A patient blood management (PBM) strategy for SA – highlights of the SAMJ submission

Dr Jackie Thomson

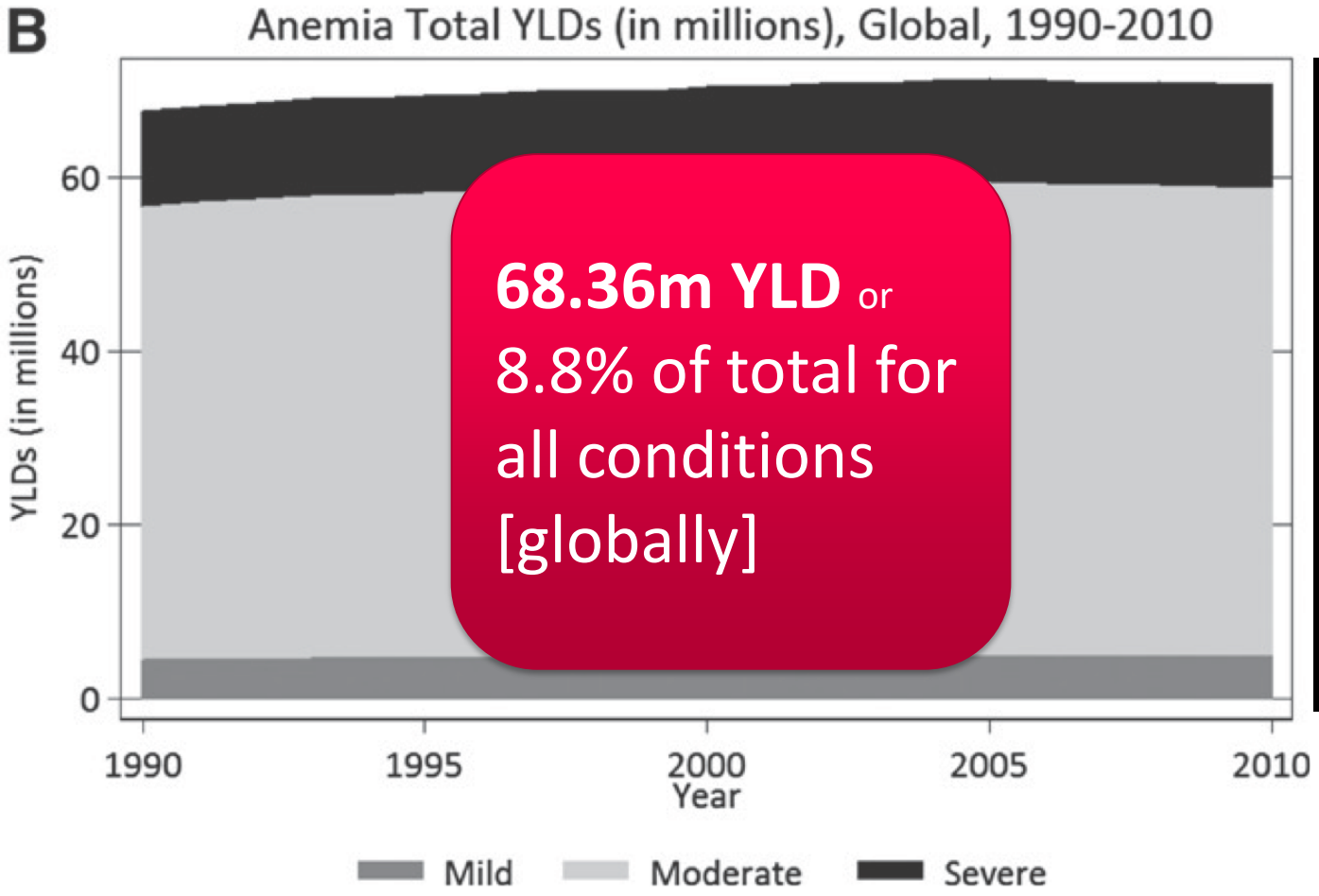
The triad of independent risk factors for adverse patient outcome

Anaemia

blood
2014 123: 615-624
doi:10.1182/blood-2013-06-508325 originally published online December 2, 2013

A systematic analysis of global anemia burden from 1990 to 2010

Nicholas J. Kassebaum, Rashmi Jasrasaria, Mohsen Naghavi, Sarah K. Wulf, Nicole Johns, Rafael Lozano, Mathilda Regan, David Weatherall, David P. Chou, Thomas P. Eisele, Seth R. Flaxman, Rachel L. Pullan, Simon J. Brooker and Christopher J. L. Murray



68.36m YLD or 8.8% of total for all conditions [globally]

Associated w/

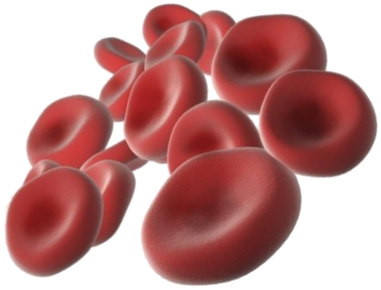
- weakness
- fatigue
- difficulty concentrating
- poor work productivity
- infection
- heart failure
- preterm labor
- low birth weight
- child and maternal mortality

Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015

*GBD 2015 Disease and Injury Incidence and Prevalence Collaborators**

www.thelancet.com **Vol 388 October 8, 2016**

- The impairment that affected the greatest number of people in 2015 was **anaemia, with 2.36 billion (2.35–2.37 billion) individuals affected**
- The prevalence of **iron-deficiency anaemia** alone was **1.46 billion** (1.45-1.46 billion).



Systematic review

Meta-analysis of the association between preoperative anaemia and mortality after surgery

- **949'449 patients of 24 studies analyzed**
- **39% of patients were anemic (WHO definition)**
- **Anemia was associated with**
  - Perioperative mortality ⬆ - OR 2.90 (2.30 – 3.68, p< 0.001)
  - Acute kidney injury ⬆ - OR 3.75 (2.95 – 4.76, p< 0.001)
  - Infections ⬆ - OR 1.93 (1.06 – 1.55, p< 0.01)
  - Stroke in cardiac surgery ⬆ - OR 1.28 (1.17 – 3.18, p< 0.01)
  - RBC transfusion ⬆ - OR 5.04 (4.12 – 6.17, p< 0.001)

Fowler A.J. et al. Br J Surg (2015) 102: 1314

THE LANCET

Articles

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

US Veterans Database (NSQIP) (n=227'425)

Anaemia (n=69'229; 30.4%)

30 day mortality

30 day composite morbidities (9 defined areas)

Multivariate regression analysis

(9 defined subgroups)

(56 confounders)

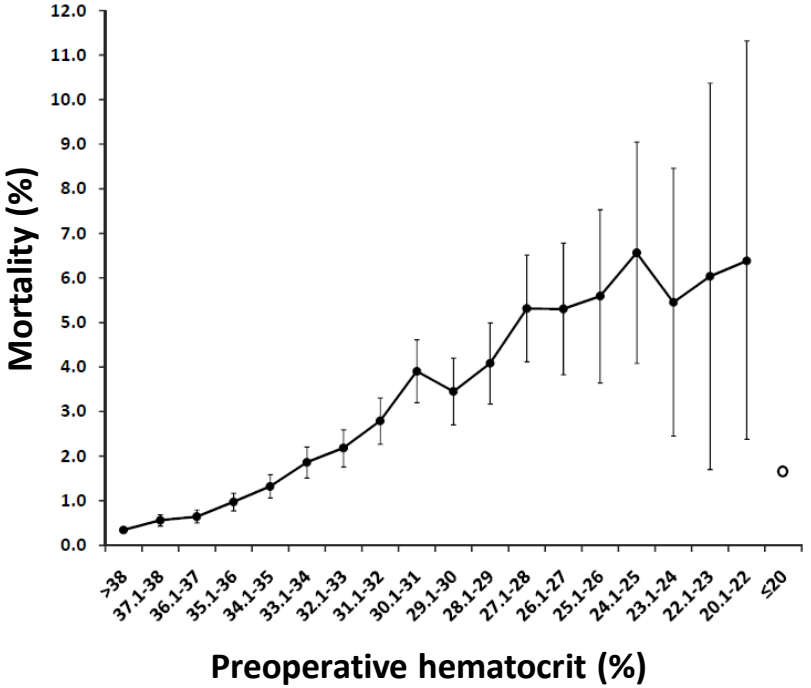
Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study

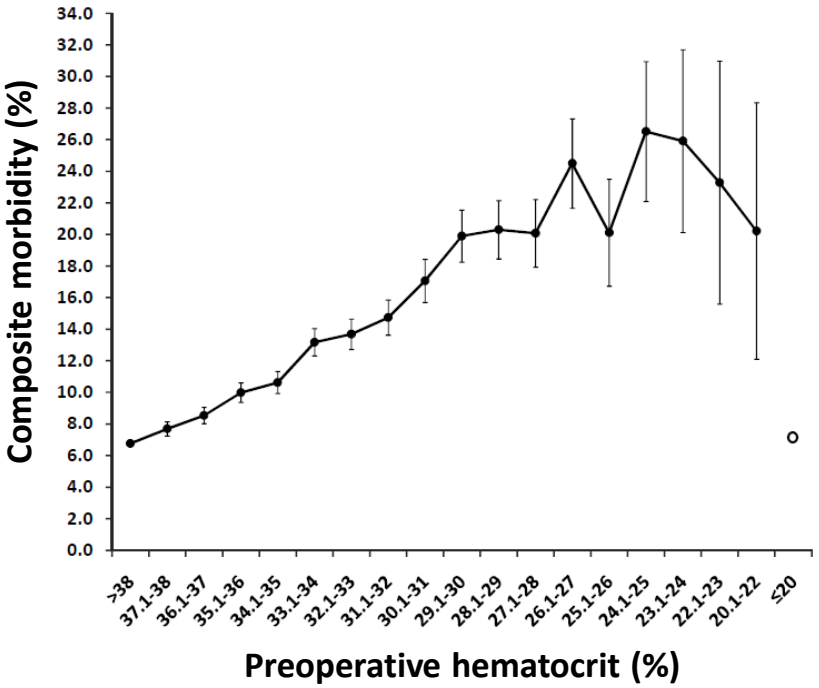
Khaled M Musallam, Hani M Tamim, Toby Richards, Donat R Spahn, Frits R Rosendaal, Aida Habbal, Mohammad Khreiss, Fadi S Dahdaleh, Kaivan Khavandi , Pierre M Sfeir, Assaad Soweid, Jamal J Hoballah, Ali T Taher, Faek R Jamali

- Preoperative anemia: 30.4%
- **Mild** anemia ➡ OR mortality ⬆: 1.4 (1.3 – 1.5)
- **Mild** anemia ➡ OR morbidity ⬆: 1.3 (1.3 – 1.4)
- RBC trans. ➡ OR mortality ⬆: 2.0 (1.8 – 2.2)
- RBC trans. ➡ OR morbidity ⬆: 1.8 (1.7 – 1.9)

Musallam, K.M., et al., Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study. Lancet, 2011.

Effect of Anemia on Mortality and Composite Morbidity





Musallam, K.M., et al., Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study. Lancet, 2011.

Targeted anemia surveillance and intervention should be a greater priority in high-risk populations, especially young children and females.[42] Despite causing so much disability, anemia does not receive its requisite attention in many public health spheres. Such inattention may be partly because anemia is thought of as a by-product of other disease processes rather than as a target for intervention in and of itself. It is somewhat ironic, then, that etiology-specific

Kassebaum NJ et al. Blood, 2014;123: 615-24

PBM has the potential to address several health care related challenges that are specific to South Africa:

- *First*, the population of South Africa totals 57.8 million in 2018 and includes an estimated
- 17.8 million suffering from anaemia,
- predominantly in neonates and children,
- women in the reproductive age and the elderly.
- also a high prevalence of HIV-related anaemia, anaemia of inflammation, malarial anaemia and anaemia from intestinal parasite infestations.
- In hospitalized patients, the prevalence of anaemia is even higher than in the general population and it is an independent predictor for adverse
- outcomes including morbidity and mortality.

Preoperative anaemia and clinical outcomes in the South African Surgical Outcomes Study

D Marsicano,[1] BComm, MB ChB, DA (SA); **N Hauser**,[2,3] BSc (Physio), MB ChB, DA (SA), FCA (SA), MMed, FANZCA; **F Roodt**,[2] MB ChB, FCA (SA); **E Cloete**,[4] MB ChB, DA (SA), FCA (SA); **W Conradie**,[5] MB ChB, FCS (SA), MMed (Surg); **V Morford**,[6] MB BCh, DA (SA), FCA (SA); **D Nel**,[7] MB ChB, DA (SA), FCA (SA); **D G Bishop**,[8] MB ChB, FCA (SA); **T E Madiba**,[9] PhD; **B M Biccard**,[1] PhD; **on behalf of the South African Surgical Outcomes Study investigators**

[1] *Department of Anaesthesia and Perioperative Medicine, Groote Schuur Hospital and Faculty of Health Sciences, University of Cape Town, South Africa*
[2] *Department of Anaesthesia and Perioperative Medicine, Groote Schuur Hospital, Red Cross War Memorial Children's Hospital and Faculty of Health Sciences, University of Cape Town, South Africa*
[3] *Department of Anaesthesia and Pain Medicine, Fiona Stanley and Fremantle Hospital Group, Perth, Australia*
[4] *Department of Anaesthesia and Perioperative Medicine, Groote Schuur Hospital, New Somerset Hospital and Faculty of Health Sciences, University of Cape Town, South Africa*
[5] *Department of Surgery, Tygerberg Hospital and Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa*
[6] *Department of Anaesthesia, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa*
[7] *Department of Anaesthesia, Chris Hani Baragwanath Academic Hospital and Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa*
[8] *Perioperative Research Group, Department of Anaesthetics, Critical Care and Pain Management, School of Clinical Medicine, College of Health Sciences, Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban, South Africa*
[9] *Department of Surgery, School of Clinical Medicine, College of Health Sciences, Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban, South Africa*

Background. In high-income countries, preoperative anaemia has been associated with poor postoperative outcomes. To date, no large study has investigated this association in South Africa (SA). The demographics of SA surgical patients differ from those of surgical patients in the European and Northern American settings from which the preoperative anaemia data were derived. These associations between preoperative anaemia and postoperative outcomes are therefore not necessarily transferable to SA surgical patients.

Objectives. The primary objective was to determine the association between preoperative anaemia and in-hospital mortality in SA adult non-cardiac, non-obstetric patients. The secondary objectives were to describe the association between preoperative anaemia and (*i*) critical care admission and (*ii*) length of hospital stay, and the prevalence of preoperative anaemia in adult SA surgical patients.

Methods. We performed a secondary analysis of the South African Surgical Outcomes Study (SASOS), a large prospective observational study of patients undergoing inpatient non-cardiac, non-obstetric surgery at 50 hospitals across SA over a 1-week period. To determine whether preoperative anaemia is independently associated with mortality or admission to critical care following surgery, we conducted a multivariate logistic regression analysis that included all the independent predictors of mortality and admission to critical care identified in the original SASOS model.

Results. The prevalence of preoperative anaemia was 1 727/3 610 (47.8%). Preoperative anaemia was independently associated with in-hospital mortality (odds ratio (OR) 1.657, 95% confidence interval (CI) 1.055 - 2.602; p=0.028) and admission to critical care (OR 1.487, 95% CI 1.081 - 2.046; p=0.015).

Conclusions. Almost 50% of patients undergoing surgery at government-funded hospitals in SA had preoperative anaemia, which was independently associated with postoperative mortality and critical care admission. These numbers indicate a significant perioperative risk, with a clear need for quality improvement programmes that may improve surgical outcomes. Long waiting lists for elective surgery allow time for assessment and correction of anaemia preoperatively. With a high proportion of patients presenting for urgent or emergency surgery, perioperative clinicians in all specialties should educate themselves in the principles of patient blood management.

S Afr Med J 2018;108(10):839-846. DOI:10.7196/SAMJ.2018.v108i10.13148

ORIGINAL RESEARCH

The iron status of South African blood donors: balancing donor safety and blood demand

Karin van den Berg,[1] Ronel Swanevelder,[2] Charlotte Ingram,[3] Denise Lawrie,[4] Deborah Kim Glencross,[4] Caroline Hilton,[5] and Martin Nieuwoudt[6,7]

BACKGROUND: Several studies in developed countries have demonstrated high levels of iron deficiency (ID) among blood donors. There is a paucity of data for developing countries where blood shortages remain a major concern.
STUDY DESIGN AND METHODS: A total of 4412 donors were enrolled in the study. Specimens were collected for full blood count, iron, transferrin saturation, and ferritin assessment. Donor demographics were recorded. ID was indicated by a ferritin level of less than 20 ng/mL for men and less than 12 ng/mL for women. Anemia was defined as hemoglobin levels less than 12.5 g/dL. Regression models for predictors of ID were developed.
RESULTS: A total of 17.5% of all donors had ID, with 16.3% prevalence in women and 18.6% in men. Low hemoglobin had the highest association with ID (adjusted odds ratio [AOR], 11.078; 95% confidence interval [CI], 7.915–15.505); male donors had twice the odds of ID compared to female donors (AOR, 2.501; 95% CI, 1.964–3.185), while increasing age was associated with lower odds (AOD, 0.965; 95% CI, 0.956–0.975). Among male donors, an interdonation interval of less than 3 months (AOR, 2.679; 95% CI, 1.929–3.720) was associated with ID. Compared to other females combined, colored female donors (AOR, 2.335; 95% CI, 1.310–4.160) had higher odds and black female donors (AOR, 0.559; 95% CI, 0.369–0.845) lower odds of ID.
CONCLUSION: ID is common among South African donors; low hemoglobin, gender, ethnicity, and past donation history is independently associated with ID. Recommendations aimed at protecting donor health may increase blood shortages in South Africa.

HB threshold for transfusion

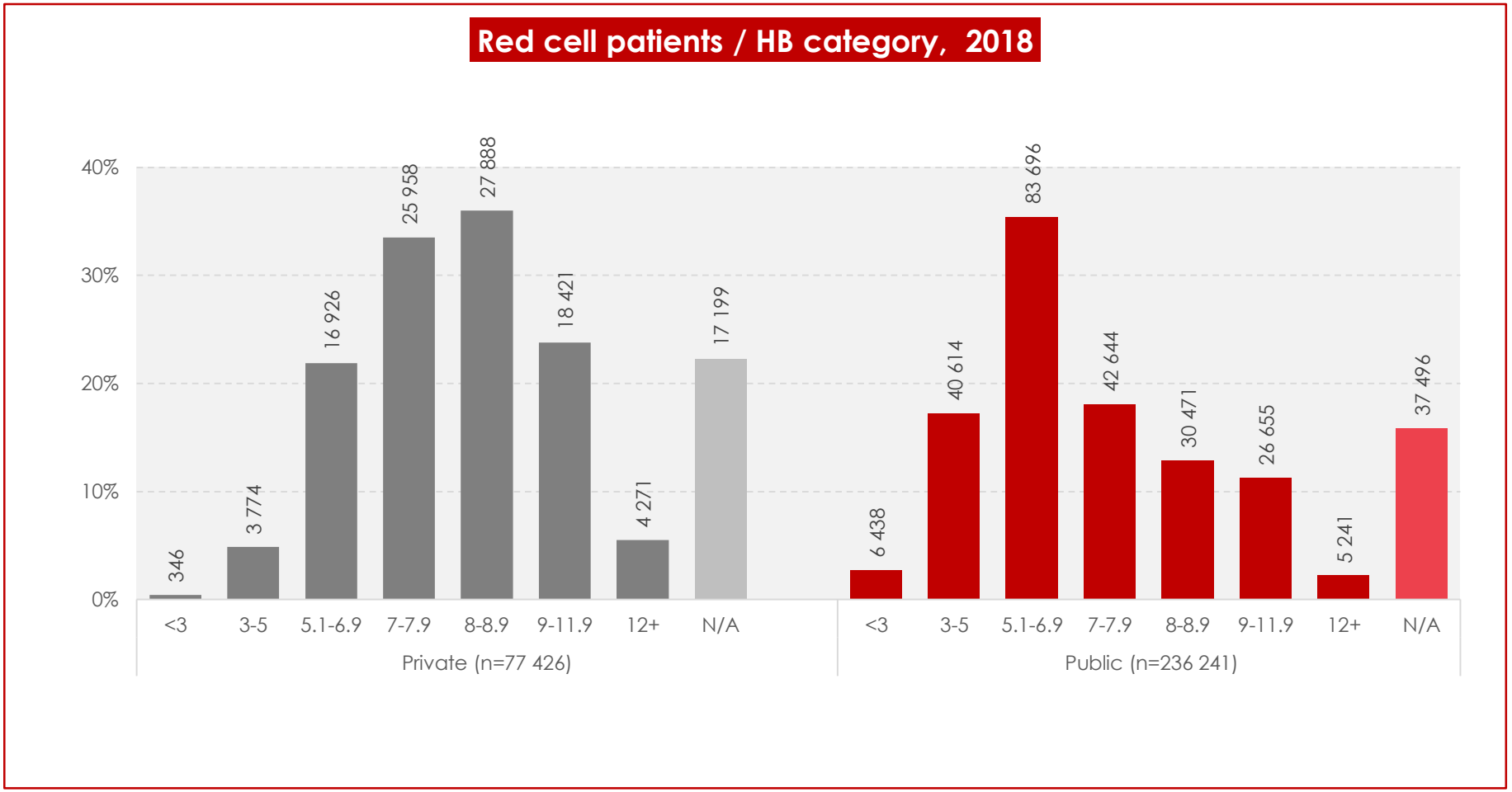
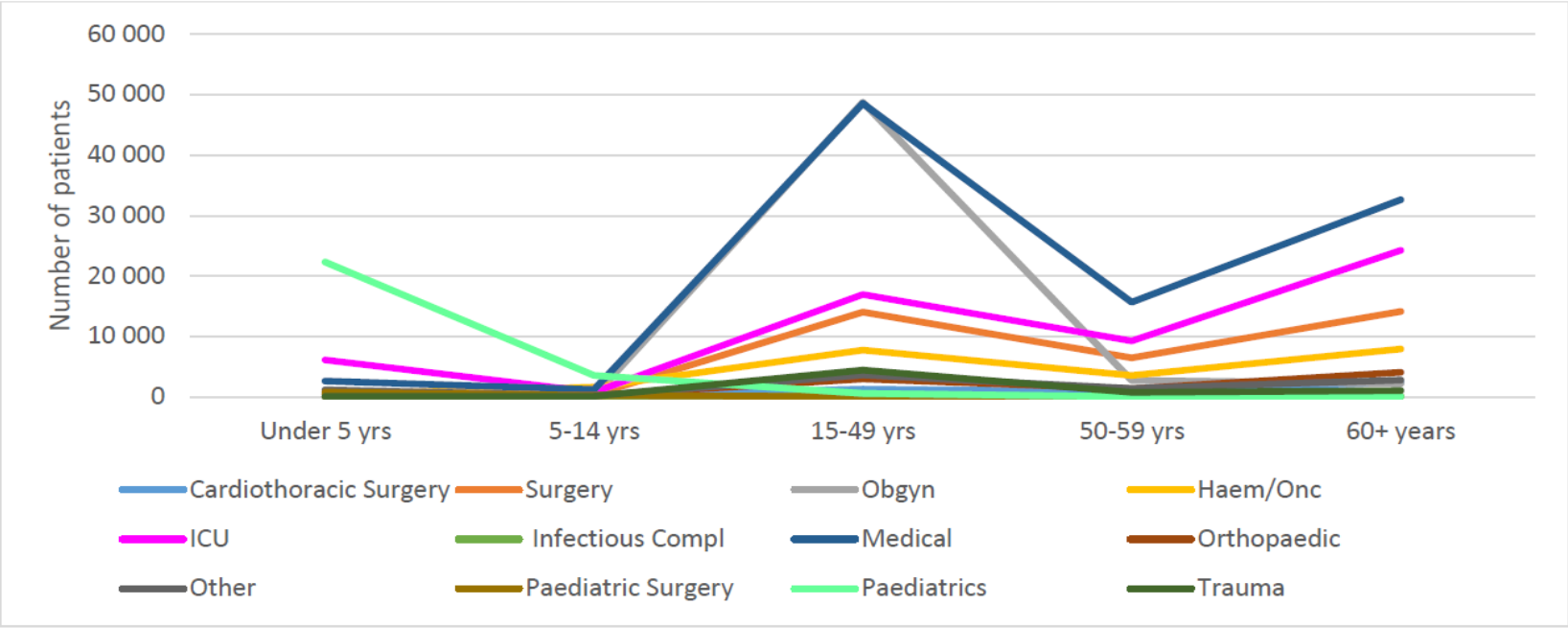


Figure 2: Usage of hospital wards by age



Blood demand

Table 1: RBC demand in 2017 under each scenario

Scenario	2017	RBC demand per 1K
Current	765,824	15.06
Actual need	1,824,756	35.87
Medium scenario	1,776,307	34.92
Best case	1,295,617	25.47

there is also an overall economic argument for the implementation of PBM:

- Unmanaged or poorly managed anaemia impairs the cognitive development of children and
- adolescents, reduces the ability to concentrate and diminishes work productivity with losses in some countries of up to 9% of the gross domestic product.
- Programs promoting oral iron therapy may be effective in specific subpopulations, but in patients with profound iron deficiency and iron deficiency anaemia, who require therapy for immediate correction, an
- appropriate dose of intravenous iron is the best option, while treatment of the underlying cause produces a cure.
- Improvements in patient outcomes with the concomitant savings as
- seen in previous studies, could lead to a significant decrease in pressure on bed occupation and a healthcare budget under extreme pressure.

Bleeding

“Uncontrolled hemorrhage is the only defense of the unconscious patient against the incompetent surgeon.”

William Stewart Halsted

1852 – 1922

Johns Hopkins University

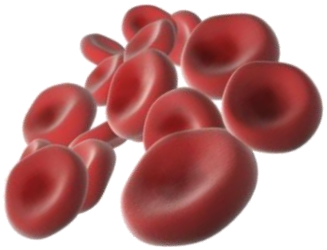
Major blood loss associated with increased

- Mortality (3-fold)
- Major morbidity (3-fold)
- ICU and hospital length of stay
- Likelihood of transfusion

Causes

- On average 75 – 90% local surgical interruption or vessel interruption
- 10–25% acquired or congenital coagulopathy

Shander A. *Surgery* 2007
Ranucci M et al. *Ann Thorac Surg* 2013; 96:478
Vivacqua et al *Ann Thorac Surg* 2011
Christensen et al *J Thorac Cardiovasc Surg* 2009
Spence et al *Am J Surg* 1990
Stokes, M.E., et al *BMC Health Serv Res*, 2011
Ye, X., et al *BMC Health Serv Res*, 2013
Alstrom, U., et al *Br J Anaesth*, 2012



Bl ost common procedure performed du ns in 2011 (12% of stays with a pro spitalizations with blood tra doubled since 1997.

H·CUP HEALTHCARE COST AND UTILIZATION PROJECT

AHRQ Agency for Healthcare Research and Quality

STATISTICAL BRIEF #165

October 2013

Most Frequent Procedures Performed in U.S. Hospitals, 2011

Anne Pfuntner, Lauren M. Wier, M.P.H., and Carol Stocks, R.N., M.H.S.A.

Introduction

When hospitalized, patients may undergo procedures for surgery, treatments (e.g., blood transfusions), or for diagnostic purposes (e.g., biopsy). The *principal procedure* is the procedure performed for definitive treatment. Hospitalizations usually involve multiple procedures, which together constitute the all-*listed* procedures performed during a hospital stay. Data on inpatient hospital procedures can help hospital administrators, health practitioners, researchers, and others understand how hospital care, including care related to diagnosis and treatment, is currently provided and what changes or consistencies in care delivery have occurred over time.

The present Statistical Brief presents 2011 data on the most common all-listed procedures performed during hospital stays in the United States, overall and by patient age. Changes between 1997 and 2011 in the number of stays and in the rate of hospitalizations with these procedures are also presented. All differences between estimates noted in the text are statistically significant at the .001 level or better.

Findings

Most frequent all-listed procedures performed during hospital stays, 2011

Table 1 shows the all-listed procedures that were performed most commonly during hospital stays in 2011, as well as the change in the rate of hospitalizations with these procedures since 1997. Procedures were performed in 63 percent of hospital stays in 2011. The hospitalization rate for stays with procedures remained stable since 1997 at 780 per 10,000 population.

Blood transfusion was the most common procedure performed during hospitalizations in 2011 (12 percent of stays with a procedure); the rate of hospitalizations with blood transfusion more than doubled since 1997.

Respiratory intubation and mechanical ventilation was the third most common procedure performed, occurring in 7 percent of stays with a procedure in 2011. The hospitalization rate for stays involving respiratory intubation and mechanical ventilation increased 56 percent since 1997.

1

Highlights

- Procedures were performed in 63 percent of hospital stays in 2011.The hospitalization rate for stays with procedures remained stable since 1997 at 780 per 10,000 population.
- Between 1997 and 2011, the hospitalization rate for stays with hemodialysis increased 68 percent.
- The hospitalization rates for stays with a blood transfusion increased 129 percent for adults aged 18–44 years and 45–64 years, 111 percent for adults aged 65–84 years, and 97 percent for adults aged 85 years and older.
- The hospitalization rate for stays with Cesarean section increased 39 percent between 1997 and 2011.
- Between 1997 and 2011, the most rapidly growing procedure was indwelling catheter—the rate of hospitalization for stays with this procedure more than tripled.
- Adults aged 65–84 years accounted for more than half of the total number of stays with knee arthroplasty in 2011; their hospitalization rate increased 59 percent since 1997.

http://www.hcup-us.ahrq.gov/reports/statbriefs/sb165.pdf

Maternal Mortality

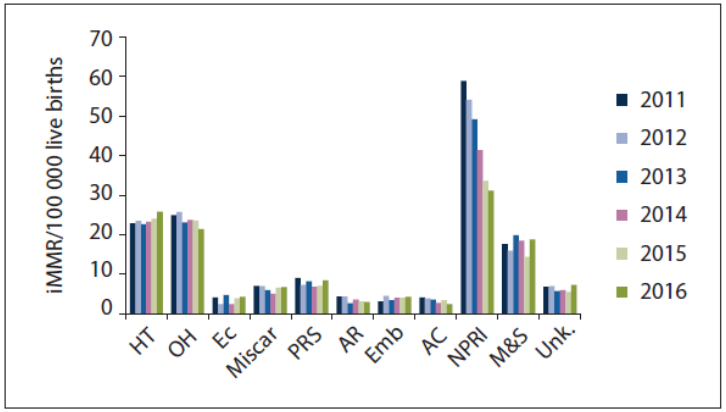


Fig. 4. Trend in iMMR per underlying cause: 2011 - 2016. (iMMR = institutional maternal mortality rate; HT = complication of hypertension in pregnancy; OH = obstetric haemorrhage; EC = ectopic pregnancies; Miscar. = miscarriage; PRS = pregnancy-related sepsis; AR = anaesthetic-related deaths; Emb. = embolism; AC = acute collapse, cause unknown; NPRI = non-pregnancy related infections; M&S = pre-existing medical and surgical conditions, Unk. = unknown.)

Infectious Agents in the Blood Supply

✔ **HIV, HCV, HBV**

✗ **New infectious agents**

- ✗ Prions (vCJD)
- ✗ Dengue (DENV)
- ✗ Babesia species
- ✗ Chikungunya (CHIKV)
- ✗ HBV variants (vl)
- ✗ HEV (vl)
- ✗ Herpes viruses (other than CMV, EBV, HHV-8) (t)

However, pathogens in the blood pool are just the tip of the iceberg when looking at the problem of adverse transfusion outcomes …

- ✗ Hantavirus New World (t)
- ✗ Hantavirus Old World (t)
- ✗ and what is next ?

Stramer, SL et al. Emerging infectious disease agents and their potential threat to transfusion safety. Transfusion, 2009. 49 Suppl 2: p. 15-295

“[M]ore patients have died in any one year owing to transfusion immunomodulation’s side effects than died in the entire transfusion transmitted AIDS epidemic”

Blumberg, N. and J.M. Heal, Immunomodulation by blood transfusion: an evolving scientific and clinical challenge. Am J Med, 1996. 101(3): p. 299-308.

Ann Thorac Surg 2001;72:S1832–7

Blood Transfusion: The Silent Epidemic

Bruce D. Spiess, MD

Department of Anesthesiology, Virginia Commonwealth University/Medical College of Virginia, Richmond, Virginia

The Multi-Billion Dollar Question:

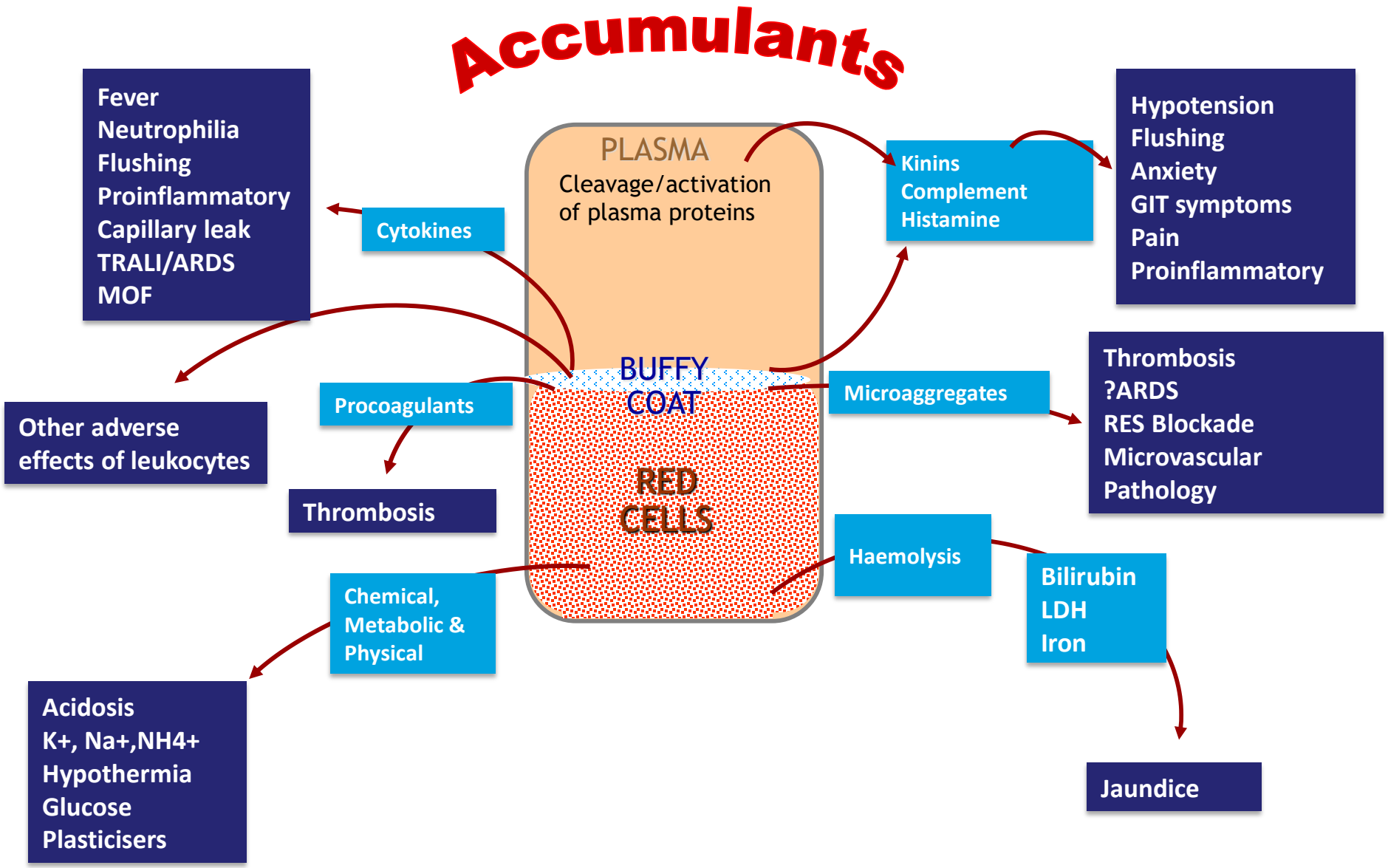
of ≈150 million allogeneic blood components per year

Does transfusion do what it is intended to do—improve outcome or prevent adverse outcomes?

- There are few if any articles that support transfusion actually improving patient outcomes.
- The majority of database papers show associations between transfusion utilization and with immunosuppression, increased infection, increased renal failure, multisystem organ failure, and death.

Spiess, B.D., Risks of transfusion: outcome focus. Transfusion, 2004. 44(12 Suppl): p. 4S-14S.

RED CELL STORAGE LESIONS



Acknowledgement: Prof. James Isbister

Transfusion and Apheresis Science 43 (2010) 69–78

Contents lists available at ScienceDirect

Transfusion and Apheresis Science

journal homepage: www.elsevier.com/locate/transci

Perfusion vs. oxygen delivery in transfusion with "fresh" and "old" red blood cells: The experimental evidence

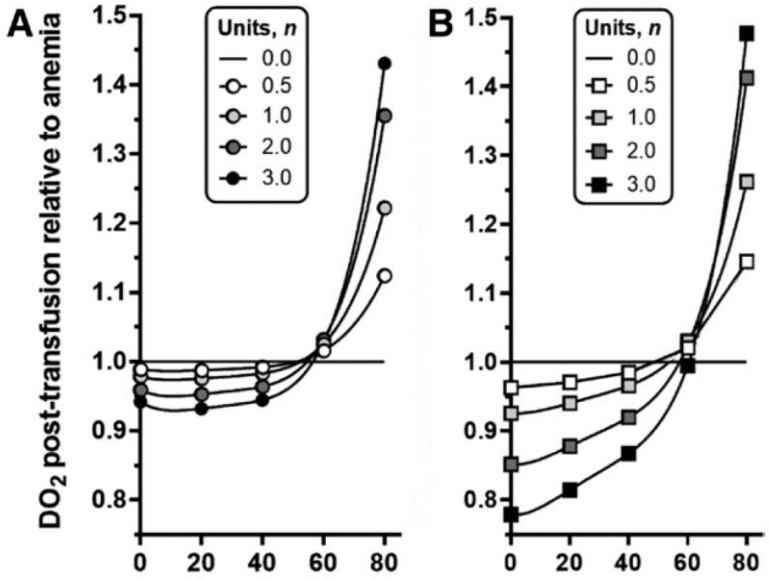
Amy G. Tsai [a], Axel Hofmann [b], Pedro Cabrales [a], Marcos Intaglietta [a,*]

[a] Department of Bioengineering, University of California, San Diego, CA, United States
[b] Society for the Advancement of Blood Management, Milwaukee, WI, United States

Impairment of oxygen transport of stored RBCs was first reported when measurement of the corresponding oxygen dissociation curves showed an immediate and significant increase in the oxygen affinity during the initial week of storage at 4 °C. This resulted in a decrease of oxygen delivery during transfusion of stored RBCs by comparison to normal RBCs, the difference being proportional to the volume transfused and storage time [16].

Posttransfusion Increase of Hematocrit per se Does Not Improve Circulatory Oxygen Delivery due to Increased Blood Viscosity

Robert Zimmerman, MS,* Amy G. Tsai, PhD,† Beatriz Y. Salazar Vázquez, MD, PhD,†‡§
Pedro Cabrales, PhD,† Axel Hofmann, ME, PhD,‖ Jens Meier, MD, PhD,# Aryeh Shander, MD,**
Donat R. Spahn, MD,¶ Joel M. Friedman, MD, PhD,†† Daniel M. Tartakovsky, PhD,*
and Marcos Intaglietta, PhD†



RESULTS: Blood transfusion of up to 3 units of PRBCs increased DO_2 when Hct (or hemoglobin) was 60% lower than normal, but did not increase DO_2 when administered before this threshold.

Zimmerman et al. Anesth Analg 2017.

Studies reporting a dose-response increase in adverse outcomes associated with red blood cell transfusion			
Author/Year	**Population**	**Sample size**	**Dose-response increased adverse outcome**
Shaw 2014[19]	Cardiac surgery	3'516	Mortality
Horvarth 2013[20]	Cardiac surgery	5'158	Infection
Mikkola 2012[21]	Cardiac surgery	2'226	Stroke
Stone 2012[22]	Cardiac surgery	1'491	Mortality
Van Straten 2010[23]	Cardiac surgery	10'425	Mortality
Hajjar 2010[24]	Cardiac surgery	512	Morbidity & mortality
Karkouti 2009[25]	Cardiac surgery	3'460	Acute kidney injury
Scott 2008[26]	Cardiac surgery	1'746	Postoperative LOS
Murphy 2007[27]	Cardiac surgery	8'500	Infection & ischemic events
Kulier 2007[28]	Cardiac surgery	5'065	Cardiac and non-cardiac adverse events
Banbury 2006[29]	Cardiac surgery	15'592	Septicemia, bacteremia, superficial & deep sternal wound infection
Koch 2006[30]	Cardiac surgery	11'963	In-hospital mortality, renal failure, postoperative ventilatory support, postoperative infection, cardiac and neurologic morbidity, overall postoperative morbidity
Koch 2006[31]	Cardiac surgery	10'289	Long-term (10-years) survival
Koch 2006[32]	Cardiac surgery	7'321	Functional recovery
Rogers 2006[33]	Cardiac surgery	9'218	Infection
Chelemer 2002[34]	Cardiac surgery	533	Bacterial infection
Leal-Noval 2001[35]	Cardiac surgery	738	Infection, pneumonia

Adapted from Farmer SL, Hofmann A, Isbister J. Transfusion and Outcomes. Patient Blood Management 2rd Edition Thieme; Stuttgart, New York: 2015

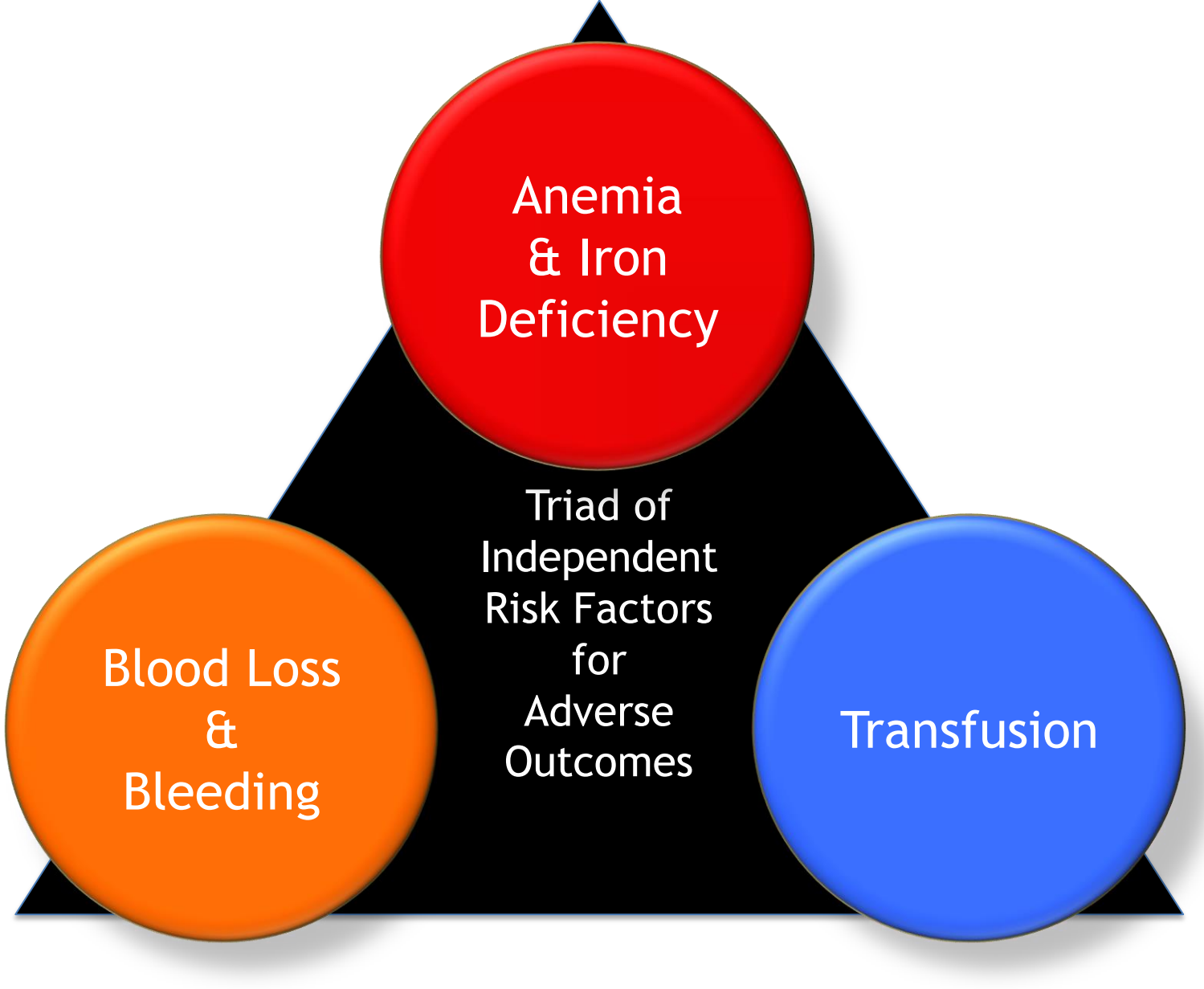
Meta-Analyses comparing Liberal vs. Restrictive Transfusion Strategies

	RCTs	Patients	RBC Txns in restrictive group	Hospital mortality in restrictive group	Infections in restrictive group
Carson 2012	19	6'264	-39%	-23%	-19%
Rohde 2014	18	7'593	n.a.	n.a.	-12%/-18%
Salpeter 2014	3	2'364	*-43%	-26%	-14%
Holst 2015	31	9'813	-44%	n.s.	-27%
Carson 2016	31	12'587	-43%	#n.s.	n.s.

*Transfusion rate
30-day mortality

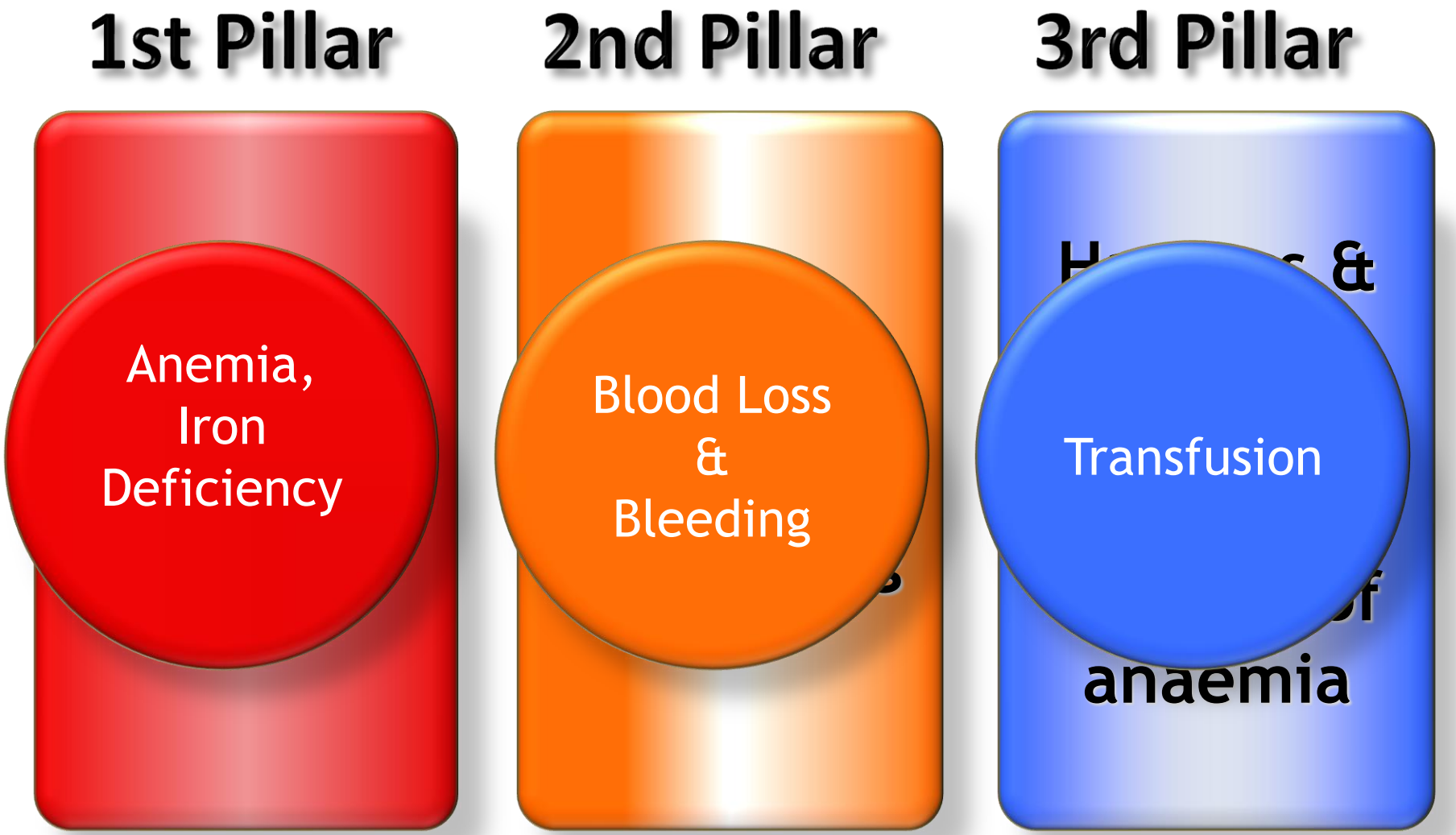
Carson J.L. et al. Cochrane Database of Systematic Reviews, 2012
*Rohde J.M. et al. JAMA, 2014. **311**(13): p. 1317-26*
Salpeter SR et al. Am J Med. 2014;127(2):124-31.e3.
Holst L.B. et al. BMJ, 2015, 350:h1354
Carson JL et al. Cochrane Database of Systematic Reviews, 2016

The Rationale behind PBM: Defeating the Triad



Farmer SL., Towler SC, Leahy MF, Hofmann A. Best Pract Res Clin Anaesthesiol, 2013. 27(1): p. 43-58.

MODIFYING THE RISK FACTORS



	1st Pillar Optimise red cell mass	2nd Pillar Minimise blood loss & bleeding	3rd Pillar Harness & optimise physiological reserve of anaemia
PREOP	• Detect anaemia • Identify underlying disorder(s) causing anaemia • Manage disorder(s) • Refer for further evaluation if necessary • Treat suboptimal iron stores/iron deficiency/anaemia of chronic disease/iron-restricted erythropoiesis • Treat other haematinic deficiencies • Note: Anaemia is a contraindication for elective surgery	• Identify and manage bleeding risk • Minimise iatrogenic blood loss • Procedure planning and rehearsal	• Assess/optimise 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 minimise blood loss, optimise red cell mass and manage anaemia
INTRAOP	• Time surgery with haematological optimisation	• Meticulous haemostasis and surgical techniques • Blood-sparing surgical devices • Anaesthetic blood conserving strategies • Autologous blood options • Maintain normothermia • Pharmacological/haemostatic agents	• Optimise cardiac output • Optimise ventilation and oxygenation
POSTOP	• Optimise erythropoiesis • Be aware of drug interactions that can increase anaemia	• Vigilant monitoring and management of post-operative bleeding • Avoid secondary haemorrhage • Rapid warming / maintain normothermia (unless hypothermia specifically indicated) • Autologous blood salvage • Minimise iatrogenic blood loss • Haemostasis/anticoagulation management • Prophylaxis of upper GI haemorrhage • Avoid/treat infections promptly • Be aware of adverse effects of medication	• Optimise anaemia reserve • Maximise oxygen delivery • Minimise oxygen consumption • Avoid/treat infections promptly • Restrictive transfusion thresholds

Perioperative multidisciplinary multimodal patient-specific team approach

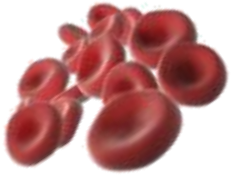
Hofmann et al. Current Opinions in Anaesthesiology 2012

PBM DEFINITION

Patient Blood Management (PBM) is an evidence-based bundle of care to optimize patient outcomes by managing and preserving a patient's blood

International Foundation for Patient Blood Management

Anaemia *and* Bleeding



Management

of Patient Blood
=managing the patient's own blood to save lives and improve overall outcomes

with Donor Blood
= saving lives by correcting Hb-values with transfusion

Current Opinion in Anaesthesiology 2008, 21:657–663

EDITORIAL COMMENT

Our own blood is still the best thing to have in our veins

Tim Frenzel, Hugo Van Aken and Martin Westphal

PBM Results

Implementation of a patient blood management monitoring and feedback program significantly reduces transfusions and costs

- 3Y interventional cohort study 2012-2014 (n=101‘794)
- Interventions
  - Mandatory guidelines 2012-04
  - PBM monitoring and feedback program 2014-01
- Outcome parameters
  - Units transfused (RBC, FFP, PLT)
  - Total transfusion cost
  - Clinical outcomes

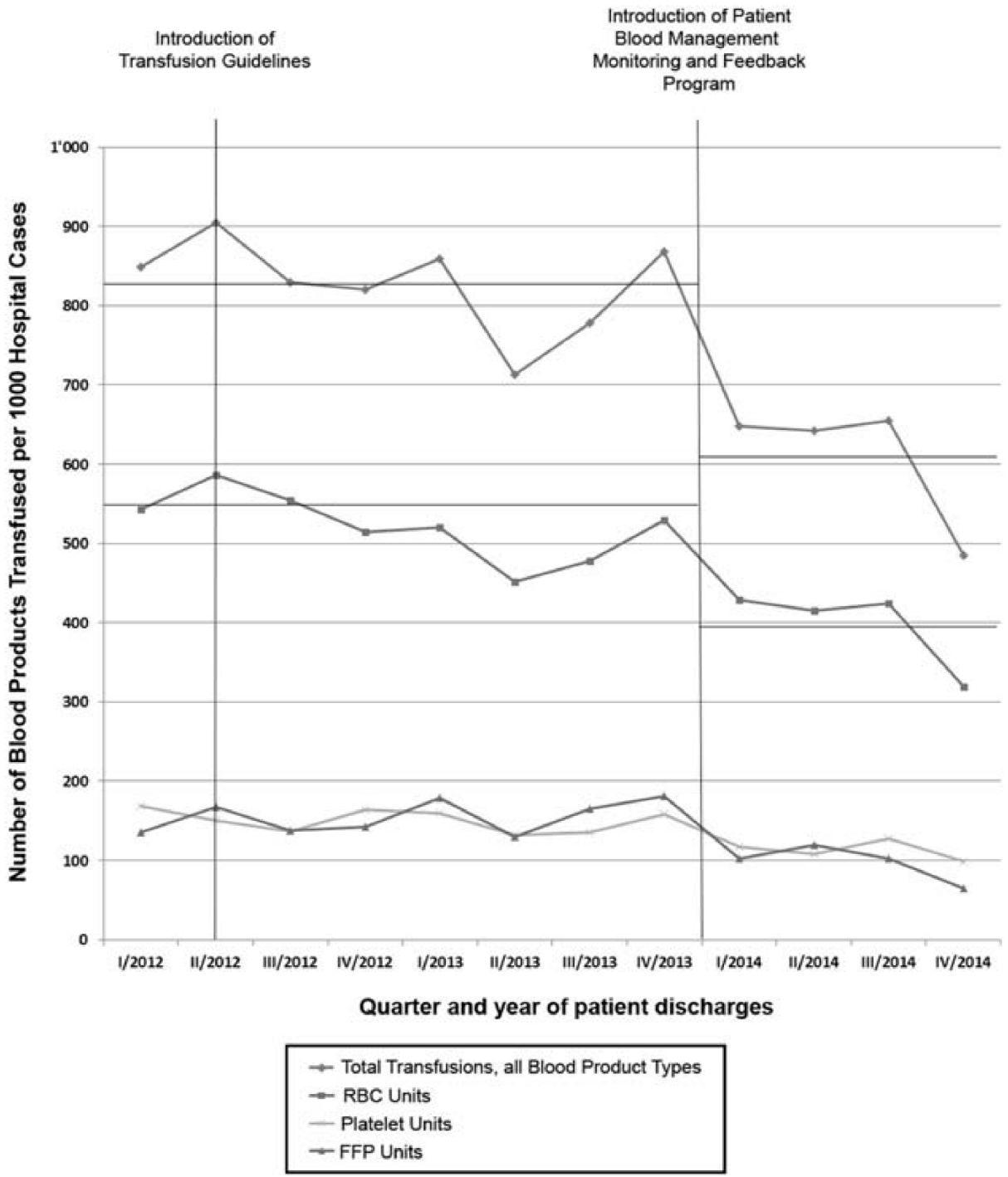
Mehra et al. Transfusion 2015

PBM Monitoring and Feedback Program at USZ

UniversitätsSpital Zürich

- Recording of each transfusion and
  - Recipient
  - Site of transfusion
  - Physician responsible for the transfusion with his/her departmental affiliation
  - Last Hb, PT, F-V and platelet count prior to transfusion
- Quarterly benchmark reports sent to department heads on guideline conformity
- Thresholds transgressed >10% → meeting with DH for specific explanation case by case

Mehra et al. Transfusion 2015



Swiss Quality Award
INNOVATIONS IN HEALTHCARE

UniversitätsSpital Zürich

Cost savings:
> 2'000'000 $

Total Blood Products -27%

RBCs -24%

PLTs -25%

FFP -37%

Mehra et al. Transfusion 2015

A template for the world: Western Australia PBM Project

TRANSFUSION

ORIGINAL RESEARCH

Improved outcomes and reduced costs associated with a health-system–wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals

Michael F. Leahy,[1,2,3] Axel Hofmann,[4,5,6] Simon Towler,[7] Kevin M. Trentino,[8] Sally A. Burrows,[1] Stuart G. Swain,[8] Jeffrey Hamdorf,[9,10] Trudi Gallagher,[11,12] Audrey Koay,[11] Gary C. Geelhoed,[11,13] and Shannon L. Farmer[9,14]

2017

Results from the world's largest PBM study (n=605'046)

BACKGROUND: Patient blood management (PBM) programs are associated with improved patient outcomes, reduced transfusions and costs. In 2008, the Western Australia Department of Health initiated a comprehensive health-system–wide PBM program. This study assesses program outcomes.

STUDY DESIGN AND METHODS: This was a retrospective study of 605,046 patients admitted to four major adult tertiary-care hospitals between July 2008 and June 2014. Outcome measures were red blood cell (RBC), fresh-frozen plasma (FFP), and platelet units transfused; single-unit RBC transfusions; pretransfusion hemoglobin levels; elective surgery patients anemic at admission; product and activity-based costs of transfusion; in-hospital mortality; length of stay; 28-day all-cause emergency readmissions; and hospital-acquired complications.

RESULTS: Comparing final year with baseline, units of RBCs, FFP, and platelets transfused per admission decreased 41% ($p < 0.001$), representing a saving of AU$18,507,092 (US$18,078,258) and between AU$80 million and AU$100 million (US$78 million and US$97 million) estimated activity-based savings. Mean pretransfusion hemoglobin levels decreased 7.9 g/dL to 7.3 g/dL ($p < 0.001$), and anemic elective surgery admissions decreased 20.8% to 14.4% ($p = 0.001$). Single-unit RBC transfusions increased from 33.3% to 63.7% ($p < 0.001$). There were risk-adjusted reductions in hospital mortality (odds ratio [OR], 0.72; 95% confidence interval [CI], 0.67-0.77; $p < 0.001$), length of stay (incidence rate ratio, 0.85; 95% CI, 0.84-0.87; $p < 0.001$), hospital-acquired infections (OR, 0.79; 95% CI, 0.73-0.86; $p < 0.001$), and acute myocardial infarction-stroke (OR, 0.69; 95% CI, 0.58-0.82; $p < 0.001$). All-cause emergency readmissions increased (OR, 1.06; 95% CI, 1.02-1.10; $p = 0.001$).

CONCLUSION: Implementation of a unique, jurisdiction-wide PBM program was associated with improved patient outcomes, reduced blood product utilization, and product-related cost savings.

Improved outcomes and reduced costs associated with a health-system–wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals

Michael F. Leahy,[1,2,3] Axel Hofmann,[4,5,6] Simon Towler,[7] Kevin M. Trentino,[8] Sally A. Burrows,[1] Stuart G. Swain,[8] Jeffrey Hamdorf,[9,10] Trudi Gallagher,[11,12] Audrey Koay,[11] Gary C. Geelhoed,[11,13] and Shannon L. Farmer[9,14]

- **Quality, safety**, and **effectiveness initiative** with resource and economic implications.
- Primary aim: **improving medical and surgical patient outcomes while achieving significant cost savings** by applying PBM principles

Leahy MF, Hofmann A, Towler S, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals. Transfusion 2017

- Retrospective observational study to assess the impact on key outcome measures in **all emergency** and **elective** adult acute-care multi-day stay inpatients **(n=605,046)** admitted to the **4 major adult tertiary-care hospitals** July 2008 – June 2014.
- Hospitals perform **majority of high-complexity procedures performed in WA** including **cardiac, major trauma, burns**, and **obstetrics** referral services
- Multivariate analysis to control for potential confounders and changes in patient case-mix

Leahy MF, Hofmann A, Towler S, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals. Transfusion 2017

Key program performance indicators

Compared to baseline year, implementation was associated in year 6 with:

- **41% reduction in blood product usage** (P<0.001)
- RBC txn Hb threshold decreased from 7.9 to 7.3 g/dL (P<0.001)
- Single-unit RBC txn increased from 33% to 64% (P<0.001)
- Proportion admitted anemic decreased from 20.8% to 14.4% (P=0.001)
- **Product acquisition cost savings** of **AU$18.5M**
- Estimated **activity-based cost savings $80 - $100M**
- A one-time **investment of $4.5M** to cover 5-year change management and implementation process.

Leahy MF, Hofmann A, Towler S, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals. Transfusion 2017

Key Patient Outcomes

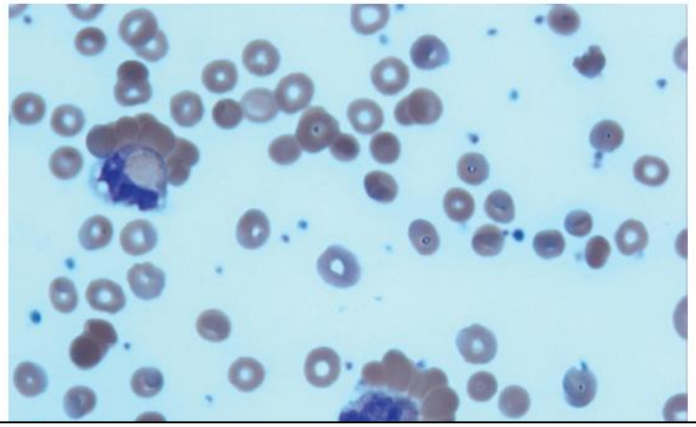
In-hospital mortality:	**28%** ↓	(95% CI, 0.67 to 0.77; P<0.001)
Length of hospital stay:	**15%** ↓	(95% CI, 0.84 to 0.87; P<0.001)
Infection:	**21%** ↓	(95% CI, 0.73 to 0.86; P<0.001)
AMI/Stroke:	**31%** ↓	(95% CI, 0.58 to 0.82; P<0.001)
Readmission:	**6%** ↑	(95% CI, 1.02 to 1.10; P<0.001)

= additional non-valorized cost savings

Leahy MF, Hofmann A, Towler S, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals. Transfusion 2017

www.transfusion.org Vol. 57, No. 6, June 2017

TRANSFUSION



Volume 57, June 2017 TRANSFUSION 1325

Spahn DR. Transfusion 2017

EDITORIAL

Patient Blood Management: the new standard

Preoperative anemia, [illegible] blood loss,[2] and transfusion of allogeneic blood products[3-6] all adversely affect patient outcome. Patient Blood Management (PBM) aims to reduce the need for blood transfusions preemptively to improve patient safety and outcome.[7] The three pillars of PBM consist of treating preoperative anemia, reducing perioperative blood loss, and optimizing anemia tolerance. In addition, the use of restrictive, evidence-based, and patient-centered transfusion triggers is an integral part of PBM.[3,8]

Implementing one or more PBM measures has indeed improved certain patient outcomes in the past,[8-12] and some of these studies included well over 100,000 patients.[10,13] What is then so unique in the landmark study by Leahy and colleagues[14] in this issue of **TRANSFUSION** in which they describe the success of the health system–wide PBM program implementation in Western Australia? Its uniqueness includes:

- The largest ever number of patients studied: 605,064.
- Multi-centric: four major adult tertiary care hospitals.
- Health system–wide PBM program not focused on surgical disciplines alone.
- Multiple outcomes assessed:
  - Safety;
  - Clinical outcomes;
  - Transfusions;
  - Costs.
- Duration of the study: 6 years.

The results are indeed impressive. The authors report a progressively reduced adjusted in-hospital mortality (−28%), a shorter hospital length of stay (−15%), less hospital-acquired infections (−21%), and a reduced rate of myocardial infarction or stroke (−31%). Transfusions of allogeneic blood products were also reduced by 41% whereby transfusions of red blood cells (RBCs) were down 41%, fresh-frozen plasma (FFP) down 47%, and platelets (PLTs) down 27%. These trends resulted in reduction of blood product acquisition costs of more than US$18M and a reduction of activity-based transfusion costs of more than US$80M.

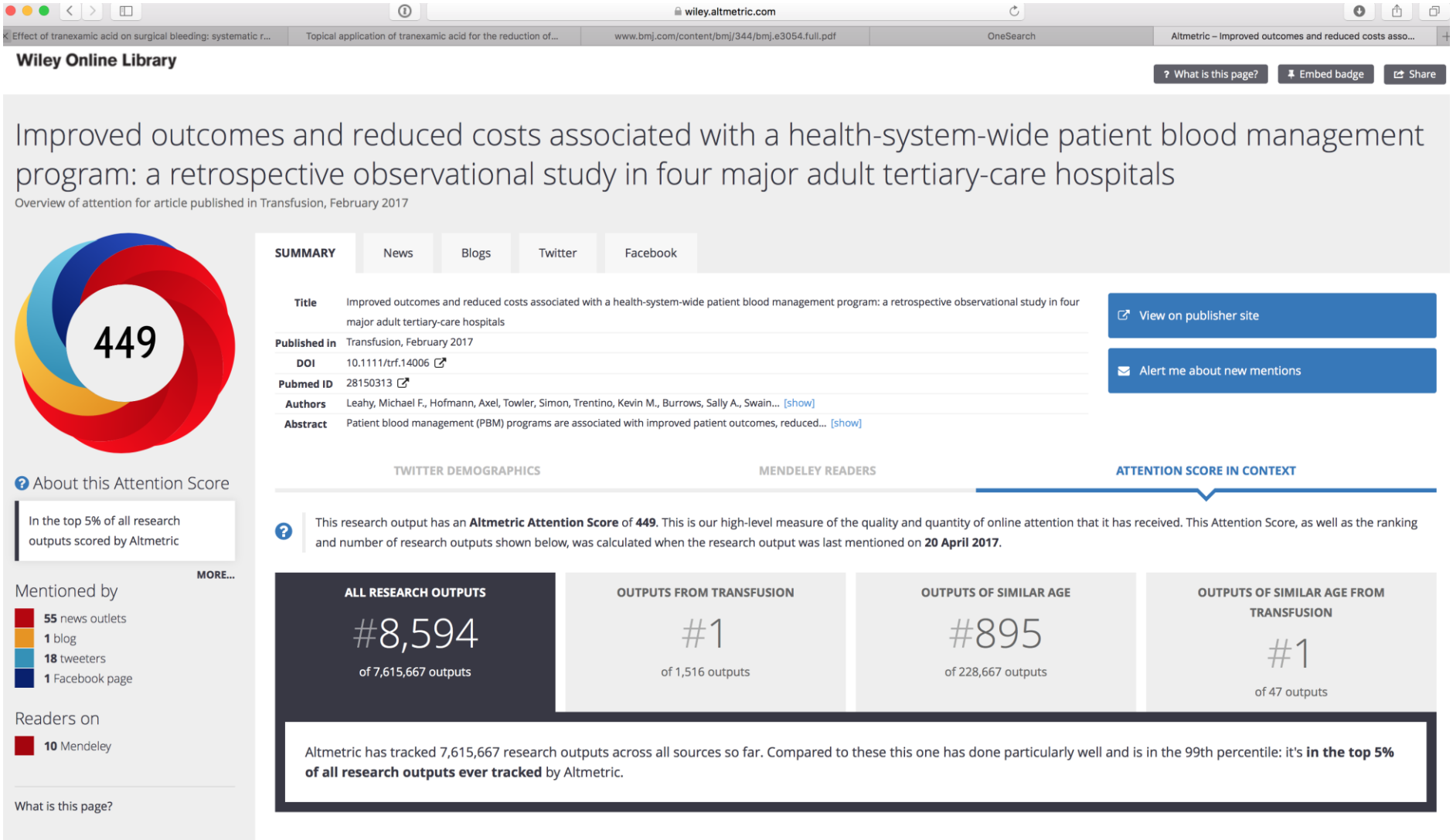
doi:10.1111/trf.14095

TRANSFUSION 2017;57;1325–1327

There is [illegible] more remarkable achievement: the percentage of elective patients admitted with anemia decreased from 20.8% to 14.4%. This result can be attributed to consistent identification and treatment of existing anemia and iron deficiency in the weeks before hospitalization. To my knowledge, this study is the first worldwide so far reporting a substantial reduction of the preoperative anemia rate. This achievement is highly remarkable given the logistic complexity of preoperative anemia treatment.

How was this program better than any other PBM program so far? The current article does not give a definitive answer. However, the extremely intense educational activity of the proponents of the Western Australia PBM program already described in a previous report by Leahy and colleagues in 2014[13] may be a key element in increasing the awareness of the high incidence of preoperative anemia and iron deficiency and its negative consequences on outcome.[1,15,16] In addition, hospital physicians and referring general practitioners could consult readily accessible diagnostic and therapeutic algorithms (http://www.healthnetworks.health.wa.gov.au/modelsofcare/docs/Elective_Joint_Replacement.pdf). Ironically, the highest-quality studies on the success of pre- and postoperative anemia treatment[17-20] were published years after the start of the Western Australia PBM program. However, a consensus is growing that elective surgery should be delayed until anemia correction. This movement started with individual claims.[3] Then experts stopped a prospective randomized study on the efficacy of preoperative treatment of iron deficiency anemia with intravenous (IV) iron due to a much more favorable outcome in the treatment group as compared to placebo group.[17] Finally, a professional society (Association of Anaesthetists of Great Britain and Ireland [AAGBI])[21] recommended delaying elective surgery until anemia correction in patients with an expected blood loss of more than 500 mL or an expected transfusion rate of more than 10%.[8,22] In addition, preoperative correction of iron deficiency without anemia has become recognized as likely to be beneficial for patient outcome.[22]

The time course of the improvements of the clinical outcomes is highly interesting. For most clinical outcomes, it took 2 to 3 years until they became significantly improved (Table 2 of the paper[14]). This lag period may well explain why other big PBM programs could only detect trends toward an improvement in clinical outcomes since most analyses published so far analyzed only the first year after the implementation of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Effect of tranexamic acid on surgical bleeding: systematic r...
Topical application of tranexamic acid for the reduction of...
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Overview of attention for article published in Transfusion, February 2017
449
About this Attention Score
In the top 5% of all research outputs scored by Altmetric
MORE...
Mentioned by
55 news outlets
1 blog
18 tweeters
1 Facebook page
Readers on
10 Mendeley
What is this page?
SUMMARY
News
Blogs
Twitter
Facebook
Title
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Published in
Transfusion, February 2017
DOI
10.1111/trf.14006
Pubmed ID
28150313
Authors
Leahy, Michael F., Hofmann, Axel, Towler, Simon, Trentino, Kevin M., Burrows, Sally A., Swain... [show]
Abstract
Patient blood management (PBM) programs are associated with improved patient outcomes, reduced... [show]
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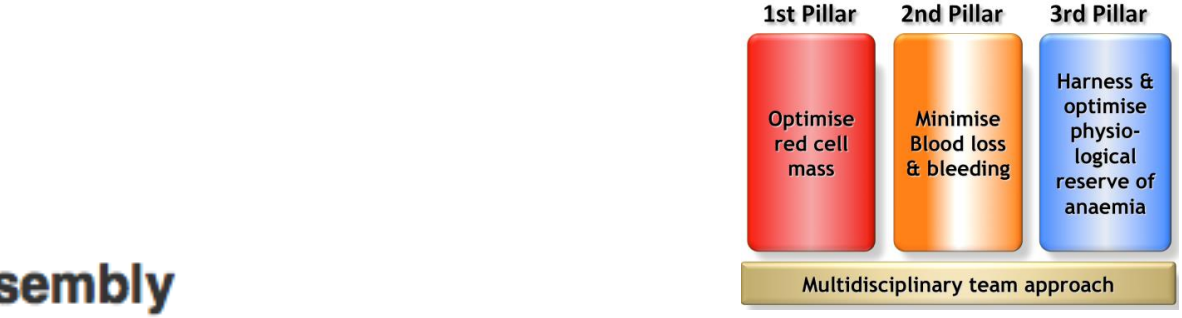
ATTENTION SCORE IN CONTEXT
This research output has an Altmetric Attention Score of 449. This is our high-level measure of the quality and quantity of online attention that it has received. This Attention Score, as well as the ranking and number of research outputs shown below, was calculated when the research output was last mentioned on 20 April 2017.
ALL RESEARCH OUTPUTS
#8,594
of 7,615,667 outputs
OUTPUTS FROM TRANSFUSION
#1
of 1,516 outputs
OUTPUTS OF SIMILAR AGE
#895
of 228,667 outputs
OUTPUTS OF SIMILAR AGE FROM TRANSFUSION
#1
of 47 outputs
Altmetric has tracked 7,615,667 research outputs across all sources so far. Compared to these this one has done particularly well and is in the 99th percentile: it's in the top 5% of all research outputs ever tracked by Altmetric.

PBM as a New Standard of Care



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**)"*

World Health Organization

Global Forum for Blood Safety: Patient Blood Management

14 -15 March 2011, Dubai, UAE

Organized by WHO HQ/Geneva and Sharjah Blood Transfusion and Research Centre and co-sponsored by the Government of United Arab Emirates (UAE)

Priorities for Action

Hospital/Institutional Level

1. Benchmark transfusion prescription and practices
2. Develop transfusion protocols based on generic/national guidelines, abandon transfusion triggers as surrogate markers
    a. Assess clinical and physiologic condition for deciding on transfusion
    b. Define symptoms, physical signs, and interpret laboratory results, based on individual patients
3. Set up multi-disciplinary teams for managing blood use in patients
4. Put in practice the use of:
    a. Standardized transfusion request form
    b. Standardized transfusion outcome form
5. Develop clinical transfusion process, as part of hospital quality system and participate in hospital accreditation programmes
6. Establish mechanisms for improving communication and coordination among various stakeholders in patient care
7. Establish and activate hospital transfusion committees (HTC)
8. Designate transfusion officers in hospitals
9. Provide pre-service and in-service training for clinicians, nurses and midwives on blood use
10. Collect a minimum set of data on patient transfusion outcomes

National Level

1. Obtain commitment of the government through policy and legal framework for HTCs and for multi-disciplinary approach for blood use in patient management
2. Identify major national clinical needs, and based on these, develop and implement national guidelines on blood use including patient blood management
3. Based on guidelines, develop algorithms for prescribing
4. Develop standards for hospital transfusion system, as part of hospital standards
5. Establish a minimum data set that can be captured at each hospital
6. Develop national or regional public health networks and their integration within the haemovigilance systems
7. Introduce technologies to facilitate decision for transfusion prescription
8. Conduct multi-centric studies
    a. Patient outcomes
    b. Alternatives
9. Conduct benchmarking studies to compare practices in different hospitals and clinicians
10. Start hospital accreditation programmes, including clinical transfusion as part of this programmes
11. Provide training for clinicians, nurses and midwives on blood use
12. Develop professional leadership skills to lead and manage hospitals across the country to strengthen hospital transfusion systems
13. Develop educational curriculum
    a. Pre-service
    b. In-service
    c. Post graduate educations (multiple discipline)
14. Focus on outcome research
15. Translate - Make available current evidence through desk research - meta analysis
    a. Move forward on randomized control trials (RCT)
    b. Need more funding for RCT in Patient Blood Management

World Health Organization

Global Forum for Blood Safety: Patient Blood Management

14 -15 March 2011, Dubai, UAE

International Level

1. Develop and provide generic tools for collection of minimum transfusion outcome and patient outcome data at national level
2. Develop and provide tools for clinical transfusion audits
3. Collect global data on blood use and transfusion outcome
4. Establish global observatory on transfusion data
5. Modify '*WHO Aide-Memoire on 'Clinical Use of Blood*' to get patient management and clinicians' perspectives
6. Promote and support research on inappropriate blood use in developing countries
7. Share opinions and information through WHO Global Forum on Blood Safety and expand to involve multiple clinical disciplines
8. Review WHO list of essential medicine to include agents to reduce need for blood transfusion
9. Disseminate information on best transfusion practices
10. Develop patient-oriented handbooks on blood use
11. Promote and support evidence based reviews
12. Promote and support research on other transfusion modalities (e. g, Washed v Unwashed red cells) during intra-operative cell salvage
13. Develop key performance indicators
    a. functioning HTC
    b. clinical transfusion process
14. Develop generic curriculum for nurse and medical students on blood use
15. Acknowledge countries providing data to promote the countries not currently providing data

Antimicrobial Use and Resistance in Australia (AURA) Project >
Charter of Healthcare Rights >
Collaboration with the IHPA
National Patient Blood Management Collaborative
Safety and Quality Framework >
Safety and Quality Goals >

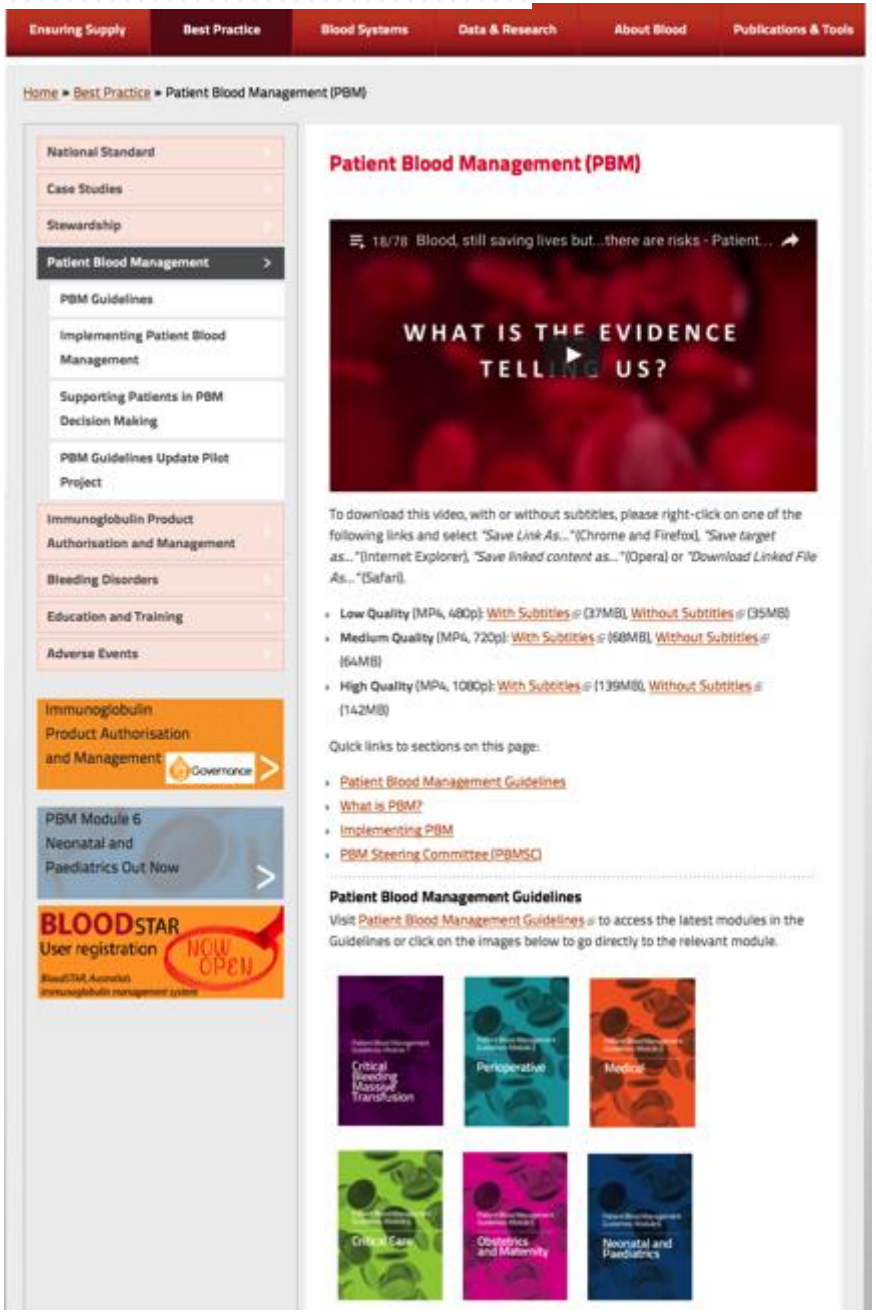
National Priorities

The Commission leads and coordinates improvements in safety and quality in health care across Australia, including the promotion, support and encouragement of the implementation of safety and quality initiatives.

A collaborative and consultative approach is undertaken in priorities of the health system that benefit from national coordination. Under its legislation the Commission has wide raging functions that also include the formulation of safety and quality standards and indicators.

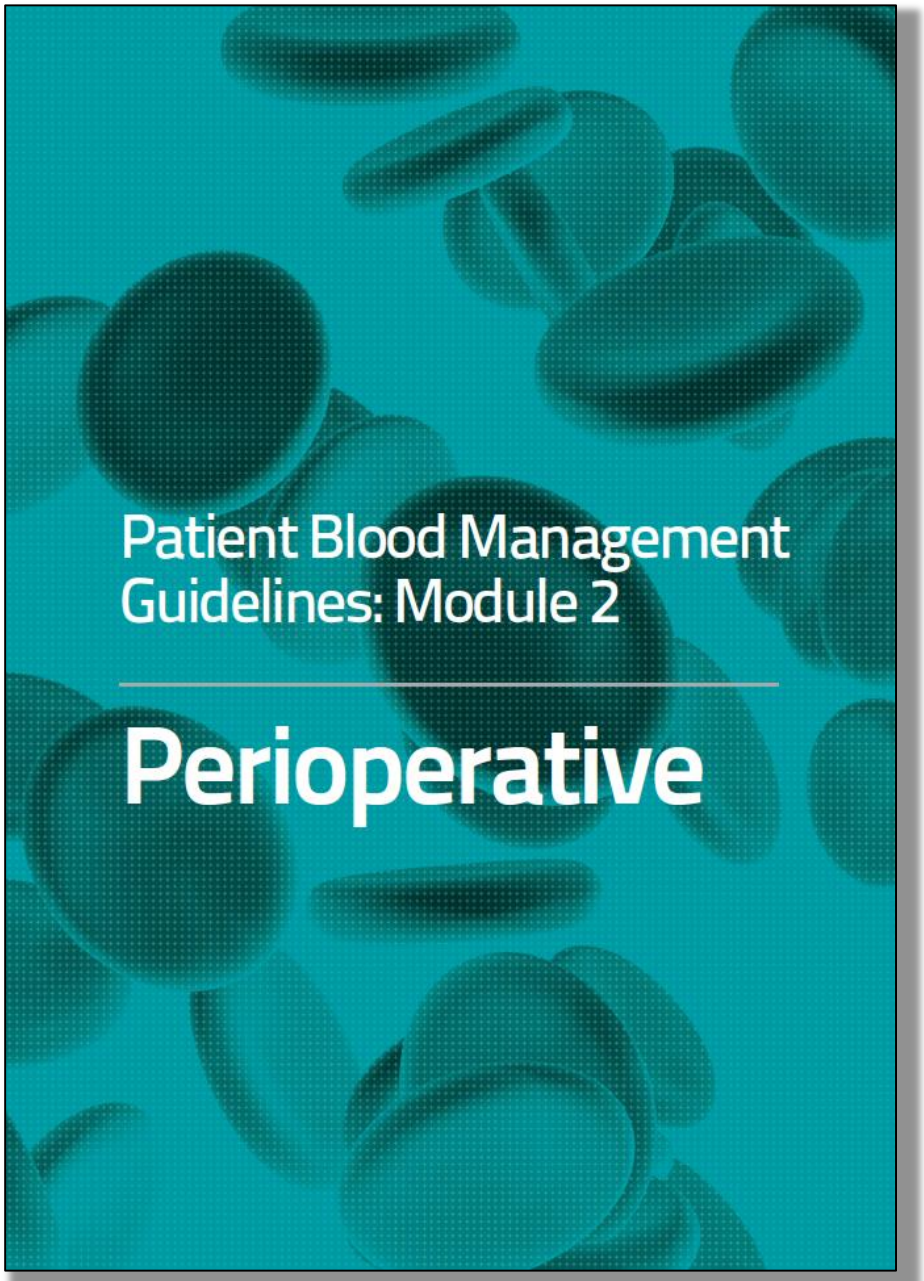
National Patient Blood Management Collaborative

The Commission has been engaged by the Department of Health to lead the National PBM Collaborative, in consultation with the National Blood Authority and the states and territories, to promote appropriate care in relation to the use of blood across Australia.



https://www.nba.gov.au


Patient Blood Management Guidelines: Module 6
Neonatal and Paediatrics



Patient Blood Management Guidelines: Module 2 - Perioperative

Development of this module was achieved through clinical input and expertise of representatives from the Colleges and Societies listed below and an independent consumer advocate (see Appendix A).

Australasian College for Emergency Medicine

Australian and New Zealand College of Anaesthetists

Australian and New Zealand Intensive Care Society

Australian and New Zealand Society of Blood Transfusion

Australian Orthopaedic Association

Australian Red Cross Blood Service

College of Intensive Care Medicine of Australia and New Zealand

Haematology Society of Australia and New Zealand

Royal Australian and New Zealand College of Obstetricians and Gynaecologists

Royal Australasian College of Physicians

Royal Australasian College of Surgeons

Royal College of Nursing Australia

Royal College of Pathologists of Australasia

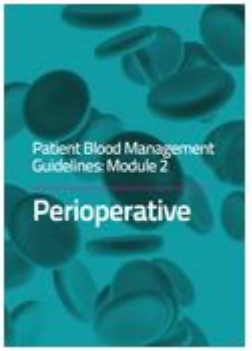
Thalassaemia Australia

The National Blood Authority gratefully acknowledges these contributions. College and Society endorsement of this Module can be found at http://www.nba.gov.au

National Blood Authority Australia

Funding, Secretariat and Project Management was provided by the National Blood Authority Australia. The systematic review methods, writing of the document or development of the final recommendations and practice points have not been influenced by the views or interests of the funding body.

Mortality Risk of Anaemia and Transfusion Clearly Adressed



3.2 Effect of anaemia on outcomes

Question 4 (Aetiological question) (GNQ1)

In patients undergoing surgery, is anaemia an independent risk factor for adverse outcomes?

3.3 Effect of red blood cell transfusion on outcomes

Question 5 (Interventional question) (GNQ2)

In patients undergoing surgery, what is the effect of RBC transfusion on patient outcomes?

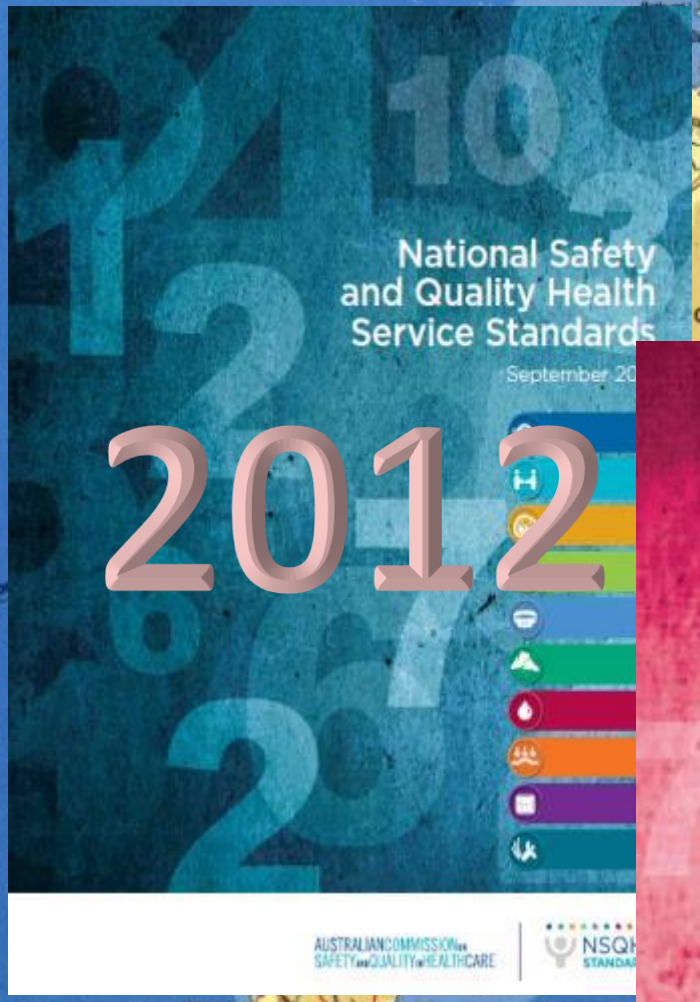
RBC, red blood cell

Preoperative anaemia is independently associated with an increased risk of morbidity and mortality.

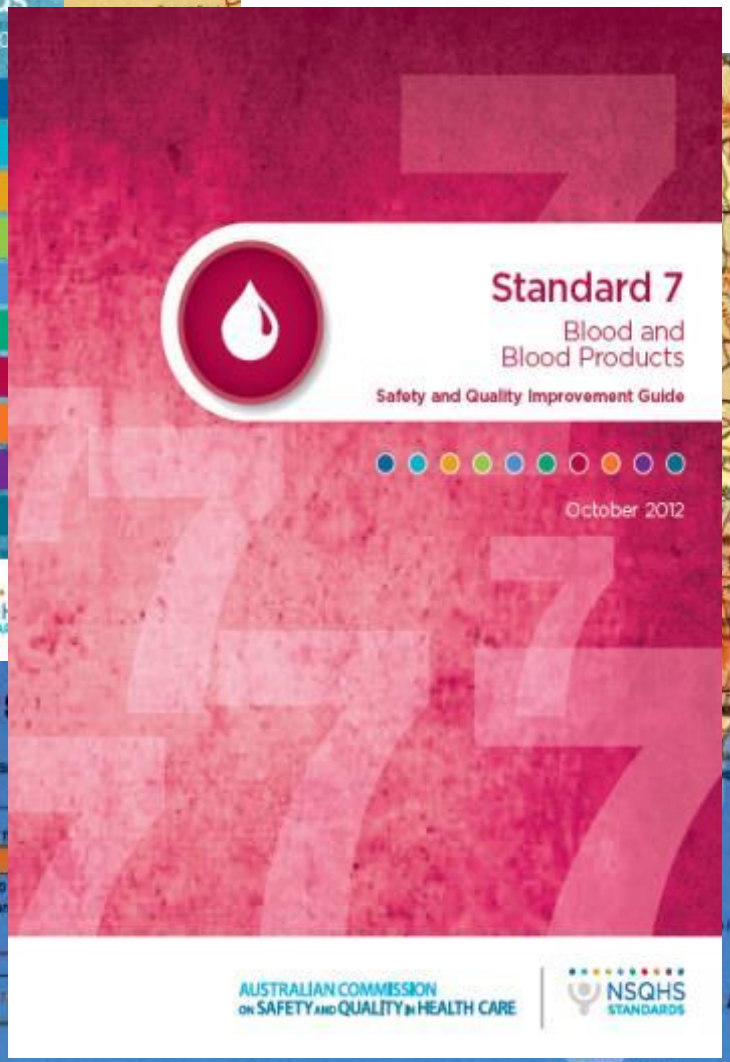
In cardiac & non-cardiac surgery, RBC transfusion is independently associated with increased morbidity & mortality. This relationship is dose dependent.

Preoperative anaemia is associated with increased hospital length of stay in non-cardiac surgery

In cardiac & non-cardiac surgery, RBC transfusion is associated with significantly longer stays in hospital and ICU



NSQHS STANDARDS



Service Contract 2013 61 06
EU-PBM Leaflet, Version: 1.0, 2014-05-16

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- Peter Rehak, Graz
- Astrid Nørgaard, Copenhagen
- Shannon Farmer, Perth
- Jens Meier, Linz
- Johann Kurz, Vienna

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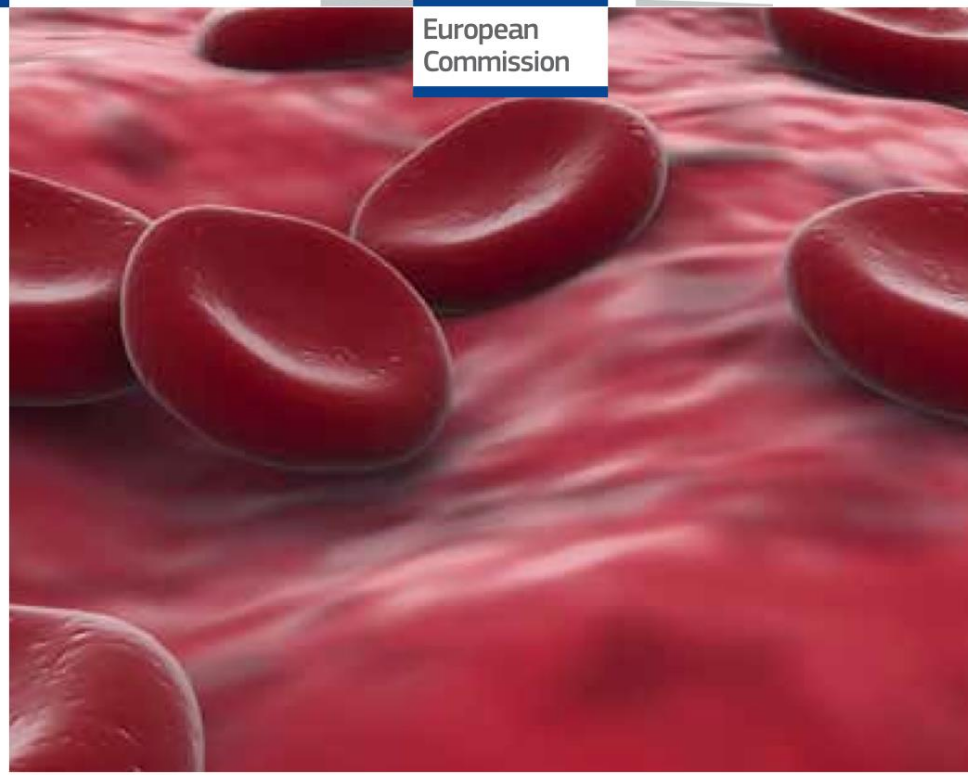
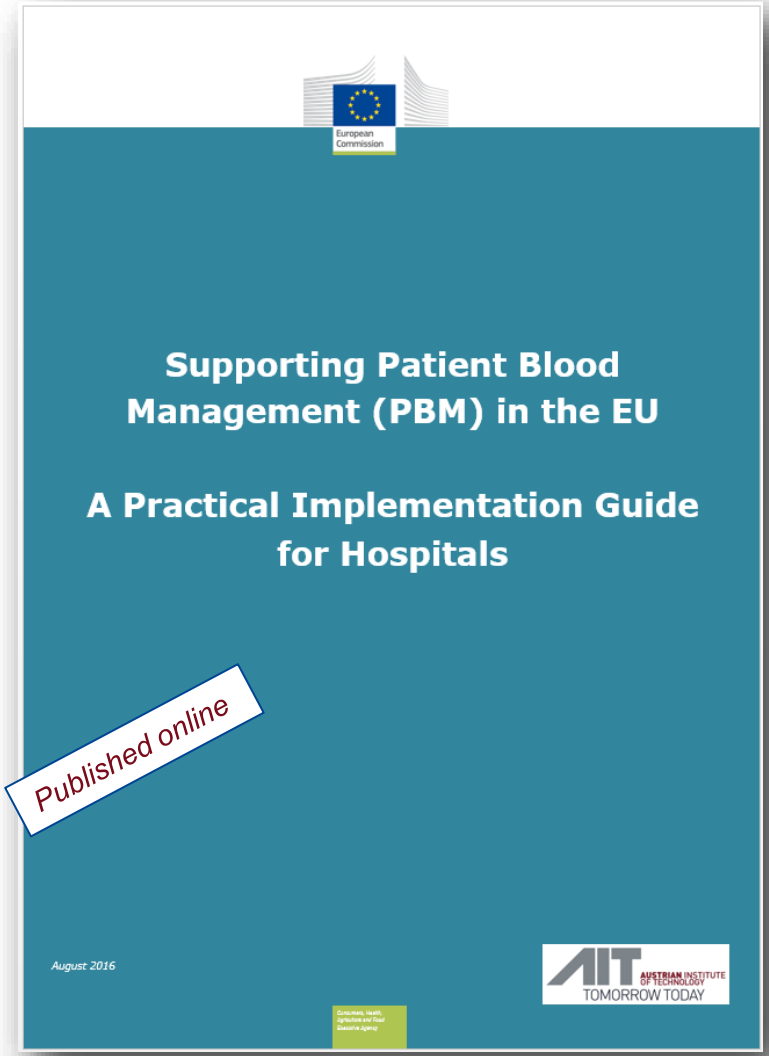
  Kai Zacharowski

European Commission



EU-PBM

PBM - Implementation Guide for Hospitals



EUROPEAN COMMISSION

Directorate-General for Health and Food Safety
Directorate B - Health systems, medical products and innovation
Unit B.4 - Medical products: quality, safety, innovation

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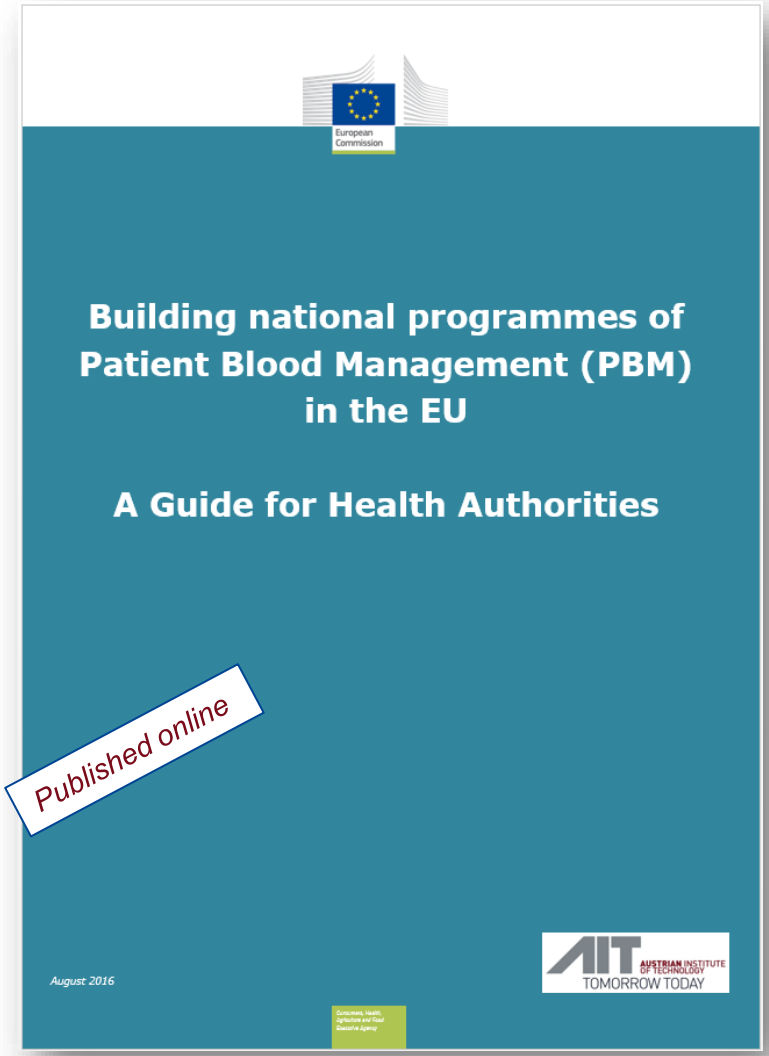
www.ait.ac.at / www.europe-pbm.eu

PBM - Guide for Health Authorities



EUROPEAN COMMISSION

Directorate-General for Health and Food Safety
Directorate B - Health systems, medical products and innovation
Unit B.4 - Medical products: quality, safety, innovation

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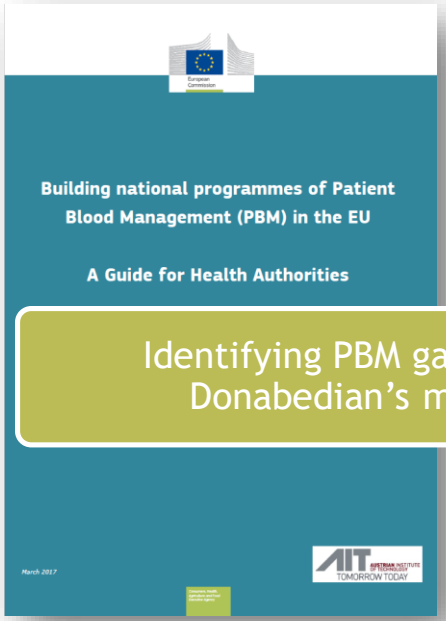


Identifying PBM gaps with Donabedian's model

Find more under chapter 4

Donabedian's quality framework: Ensuring PBM as the new standard of care

What is the public health care structure to care for the patient?

Quality of Structure

Structural deficits represent major obstacle for health-system wide PBM implementation

What is done to the patient?

Quality of Process

Numerous hospitals worldwide including some EU-PBM pilot sites with well coordinated PBM processes

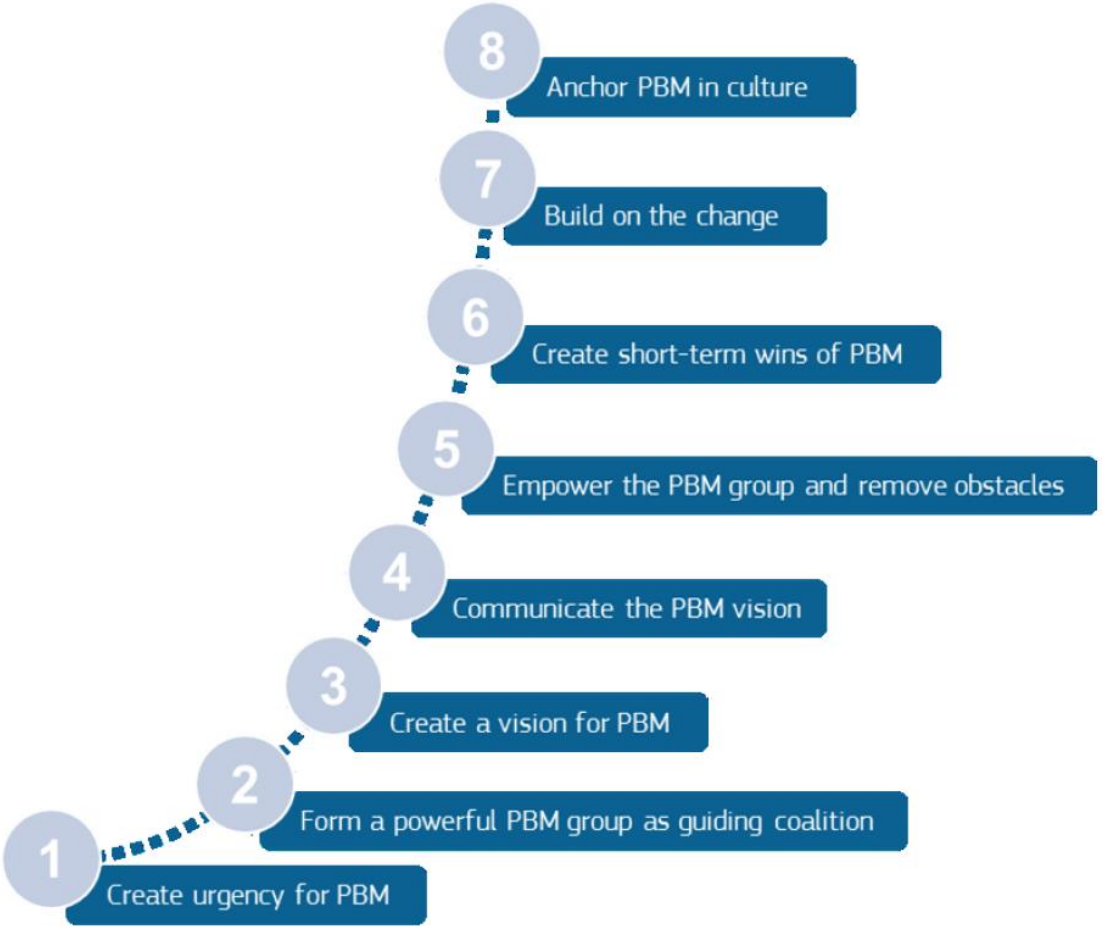
What happens to the patient?

Quality of Outcome

Evidence demonstrates **improved outcome** and **patient safety** with PBM

Structural problems

- PhD students – Structural Challenges
- PhD Students- Educational Challenges


8
Anchor PBM in culture
7
Build on the change
6
Create short-term wins of PBM
5
Empower the PBM group and remove obstacles
4
Communicate the PBM vision
3
Create a vision for PBM
2
Form a powerful PBM group as guiding coalition
1
Create urgency for PBM

Patient Blood Management

a. PBM requires a basic data set

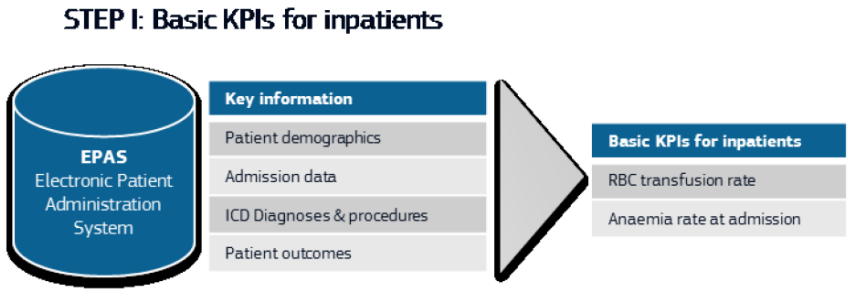


Figure 4. Step I: Mandatory introduction of basic key performance indicators (KPI) for inpatients: RBC transfusion rate, transfusion index and rate of patients admitted with and/or operated with anaemia.

PBM project feasibility

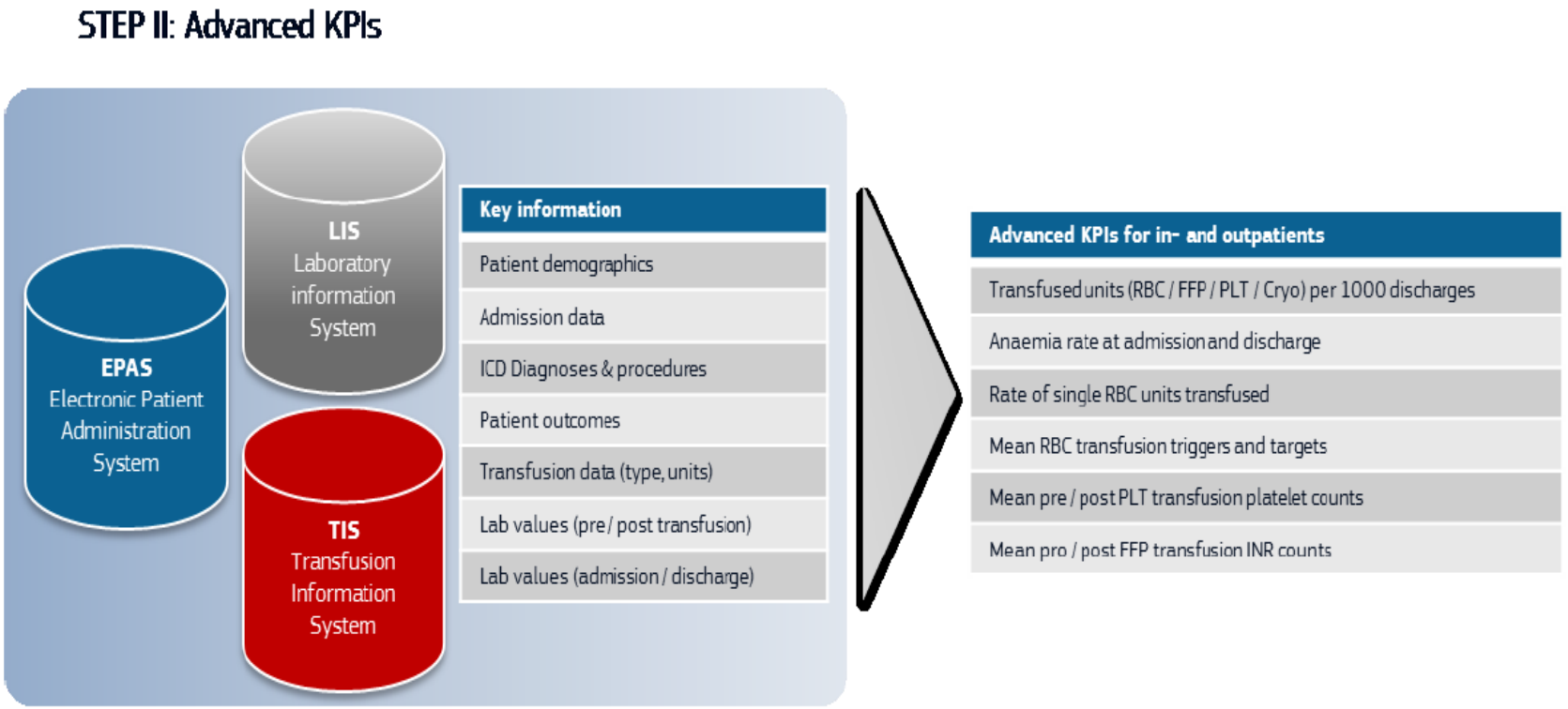
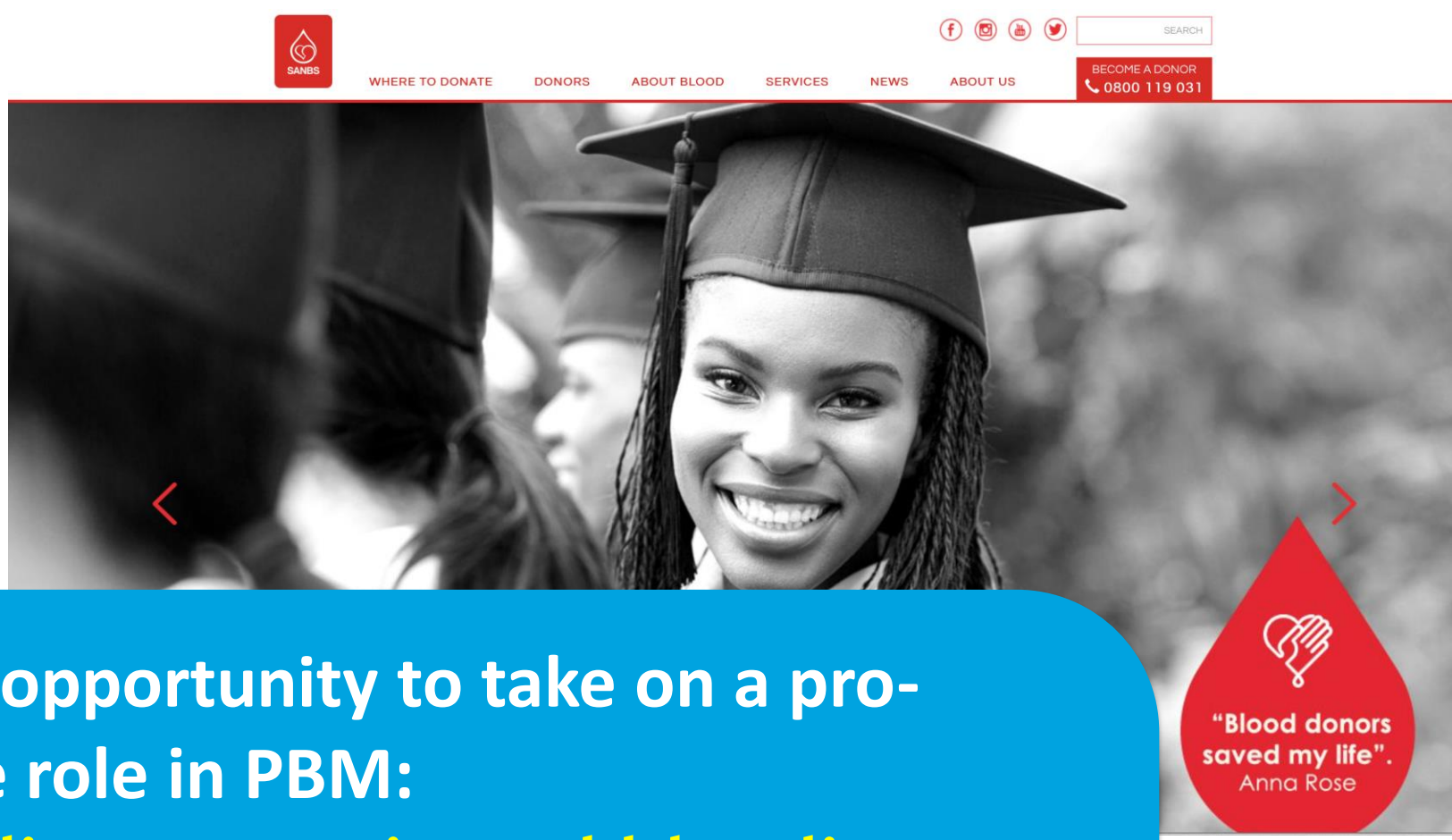


Figure 5. Recommended integration of different data sources to provide advanced KPIs which allow continuous surveillance of the utilisation of blood and blood components (RBC, FFP, PLT, Cryoprecipitate) (144, 145).

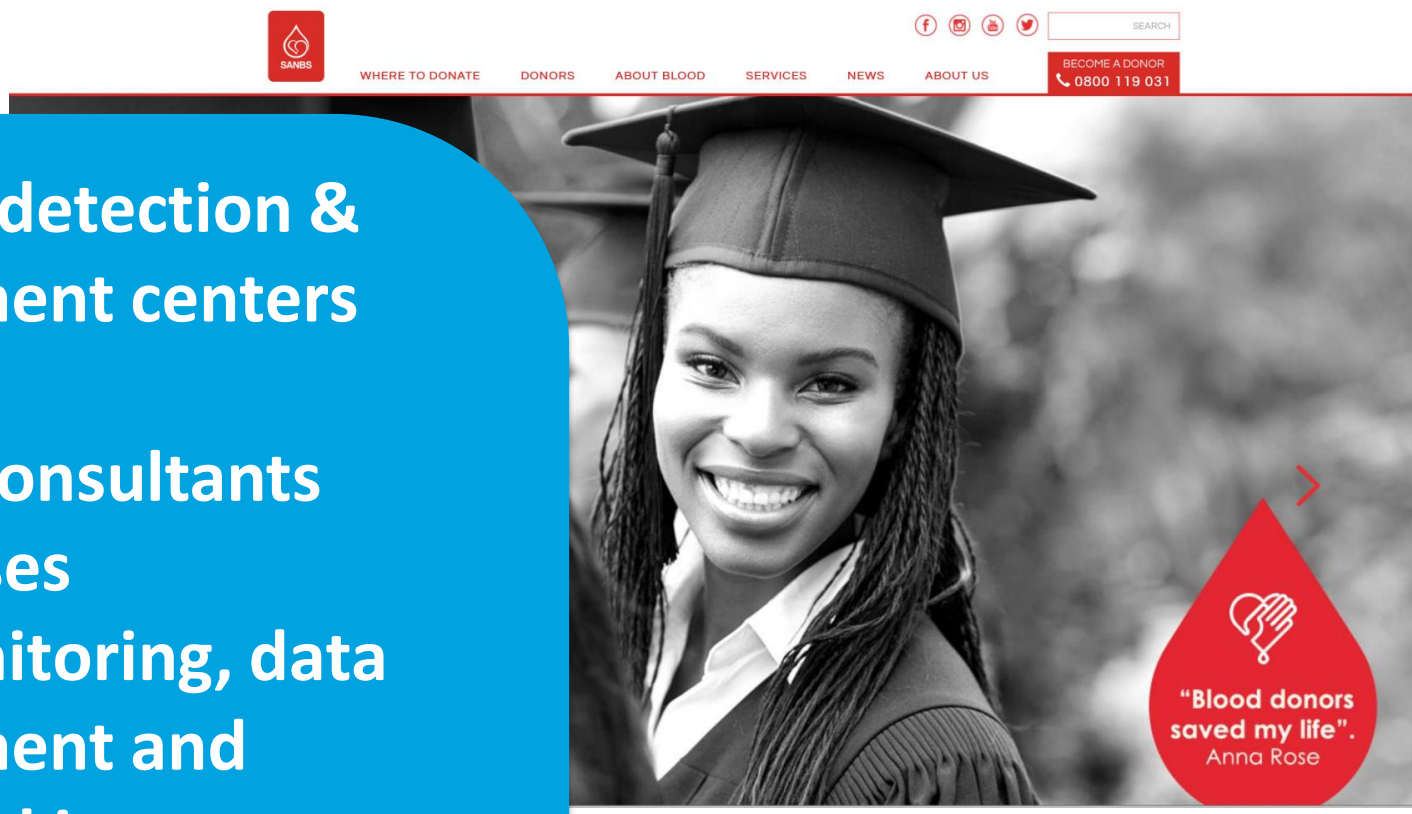
PBM and the Transfusion Establishment: Threat or Opportunity?

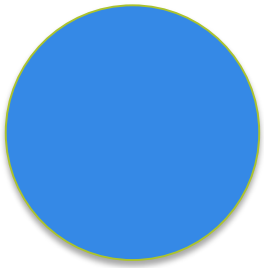


Huge opportunity to take on a pro-active role in PBM:

Avoiding anaemia and bleeding disorders in general and particularly prior to hospitalizations

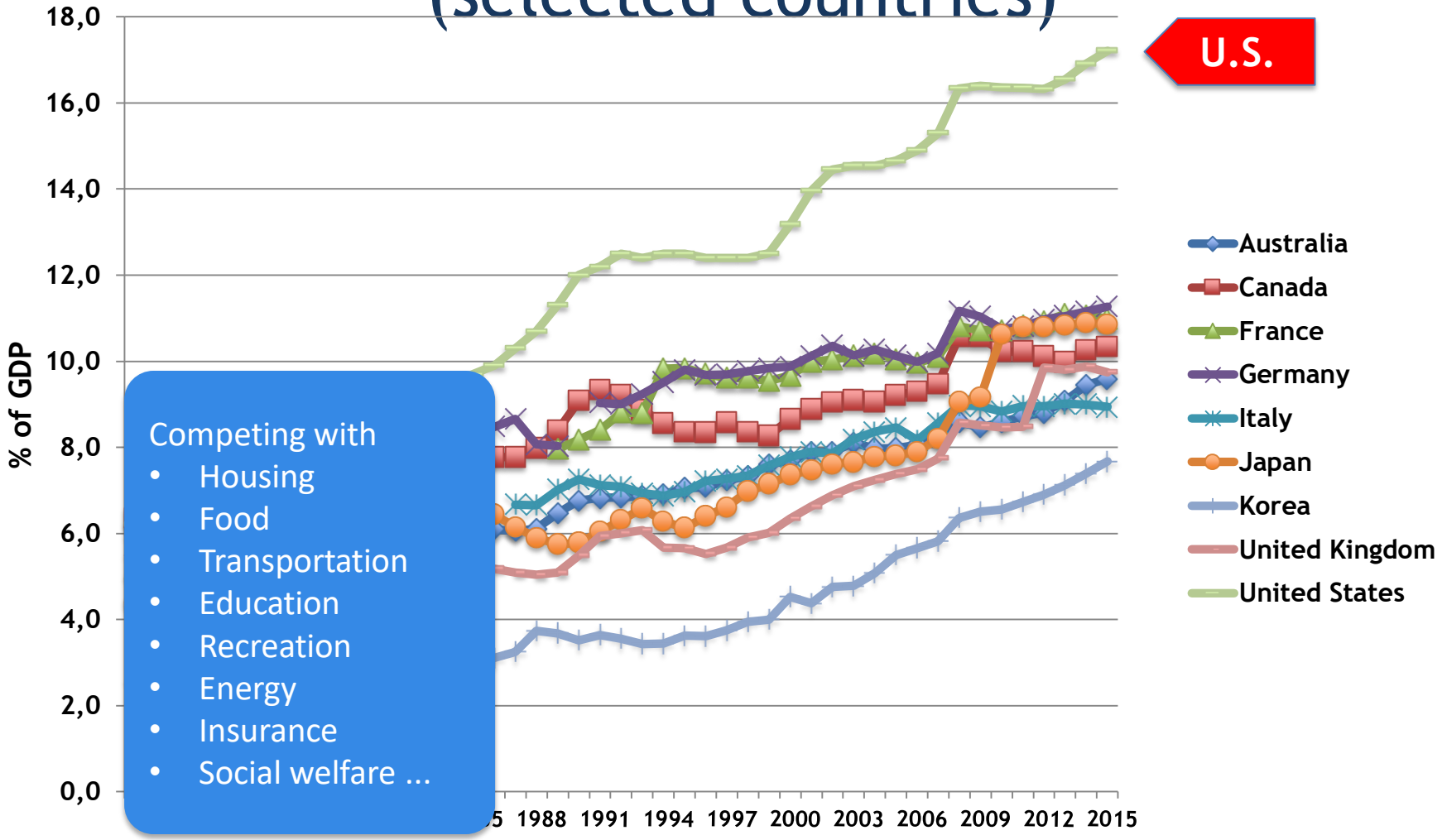
- Anaemia detection & management centers
- PBM experts/consultants
- PBM nurses
- PBM monitoring, data management and benchmarking
- PBM outcomes research
- PBM education
- PBM online training courses/CME
- PBM certification





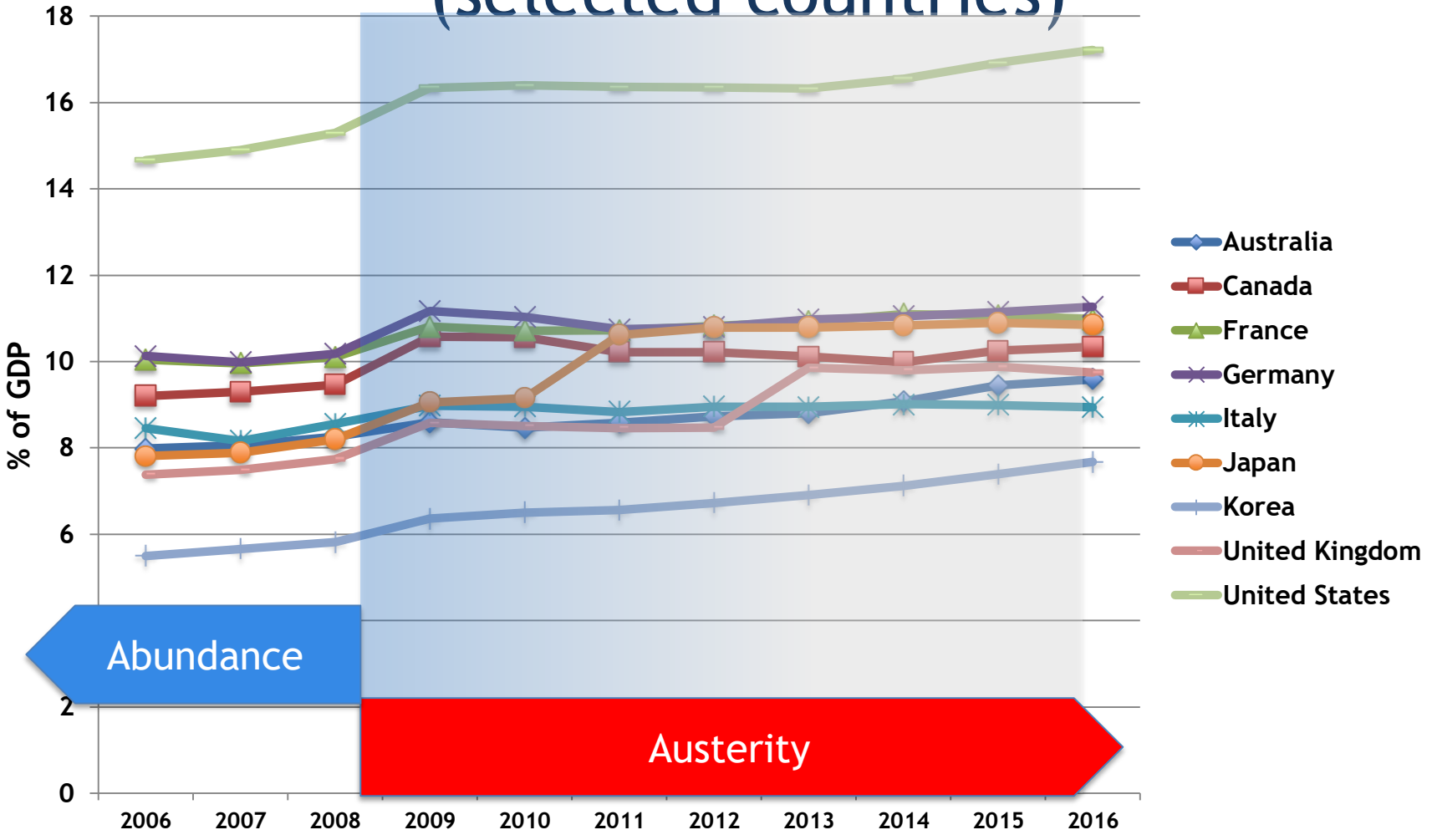
The Global Health Care Crisis

Health Care Expenditures – All Providers (selected countries)

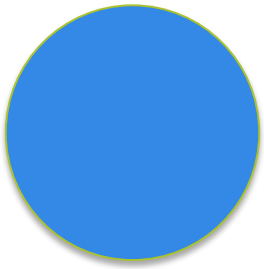


OECD Health Data 2017

Health Care Expenditures – All Providers (selected countries)



OECD Health Data 2017



The Current Imperative:
Improve Productivity

The Cost of Health Care

How much are we spending?

■ = $1 Billion

$2.5 Trillion

spent in the U.S. on health care in 2009

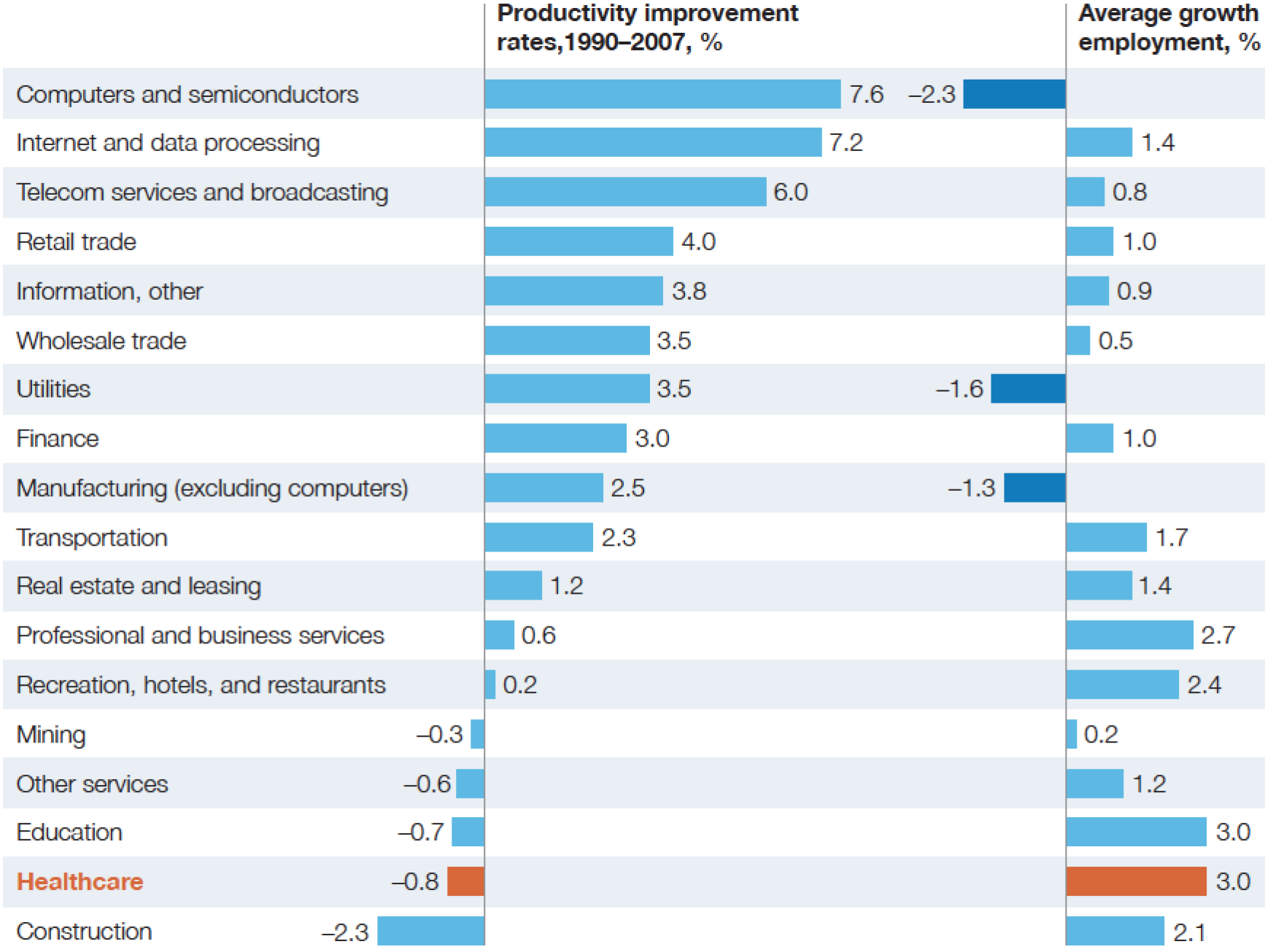
The Cost of Health Care
How much is waste?

Source: Data from workshop presentations and discussions summarized in *The Healthcare Imperative*

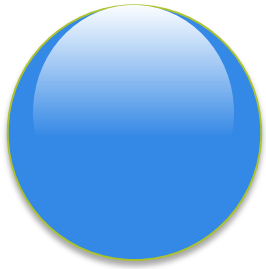
The Cost of Health Care
How much is waste?

Click the diagram for more detail or here to **CONTINUE**

Source: Data from workshop presentations and discussions summarized in *The Healthcare Imperative*

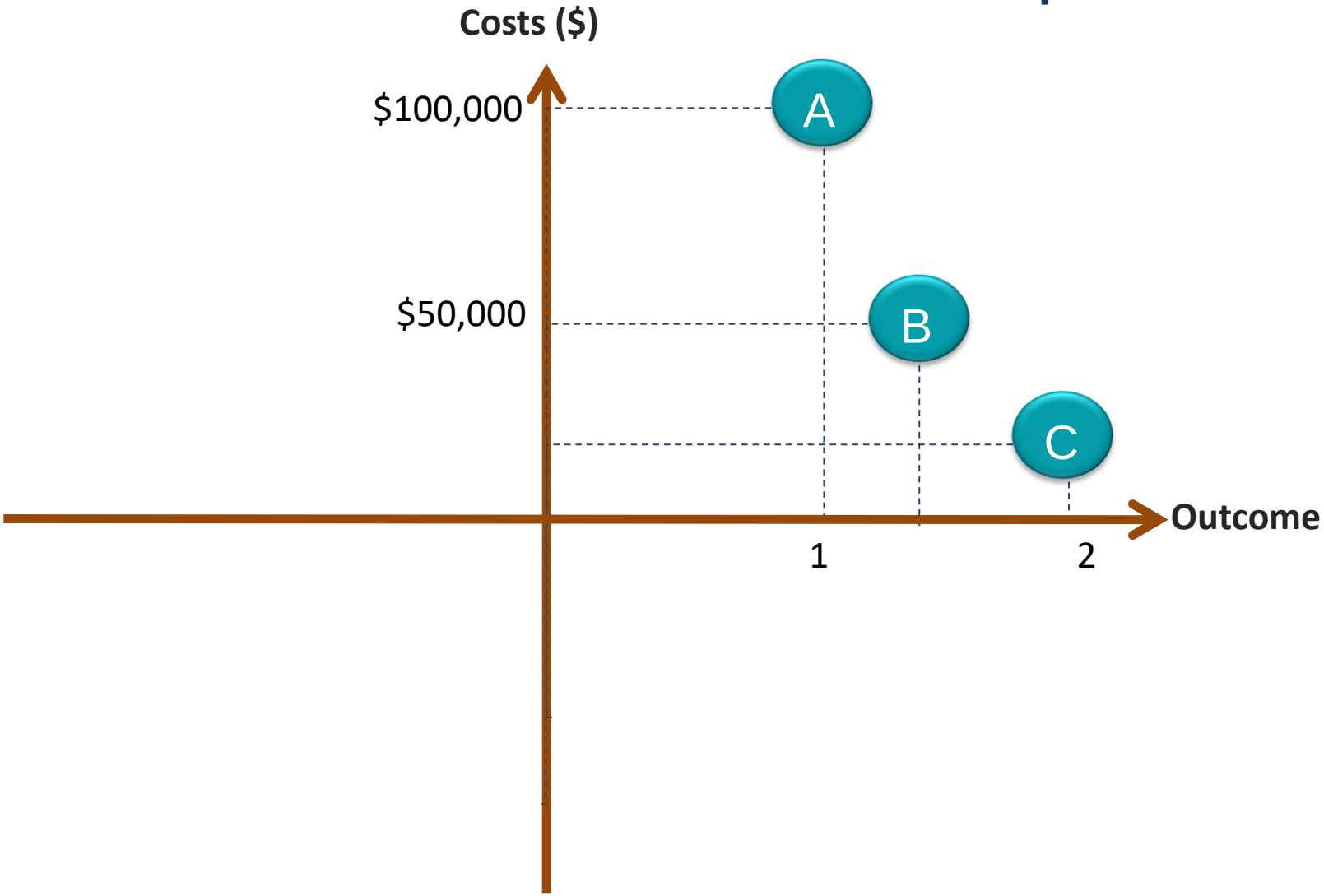


Source: Bureau of Economic Analysis; Centers for Medicare and Medicaid Services; Haver Analytics; McKinsey analysis

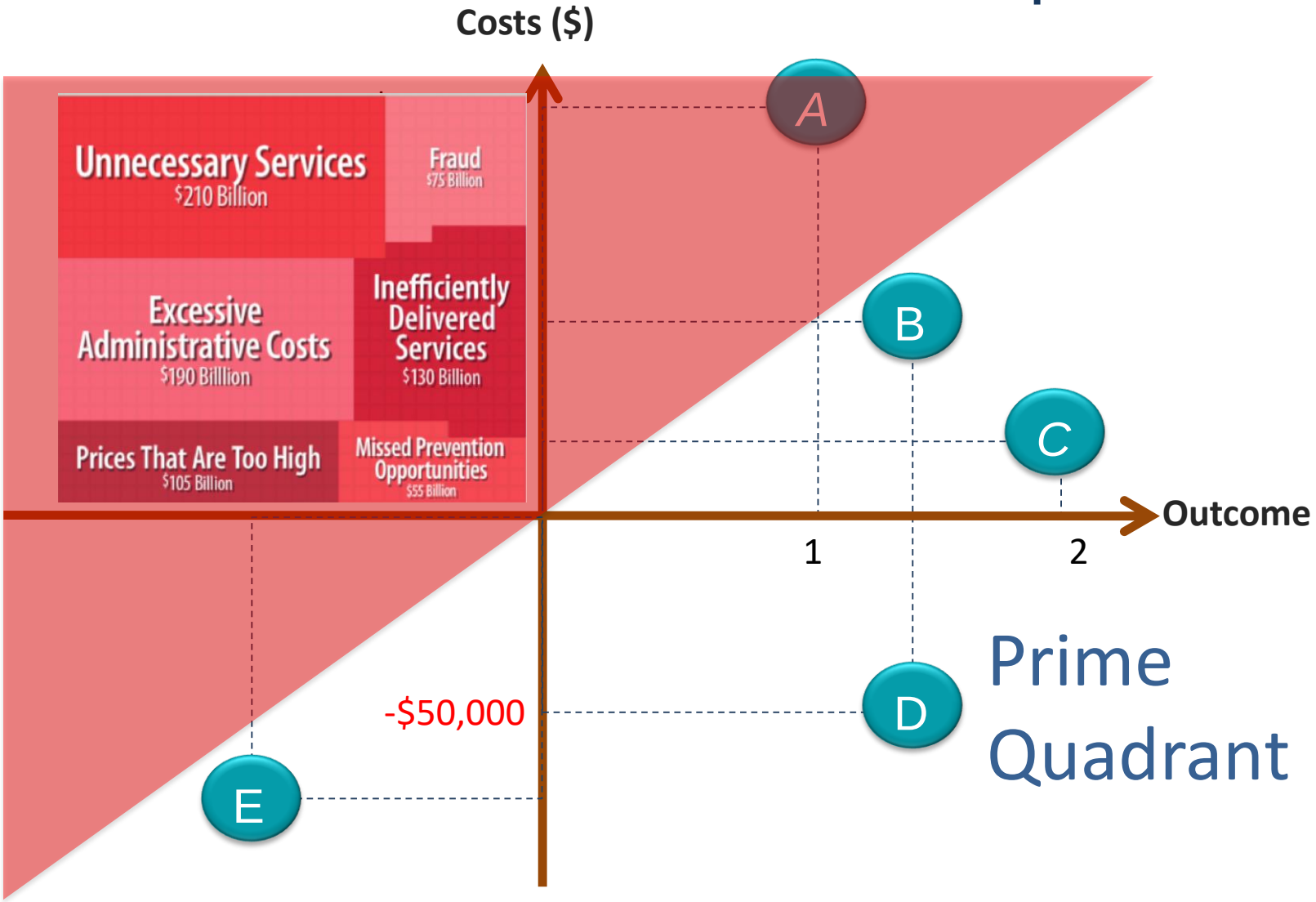


A Guide to Productivity:
Cost-effectiveness

Cost-Effectiveness Concept



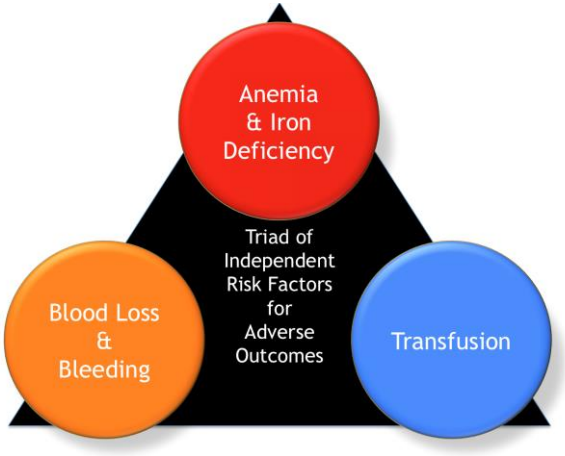
Cost-Effectiveness Concept

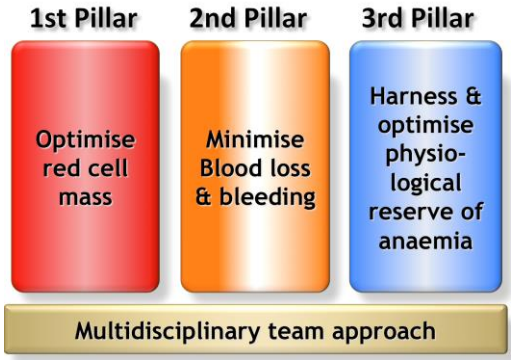


A huge missed opportunity:
As a standard of care, managing the patients' own blood rather than resorting to donor blood!

→ PATIENT BLOOD MANAGEMENT

Summary





- Anaemia, blood loss and transfusion are modifiable risk factors for adverse outcomes
- PBM addresses these risks:
  - Reduced mortality
  - Reduced morbidity
  - Reduced transfusions, thus leading to improved safety
  - Reduced LOS
  - Less cost
- PBM recommended as STANDARD OF CARE by the WHO, EC/EU, NBA, NHS, ESA, EBA, ACSQHC, SABM, IFPBM, AABB, ARC Blood Service and others

PBM SA

- Guiding Coalition- Publication
- IT infrastructure integration
- Guidelines
- Training of Blood service PBM champions
- Creating awareness National, Provincial, Private, Patient groups
- Visit NBA
- Congress
- Research projects
- Training pre-graduate and post graduate level

Acknowledge

Axel Hofmann, Dr rer medic, ME
Claire Armour Barrett, MBChB, Dip Transfusion Med, MMed
Anothony Beeton, MBBCh, FFA(SA)
Gregory Bellairs, MB ChB, MBA, Dip Transfusion Med
Lorenzo Boretti, PhD, MB ChB
Marius Coetzee, MBChB, MMed(Path), FFPath (SA)
Shannon Farmer, Research fellow
Matthew Gibbs, MBChB, DA (SA), FCA (SA), MMed (Anaes)
Hans H Gombotz,, MD
Caroline Hilton, C Hilton,8 MBChB, Dip HIV Man (SA)
Chris Kassianides,, MBBCh, FCP(SA);
Vernon Louw, MBChB(Stell), MMed (Int Med)(Stell), PhD(HPE)(UFS)
Cristina Lundgren, MB, ChB; FFA (SA); PhD; MSc Med, Health Law and Bi
Johnny Mahlangu, BSc, MBBCh, MMed, FCPath, Cert Clin Haem
Colin Byron Noel, FCS (SA), M.B., Ch.B., MMed Surgery, B
Vanitha Rimbiritch, BTech Biomed (DUT), PGDip HPE (UCT)
Frank Schneider, MBChB FRCA FANZCA;
Estelle Verburgh, MD PhD
Petro-Lize Wessels, BMedSc, MBChB, Dip Transfusion Med
Pieter Wessels, MBChb, MMED (Haem), Cert. Clin Heam
Robert Wise, MB ChB, FCA (SA), MMed (Anaes), Cert Crit Care (SA
Aryeh Shander, MD, FCCM, FCCP