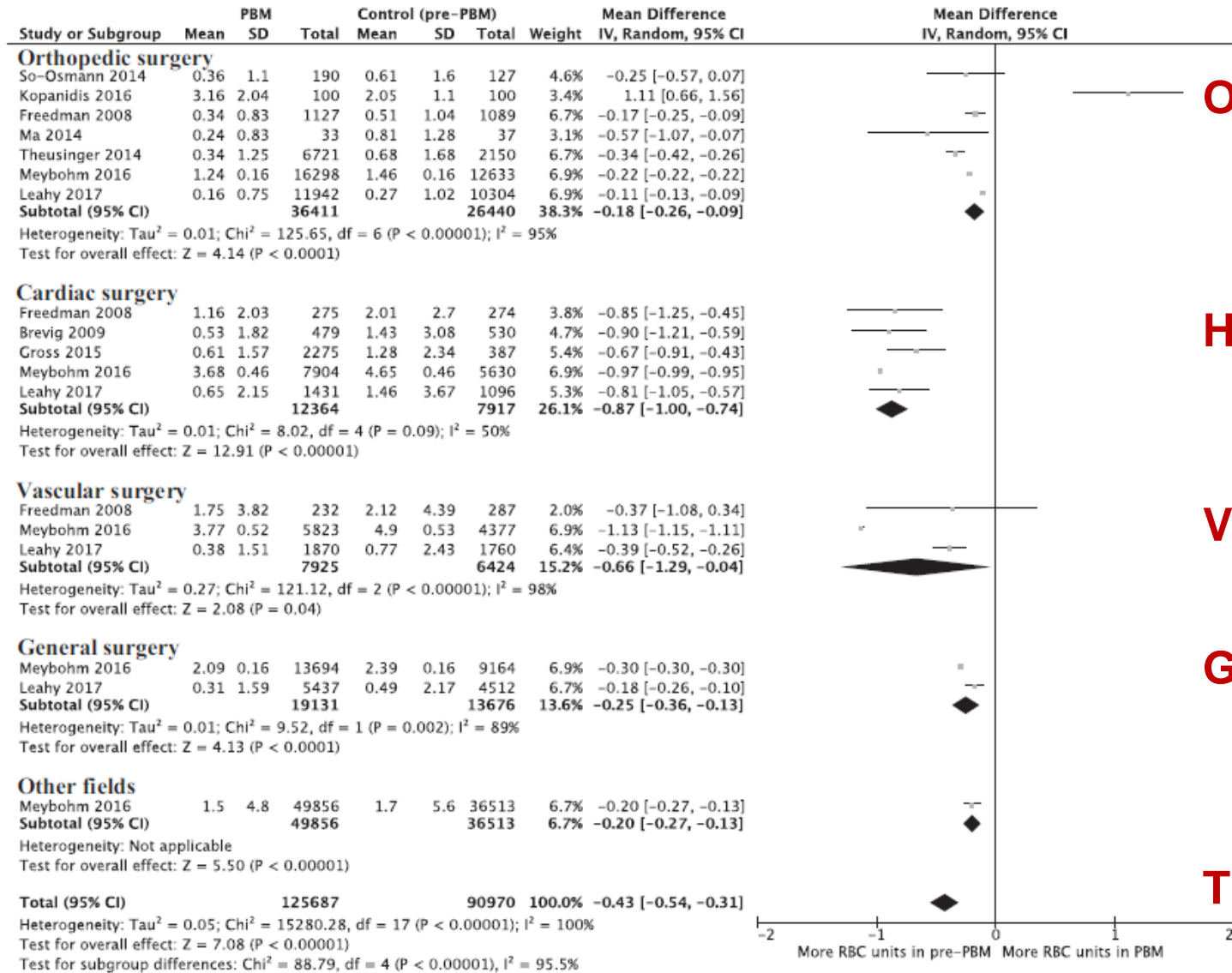
Vascular surgery

General surgery

Total

CI=confidence interval;
 PBM=patient blood management
 Althoff et al. Ann Surg 2019;269(5):794–804

Number of RBC units per patient



Orthopaedic surgery

Heart surgery

Vascular surgery

General surgery

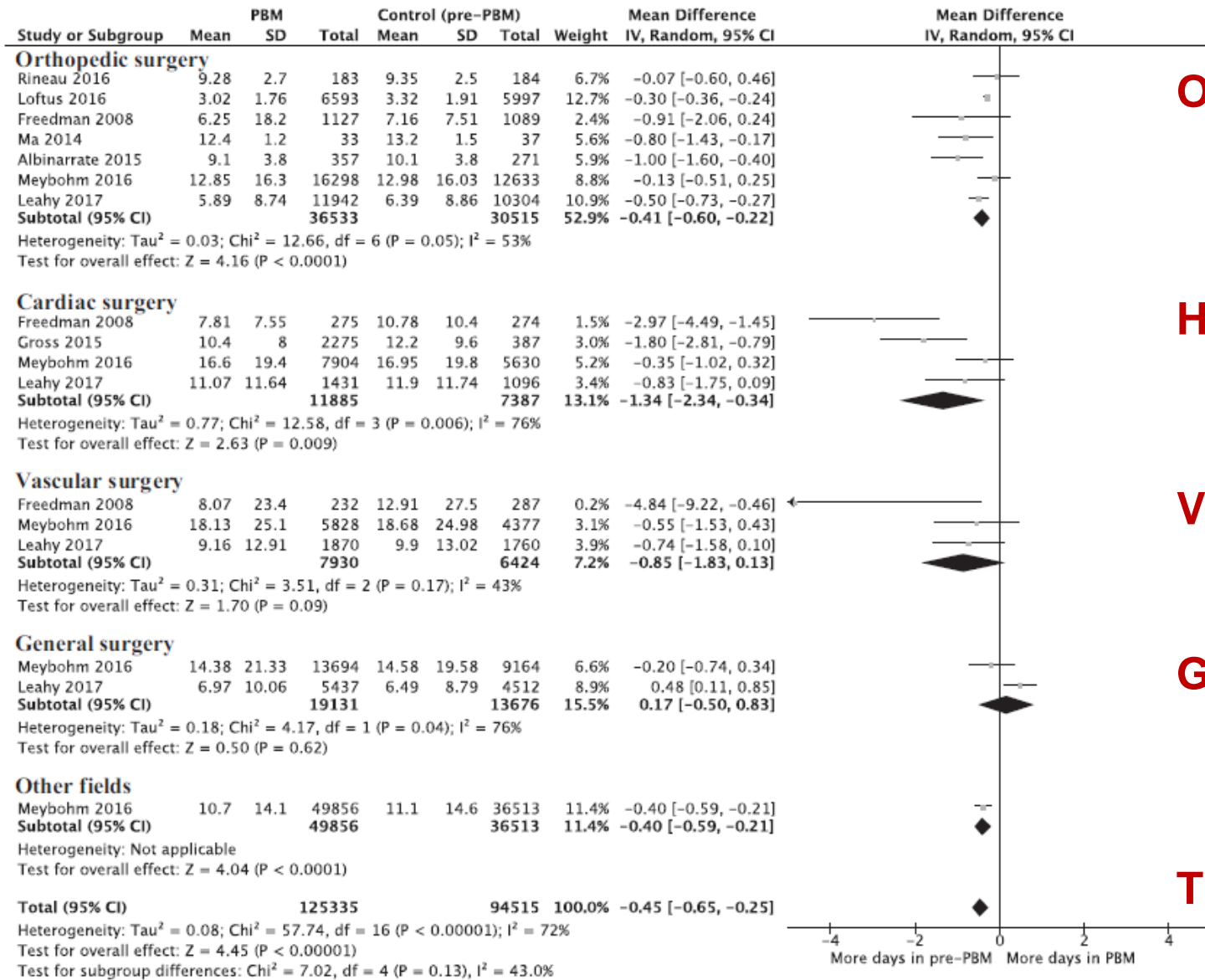
Total

CI=confidence interval;

PBM=patient blood management; RBC=red blood cell

Althoff et al. Ann Surg 2019;269(5):794–804

Length of hospital stay

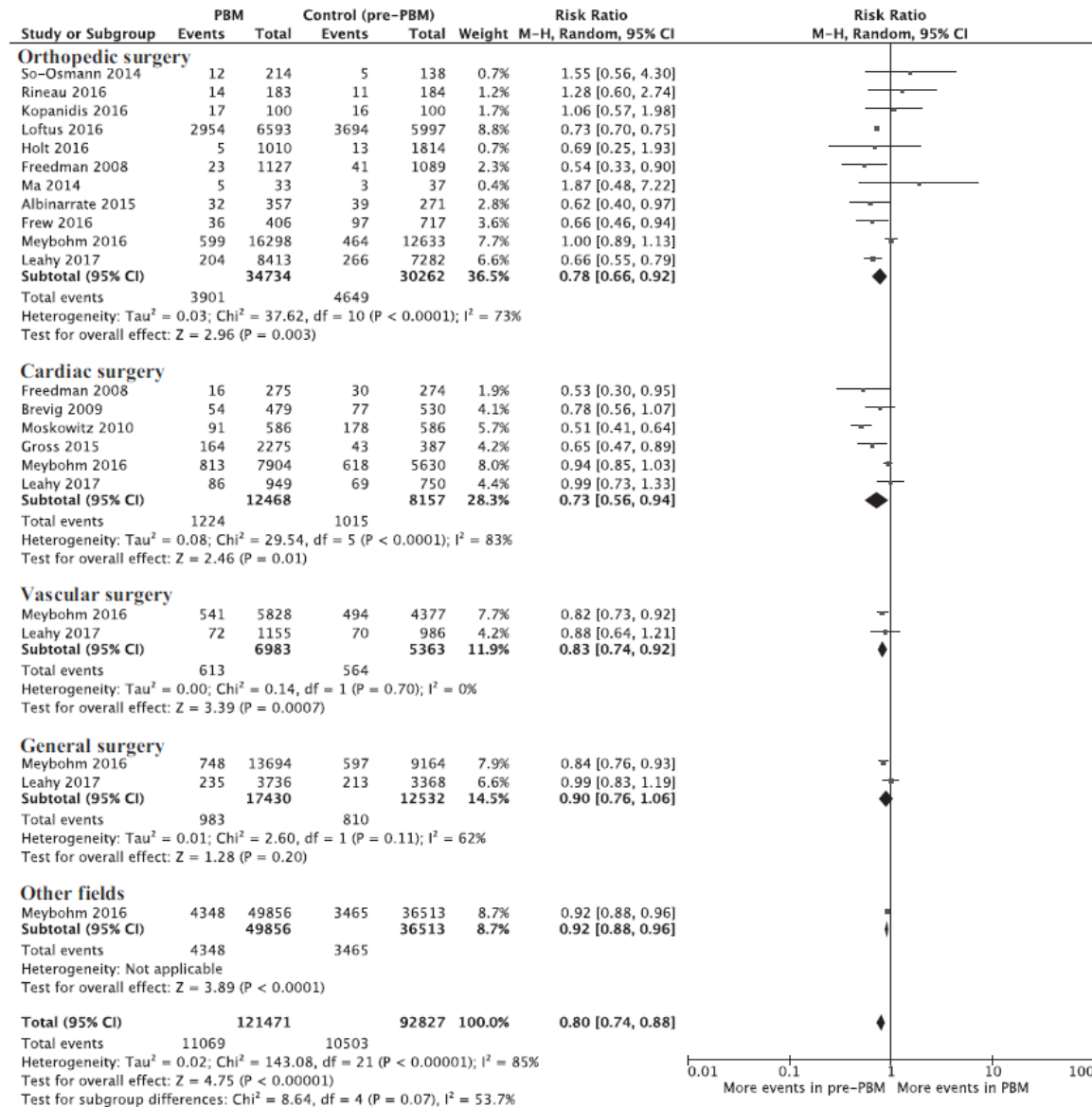


CI=confidence interval;

PBM=patient blood management

Althoff et al. Ann Surg 2019;269(5):794–804

Number of complications



Orthopaedic surgery

Heart surgery

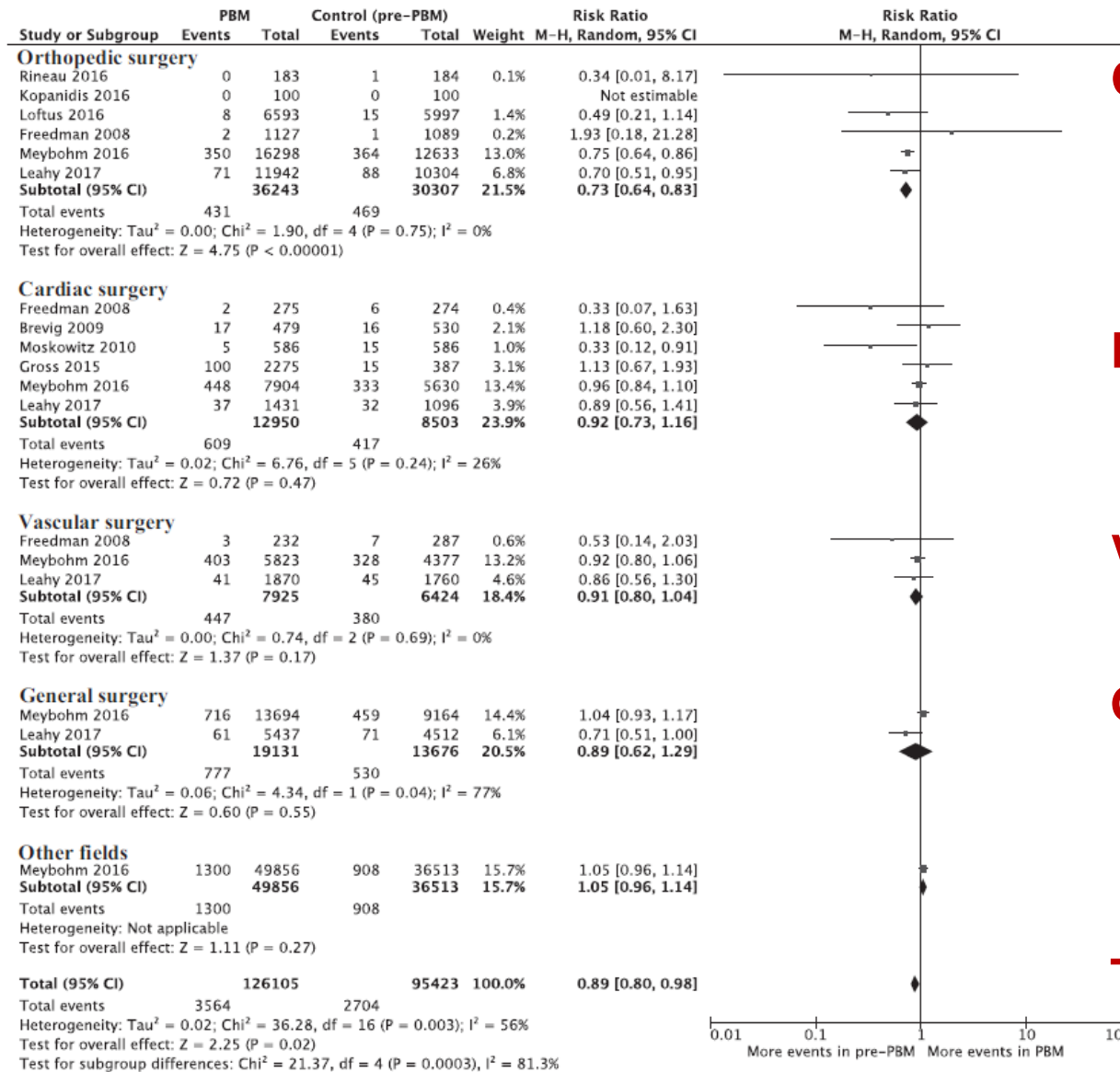
Vascular surgery

General surgery

Total

CI=confidence interval;
 PBM=patient blood management
 Althoff et al. Ann Surg 2019;269(5):794–804

Mortality



Orthopaedic surgery

Heart surgery

Vascular surgery

General surgery

Total

CI=confidence interval;

PBM=patient blood management

Althoff et al. Ann Surg 2019;269(5):794–804



Patient Blood Management: Patienten schützen, Ressourcen sparen

Deutschlandweit werden pro Jahr fast vier Millionen Blutkonserven verab-

Newsletter
für Journalisten

Gesundheit



BARMER



Leibniz-Institut für
Wirtschaftsforschung

BARMER-Krankenhausreport 2019



dem haben die vier Uniklinika die bis dato weltweit größte Begleitstudie zur Qualitätssicherung beim PBM durchgeführt, bei der fast 130.000 Patienten einbezogen wurden.

Uniklinika als Innovationsmotor stärken

Das Patient Blood Management zeigt: Uniklinika übernehmen Gemeinwohl-Aufgaben für das Versorgungssystem und bringen über Netzwerkbildung neue Konzepte in die Fläche. Die Politik sollte diese Rolle der Universitätsklinik als Vorreiter für Innovationen stärker unterstützen. Die Rahmenbedingungen für diese besonderen Aufgaben, die im standardisierten Finanzierungssystem nicht abgebildet sind, müssen dringend verbessert werden.

Störende Rötungen im Gesicht
Rosazea erkennen und
behandeln 5

Hätten Sie's gewusst?
Warum ist der Musculus
Iliopsoas so wichtig? 7

Blutprodukte in Deutschland grundsätzlich unbedenklich sind, darf man nicht vergessen, dass jede Transfusion eine Art Mini-Transplantation ist, inklusive aller damit verbundenen Risiken und Nebenwirkungen*, so Marschall. So kann es beispielsweise zu einer Überforderung des Immunsystems, allergischen Reaktionen oder – trotz aller Sicherheitsmaßnahmen – zur Übertragung von Bakterien und Viren kommen. Außerdem zeigen Studien, dass Patienten, die Blutspenden erhalten haben, anfälliger für einen Herzinfarkt, einen Schlaganfall oder eine Lungenembolie sind.