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IPO Conference

Patient Blood Management: a new standard of care to significantly improve outcomes and reduce costs

Prof. Dr. Axel Hofmann
Zürich, Switzerland & Perth Australia

Prevention Outcomes IPO

November 15th 2017, Düsseldorf (DE)

MEDICA

Gesellschaft Deutscher Krankenhaustag

Patient Blood Management:
a new standard of care to significantly improve outcomes and reduce costs

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Faculty of Medicine Dentistry and Health Sciences
University of Western Australia

Curtin University

Adjunct Professor | Faculty of Health Sciences
Curtin University Western Australia

AIT Austrian Institute of Technology
TOMORROW TODAY

International Foundation for Patient Blood Management

Disclaimer

In the past 5 years, Dr. Hofmann has received fees, honoraria or travel for consulting or lecturing from the following companies and legal entities:

- Austrian Institute of Technology, Vienna, Austria
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- International Foundation for Patient Blood Management
- MEDahead GmbH, Vienna, Austria
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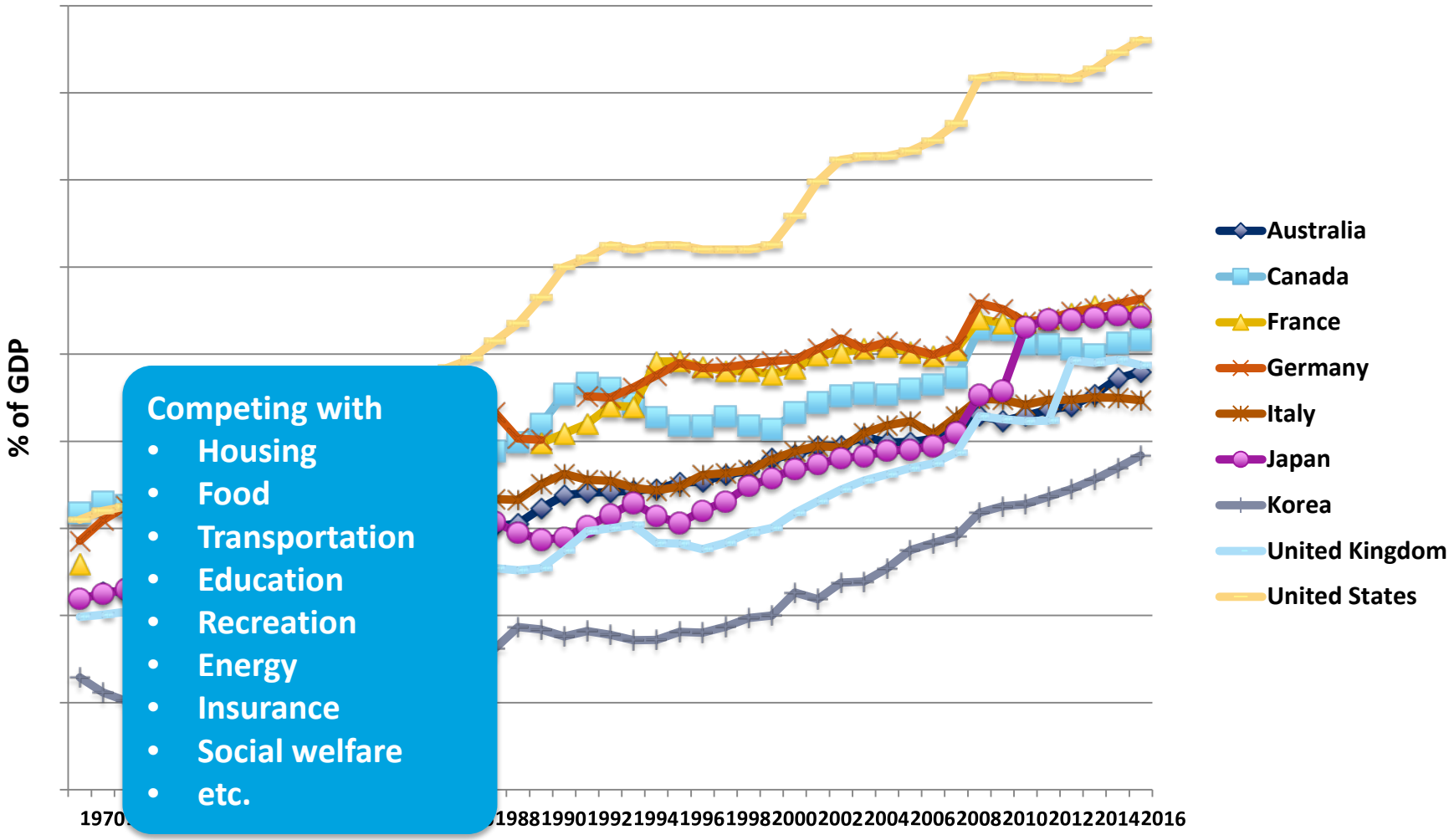
- Medical Society for Blood Management, Laxenburg, Austria
- National Blood Authority, Canberra, Australia
- South African National Blood Service
- UCB Pharma, PR of China
- Vifor Fresenius Medical Care Renal Pharma Ltd., Switzerland
- Vifor International AG,, Switzerland
- Vision Plus S.r.L., Italy
- Western Australia Department of Health, Perth, Australia

The Global Health Care Crisis

Health Care Expenditures – All Providers
(selected countries)



OECD Health Data 2017

The NEW ENGLAND JOURNAL of MEDICINE

EDITORIALS

A Glimpse of the Next 100 Years in Medicine

Isaac S. Kohane, M.D., Ph.D., Jeffrey M. Drazen, M.D., and Edward W. Campion, M.D.

- [T]he era of shifting more and more economic resources toward health care is going to end.
- The medicine of the future will focus on more efficient use of resources.

Kohane, I.S., J.M. Drazen, and E.W. Campion, A glimpse of the next 100 years in medicine. N Engl J Med, 2012. 367(26): p. 2538-9

2

The Grey Tsunami: Aggravating the Crisis

March 7, 2014

THE HUFFINGTON POST

THE BLOG

Featuring fresh takes and real-time analysis from HuffPost's signature lineup of contributors

HOT ON THE BLOG

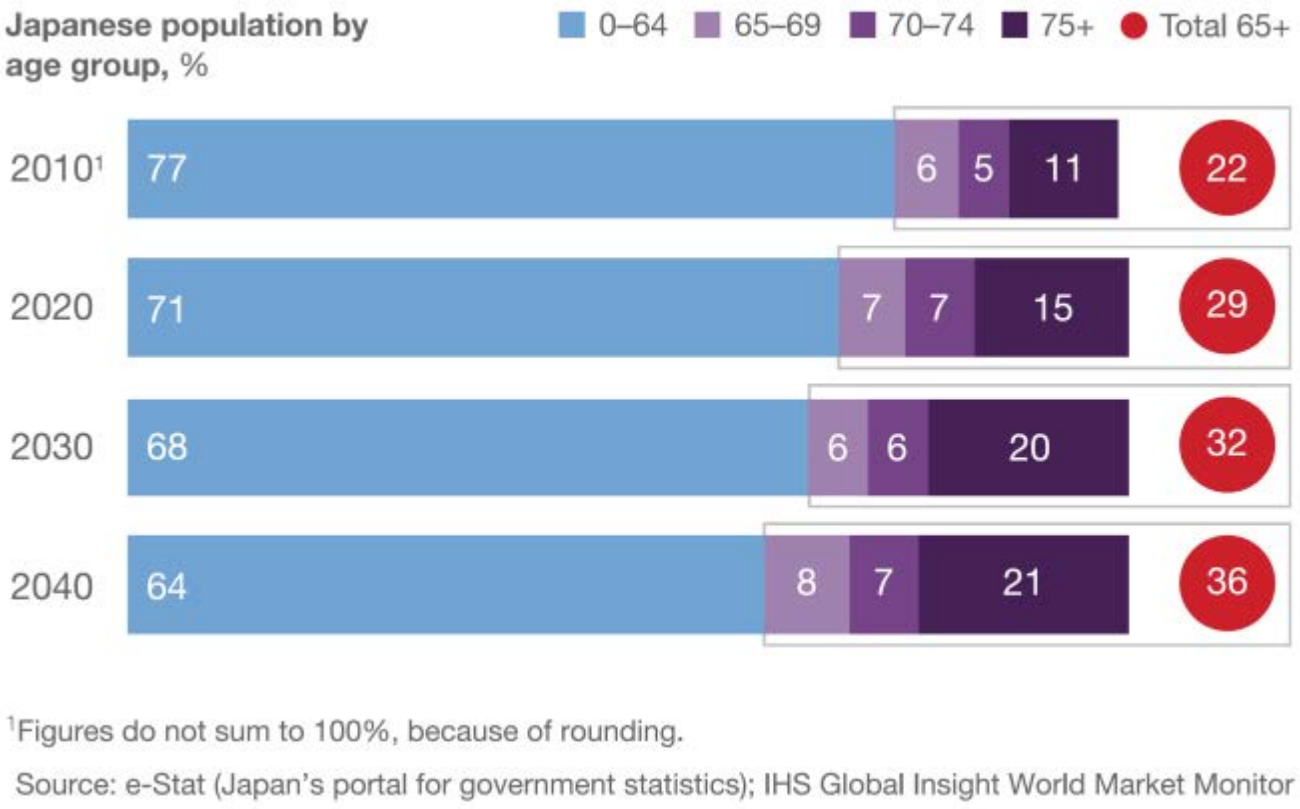
Nadia Tolokonnil
Harry Belafonte

Susan Blumenthal, M.D.

Public Health Editor at HuffPost and Former U.S. Assistant Surgeon General

Baby Boomers: Public Health's Biggest Challenge

From Aging to Hyperaging



Adachi M,Ishida R, Oka G. Japan: Lessons from a hyperaging society. McKinsey Quarterly, 2015

Reproduced from World eXplorer
'http://ncva.itn.liu.se/explorer/world-explorer?l=en

Population, total

Population 60+ ↑
Longevity ↑
Health care volume ↑

Japan
1960-2013

Italy

Germany

U.S.

China

India

2013

Population ages 65 and above (% of total)

26
24
22
20
18
16
14
12
10
8
6
4
2

48
52
56
60
64
68
72
78
80

Life expectancy at birth, total years

Mitigating the Crisis, but how?

Analyze what is going on and wrong in health care

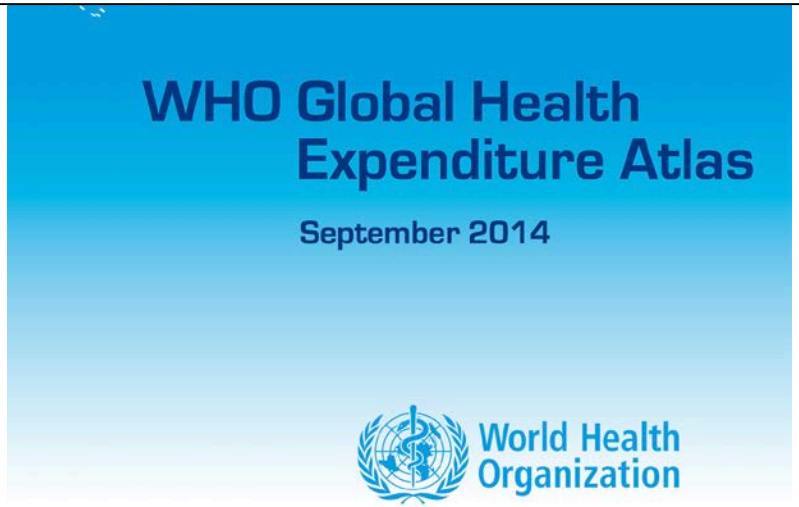
The financial dimension of what is going wrong

Health financing March 2014

Key facts[1]

- 100 million people are pushed into poverty every year because they have to pay directly for their health care.
- WHO recommends moving away from direct, out-of-pocket payments to using prepaid mechanisms to raise funds for health.
- In 2011, US$ 6.9 trillion was spent on health.
- Typically between 20–40% of health spending is wasted.

A minimum of US$ 44 is needed per person per year to provide basic, life-saving health services: 26 WHO Member States spend less than this in 2011[2]



The Cost of Health Care

How much are we spending?

■ = $1 Billion

The Cost of Health Care
How much is waste?

■ = $1 Billion

Total 2009 health care spending*:

France	$243 Billion
Germany	$339 Billion
Italy	$183 Billion
Total	$765 Billion

WASTE:
$765 Billion
30% of 2009 total health care spending

**Stats.OECD.org*

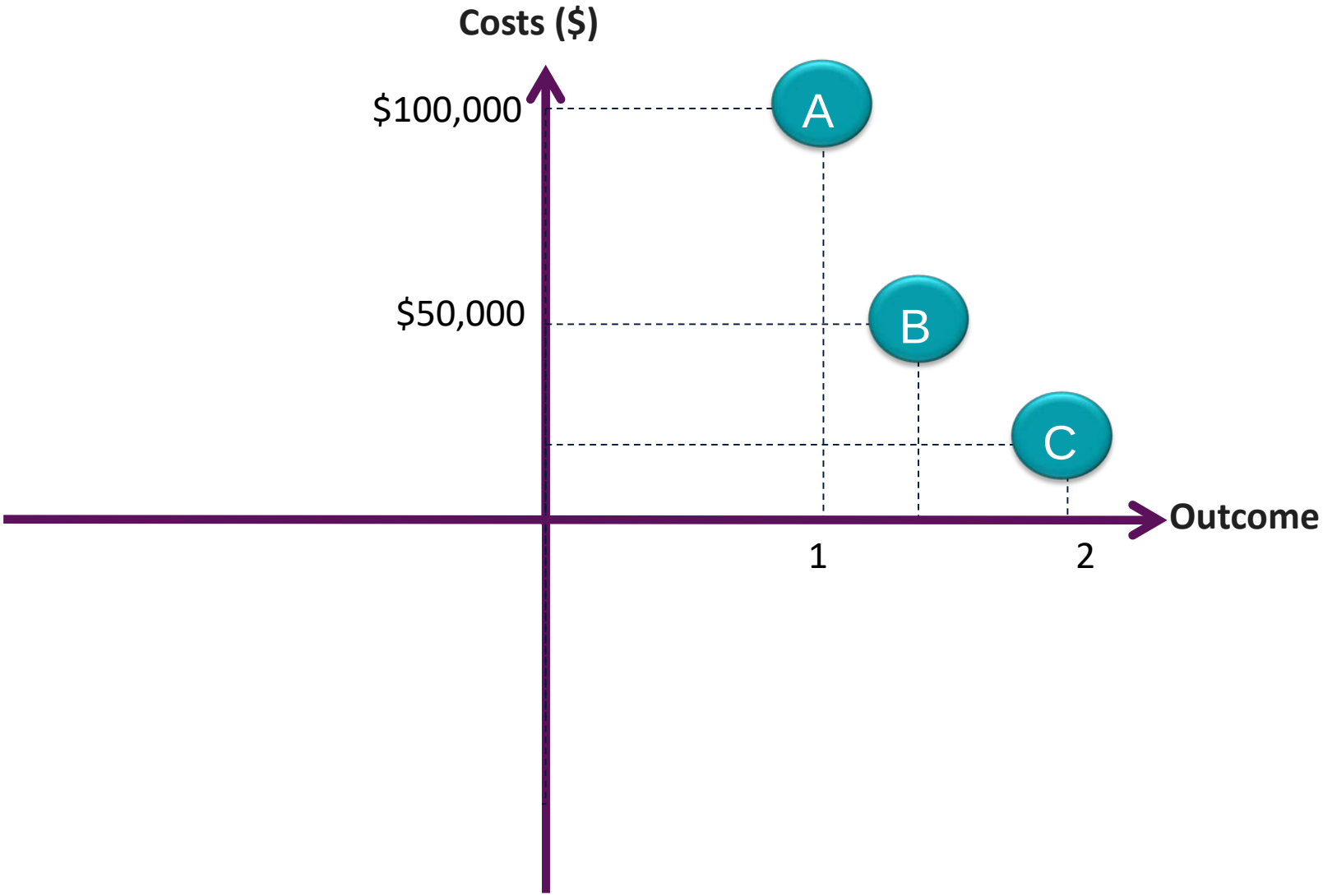
Source: Data from workshop presentations and discussions summarized in *The Healthcare Imperative*

The Cost of Health Care
How much is waste?

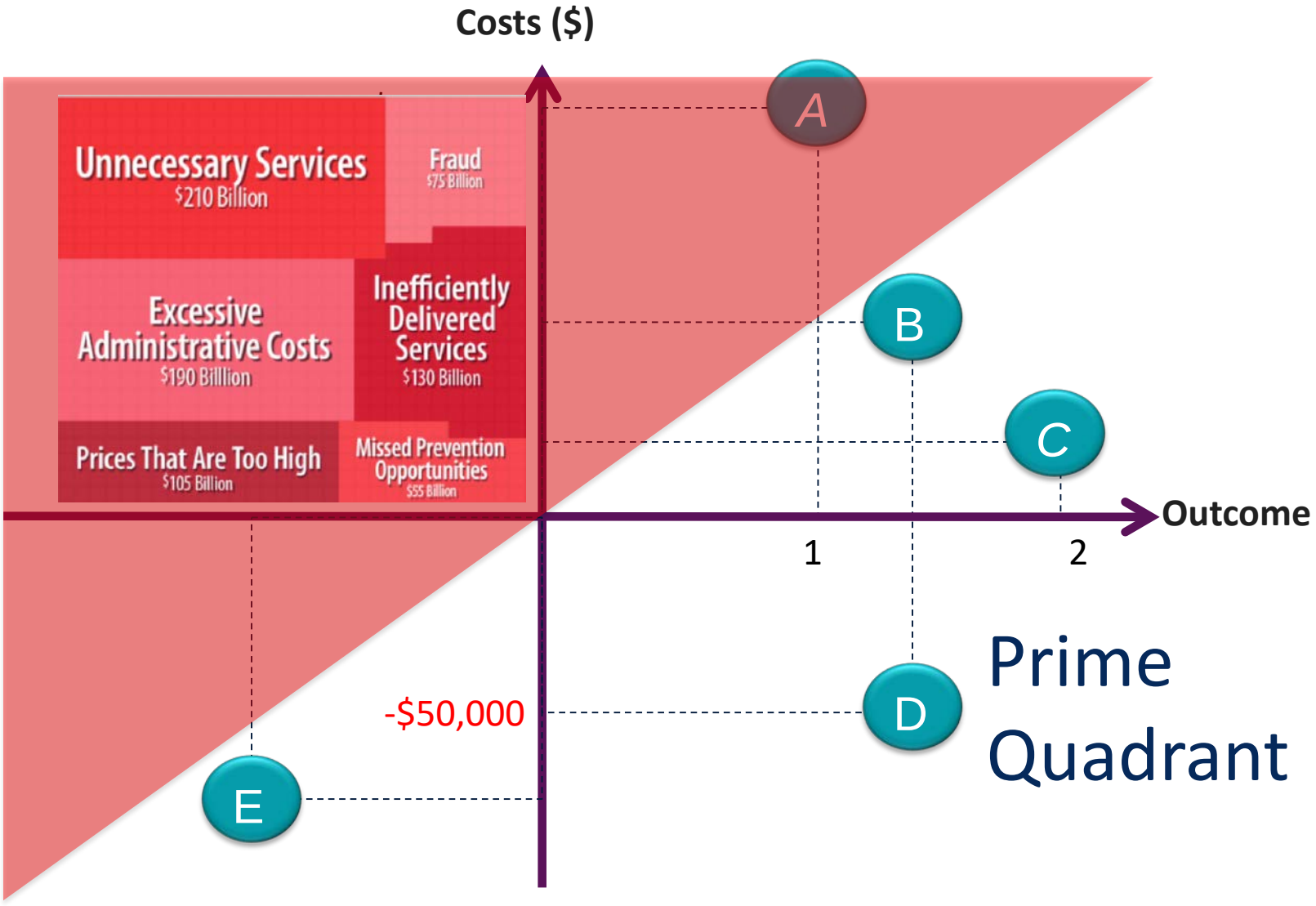
Click the diagram for more detail or here to CONTINUE

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

Cost-Effectiveness Plane



Cost-Effectiveness Plane



Focus on one of the bigger issues

The triad of anaemia, bleeding & transfusion

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

Bleeding

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

William Stewart Halsted

1852 – 1922

Johns Hopkins University

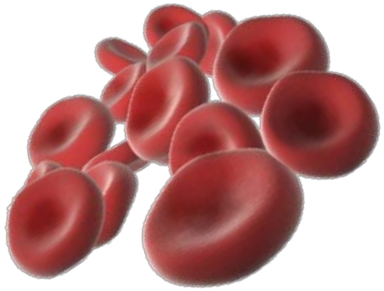
Major blood loss associated with increased

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

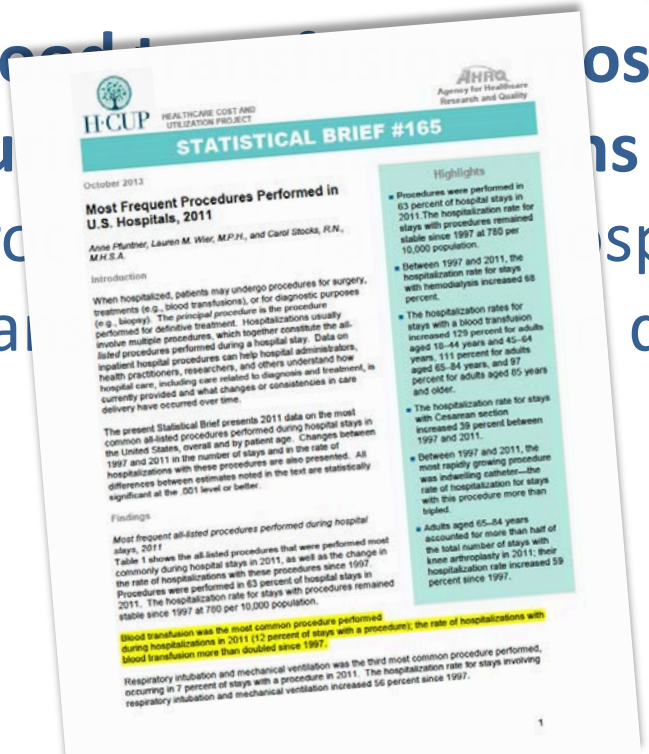
Causes

- 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



Blo 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 38 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

“[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.

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

2007

- 8,500 pts
- Compared transfused vs non-transfused after multivariable logistic regression and propensity score analysis

- 30-day mortality was over 6-times higher in the txd patients
- Increased ICU, high-dependency unit and hospital length of stay

"RBC transfusion appears to be harmful for almost all cardiac surgery patients"

Murphy, G.J., et al., Increased mortality, postoperative morbidity, and cost after red blood cell transfusion in patients having cardiac surgery. Circulation, 2007. 116(22): p. 2544-52.

Outcome	Odds ratio	C.I.
Composite infection	3.38	2.60 – 4.40
Ischaemic events	3.35	2.68 – 4.35

Infectious Events	
RBC units txd	Adjusted OR; CI
0	AOR 1.0; 95% CI, …
1	AOR 1.46; 95% CI, 0.92–2.11
2	AOR 2.36; 95% CI, 1.42–3.30
3 or 4	AOR 3.82; 95% CI, 2.22–5.47
5-9	AOR 10.75; 95% CI, 5.83–15.9
>9	AOR 45.44; 95% CI, 22.6–73.6

Murphy, G.J., et al., Increased mortality, postoperative morbidity, and cost after red blood cell transfusion in patients having cardiac surgery. Circulation, 2007. 116(22): p. 2544-52.

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**
Parsons 2013[12]	ICU	124	Decreased muscle strength
Zilberberg 2007[13]	ICU	4'892	ARDS
Gong 2005[14]	ICU	688	ARDS & ARDS mortality
Shorr 2005[15]	ICU	4'892	Blood stream infection
Corwin 2004[16]	ICU	4'892	Mortality, ARDS, ICU and hospital LOS
Taylor 2006[17]	ICU	2'085	Nosocomial infection, ICU & hospital LOS, mortality
Kneyber 2007[18]	Pediatric ICU	295	Mortality

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

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**
Goobie 2016[36]	Non-cardiac surgery, pediatrics	114'395	Mortality, Infection
Ferraris 2012[37]	Non-cardiac surgery	941'496	Morbidity, mortality, resource use
Ferraris 2011[38]	Thoracic surgery	8'728	Morbidity & mortality
Al-Refaie 2012[39]	Cancer surgery	38'926	Mortality, complications, hospital LOS
Linder 2013[40]	Nephrectomy	2'318	Mortality
Bernard 2009[41]	General surgery	125'177	Morbidity & mortality
Beattie 2009[42]	Non-cardiac surgery	7'759	Mortality
Bursi 2009[43]	Vascular surgery	359	Mortality, MI, composite MI/mortality
Dunne 2002[44]	Non-cardiac surgery	6'301	Pneumonia, hospital LOS, mortality
Gauvin 2008[45]	Paediatrics	1'100	Mortality
Jagoditsch 2006[46]	Rectal surgery	597	Mortality
Xenos 2012[47]	Colorectal surgery	21'943	VTE
Chang 2000[48]	Colorectal surgery	1'349	Infection
Vignali 1996[49]	Colorectal surgery	267	Infection
Ho 2007[50]	Spinal surgery	1'046	Delayed infection
Carson 1999[51]	Hip fracture surgery	9'598	Infection, pneumonia
Palmieri 2006[52]	Burns	666	Infection & mortality

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

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**
Jones[1]	Massive Bleeding/Trauma	1'538	Organ failure, ventilator-associated pneumonia, sepsis, blood stream infection, catheter-related bloodstream infection, UTI, ARDS and nosocomial infection
Johnson 2016[2]	Massive Bleeding	272'592	Mortality, Infection, kidney injury, thrombotic, respiratory, ischemic events and composite morbidity
Patel[3]	Massive Bleeding/Trauma	106'477	Mortality, MOF, ARDS/ ALI
Chaiwat 2009[4]	Trauma	14'070	ARDS
Salim 2008[5]	Traumatic Brain Injury	1'150	Mortality, ARDS, ARF, acute respiratory failure, bacteremia or fungemia, MOF, pulmonary embolism, pneumonia, sepsis
Bochicchio 2008[6]	Trauma	1'172	Infection, hospital & ICU LOS, mechanical ventilations, mortality
Weinberg 2008[7]	Trauma	1'624	Morbidity & mortality
Charles 2007[8]	Trauma	8'215	Mortality
Malone 2003[9]	Trauma	15'534	Mortality
Claridge 2002[10]	Trauma	1'593	Infection
Moore 1997[11]	Trauma	513	MOF

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

nature
International weekly journal of science
24 | NATURE | VOL 520 | 2 APRIL 2015

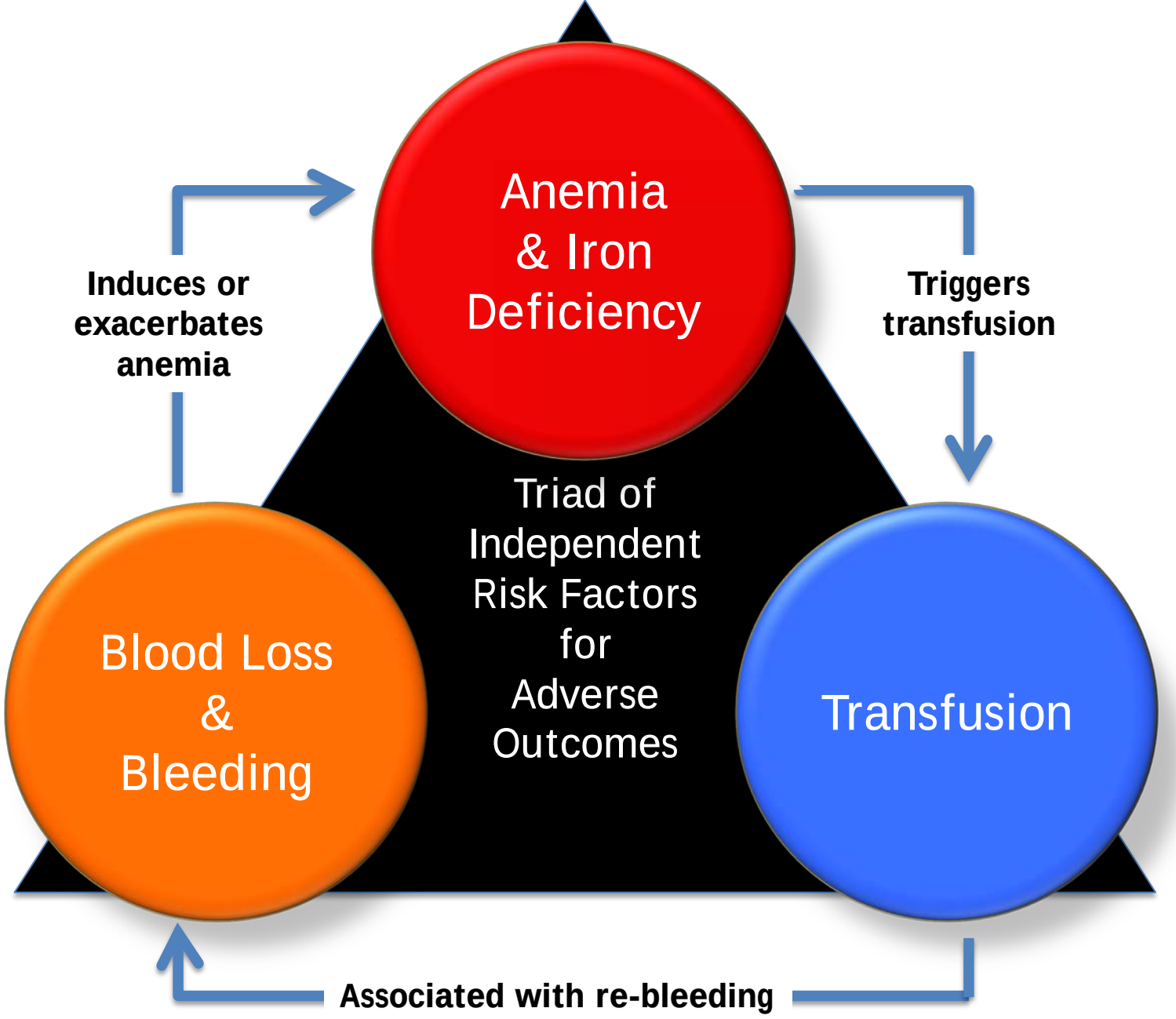
Marking the paradigm shift

SAVE BLOOD, SAVE LIVES

Transfusions are one of the most overused treatments in modern medicine, at a cost of billions of dollars. Researchers are working out how to cut back.

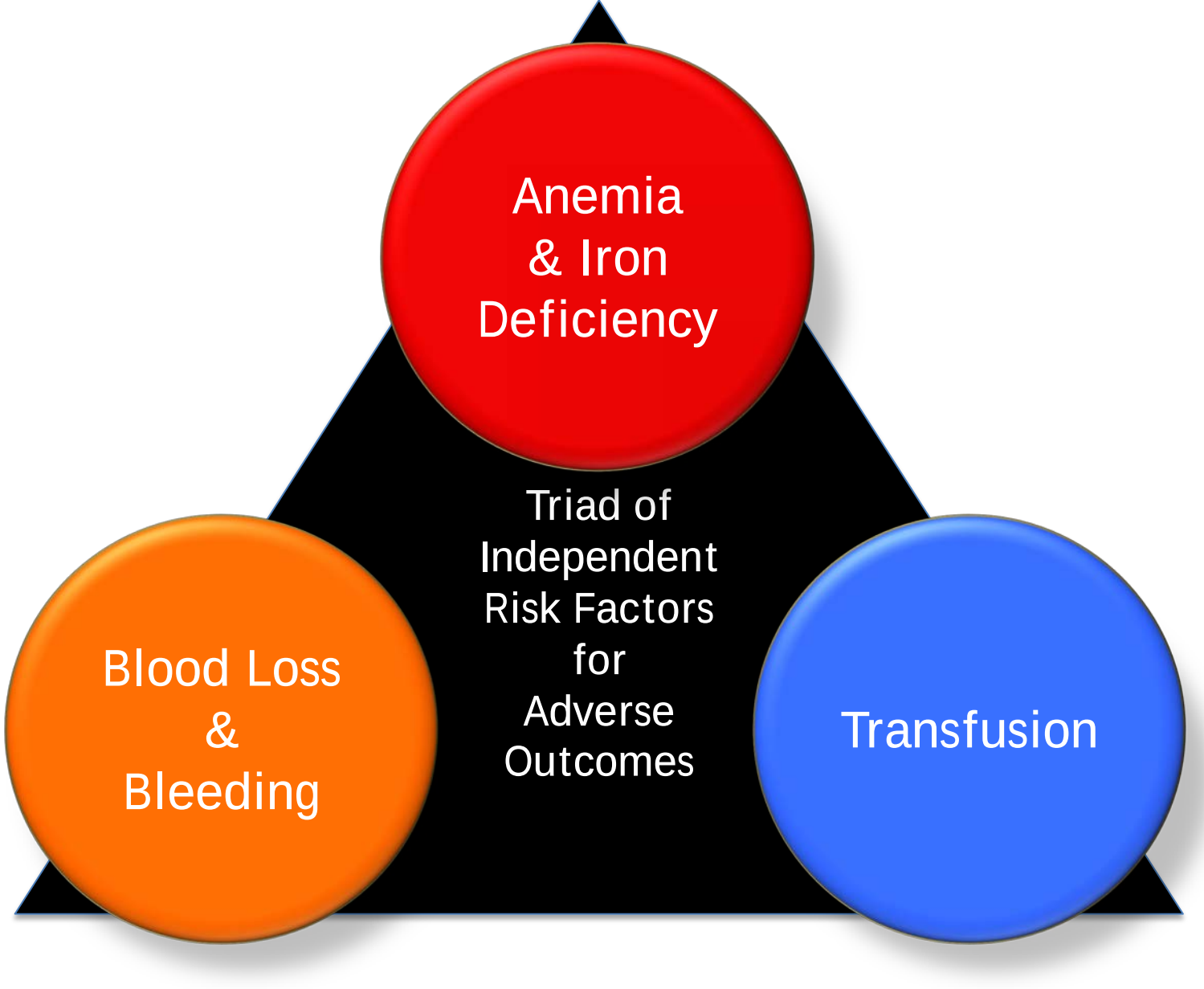
BY EMILY ANTHES


VOLUNTEER DONOR
Rh POSITIVE
O



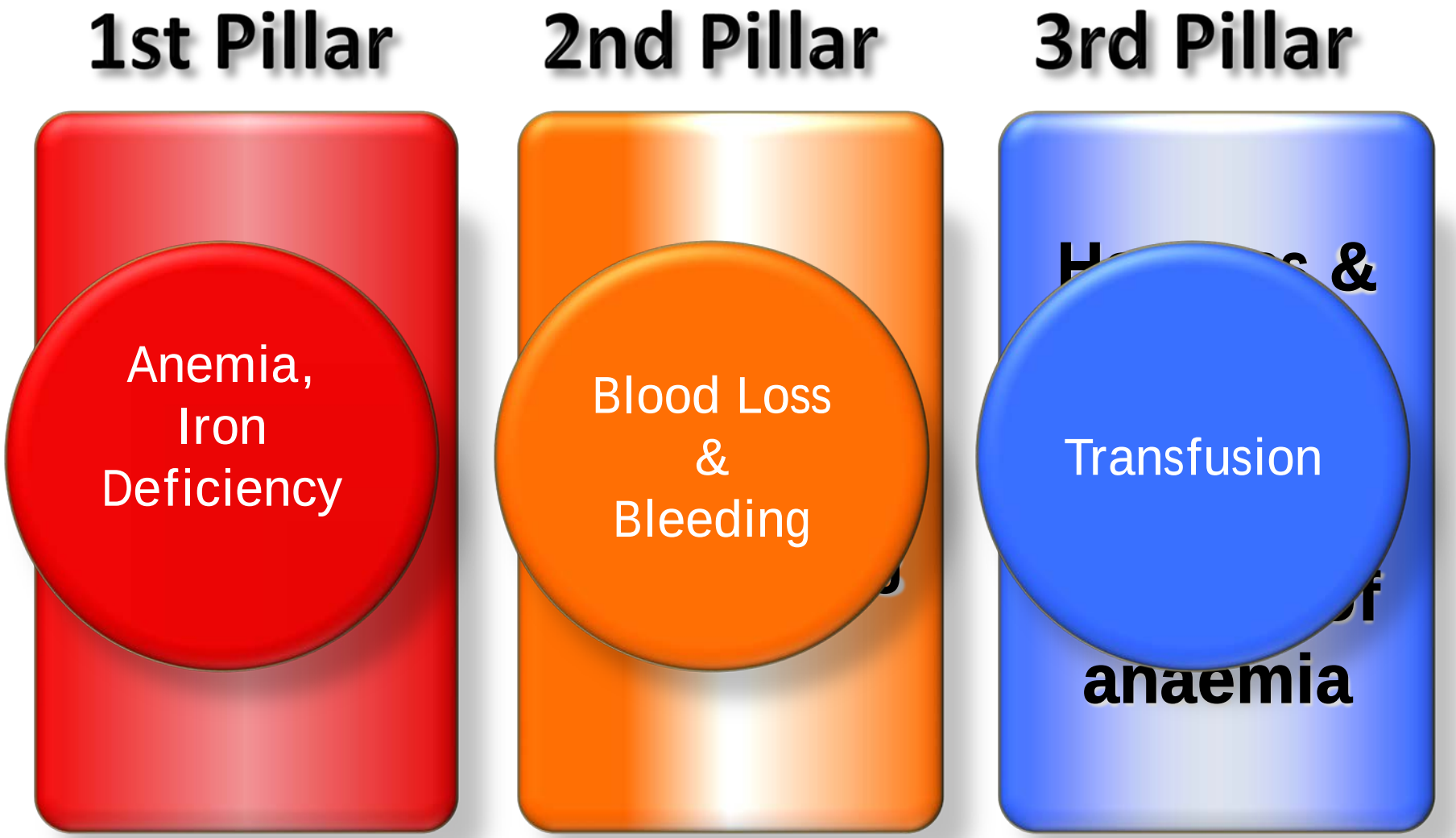
Farmer SL., Towler SC, Leahy MF, Hofmann A. Best Pract Res Clin Anaesthesiol, 2013. 27(1): p. 43-58.

PBM: Breaking the viscous cycle



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

MODIFYING THE RISK FACTORS

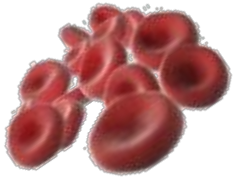


	1st Pillar Optimise red cell mass	2nd Pillar Minimise blood loss & bleeding	3rd Pillar Harness & optimise physiological reserve of anaemia
PREOP	• Detect anaemia • Identify underlying disorder(s) causing anaemia • Manage disorder(s) • Refer for further evaluation if necessary • Treat suboptimal iron 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

Anaemia *and* Bleeding



Blood Management

Patient Blood Management
(managing the patient's own blood)

Donor Blood Management
(treating the patient with transfusion)

… **because**

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

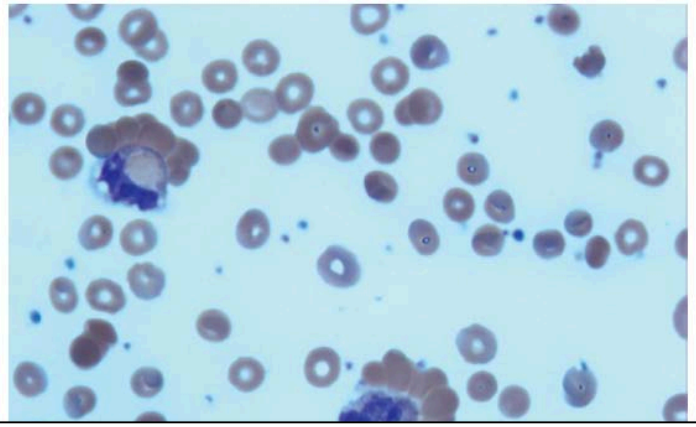
PBM DEFINITION

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

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

TRANSFUSION



Volume 57, June 2017 TRANSFUSION 1325

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

A template for the world: Western Australia PBM Project

- WA represents one third of the Australian land mass
- 2.5 million square kilometers for 2.5 million people
- ~74% live in Perth
- Fastest growing population and fastest growing older age segment in Australia

TRANSFUSION

2017

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

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]

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 (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$18.5 million
- Estimated activity-based cost savings $80 - $100 million
- 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

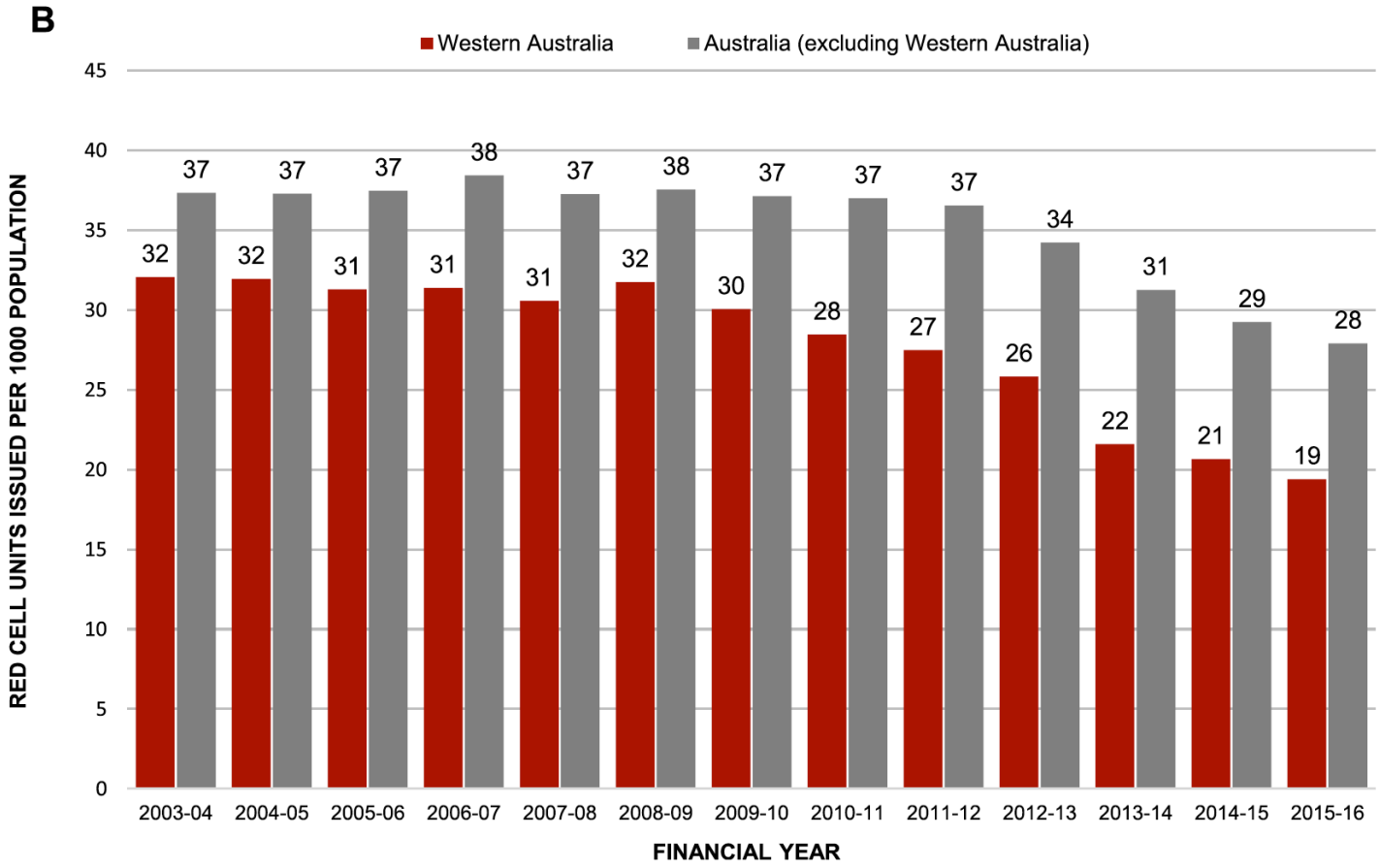
Key Patient Outcomes

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

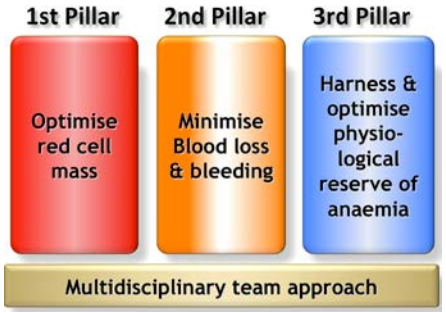
Leahy MF, Hofmann A, Towler S, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals. Transfusion 2017

Utilization Rate



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

PBM as a new standard of care



World Health Organization

Sixty-third World Health Assembly

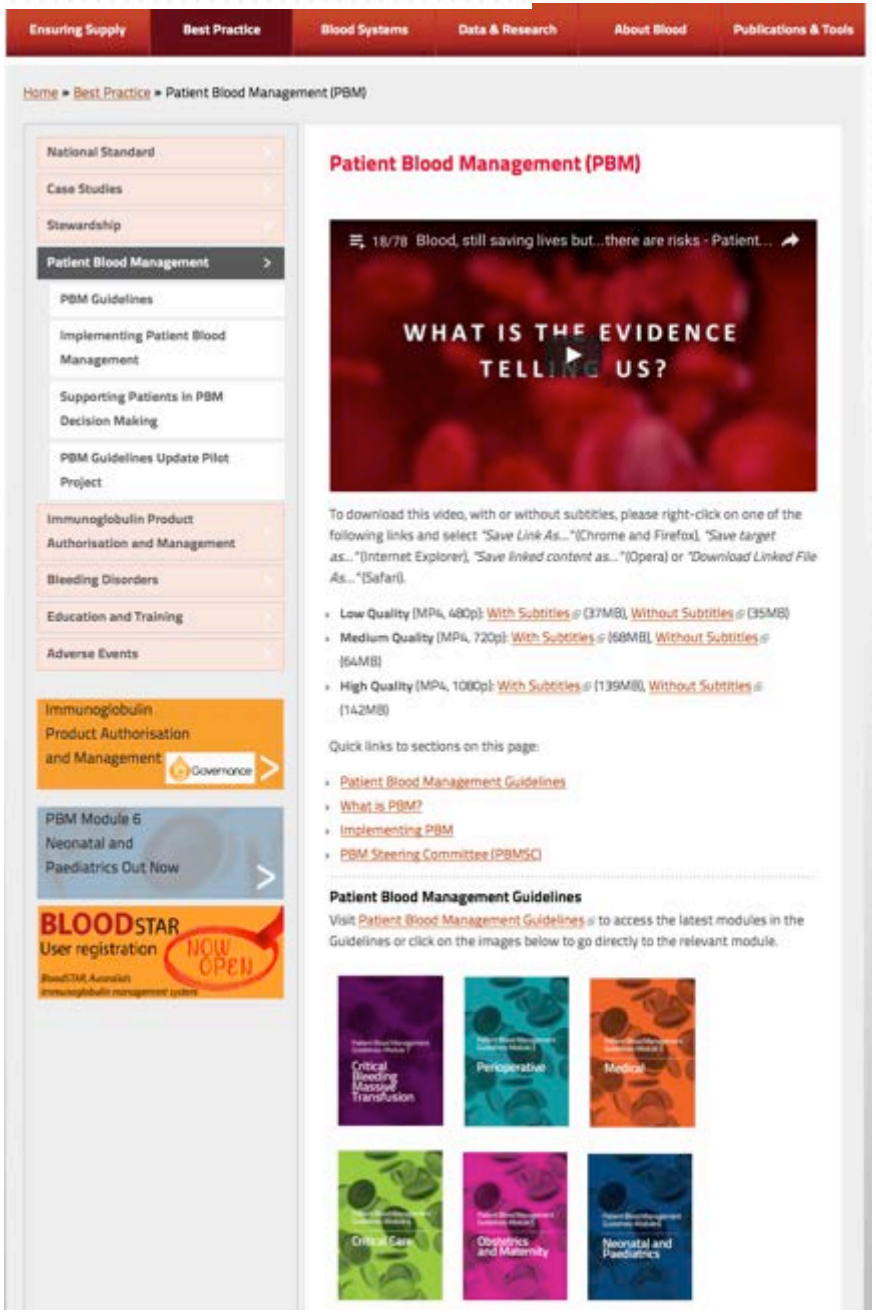
Date: 17–21 May 2010
Location: Geneva, Switzerland

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:

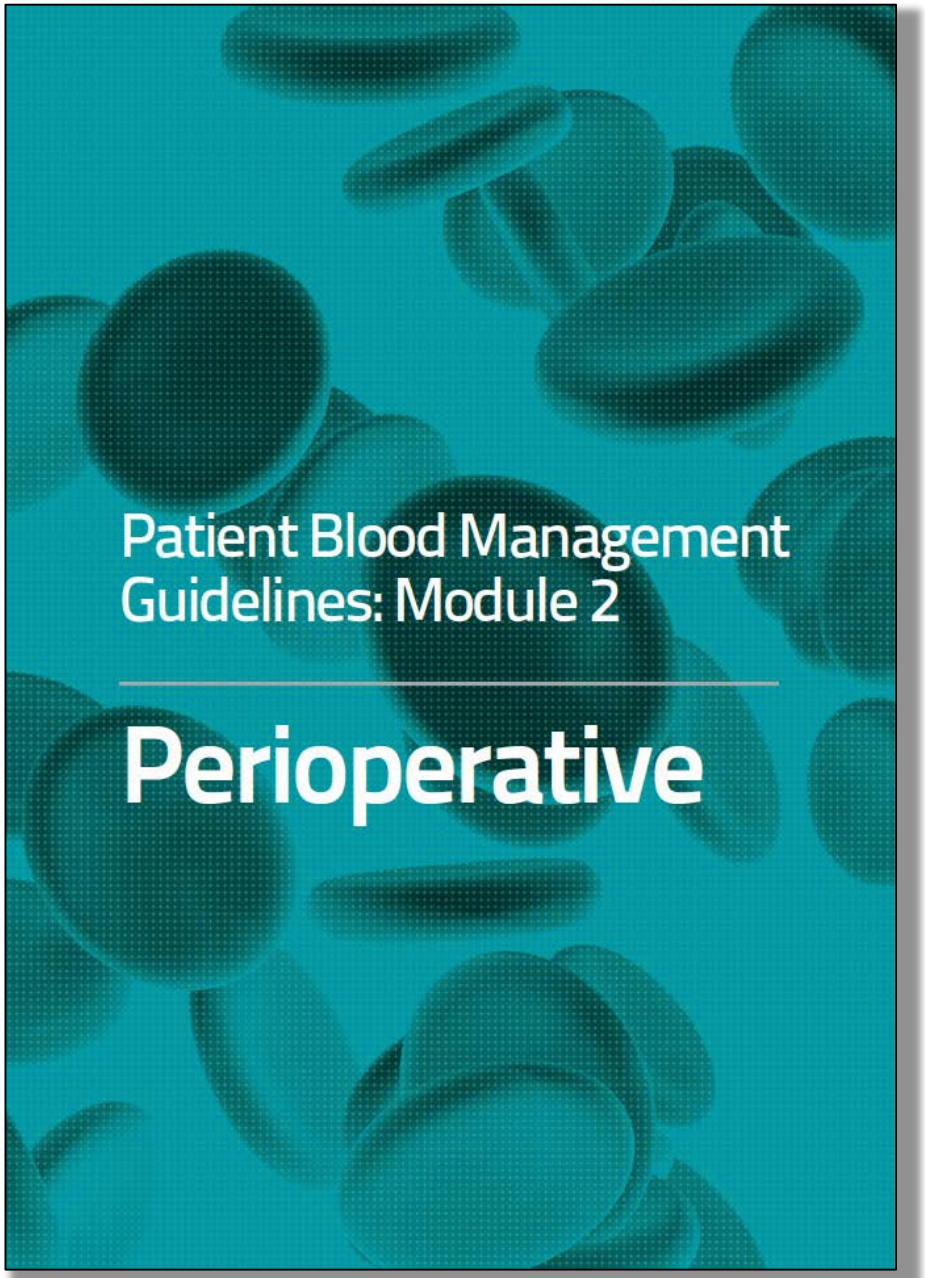
WHA63.12 adopted by resolution May 21, 2010:

*„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**)"*

Commwealth of Australia



https://www.nba.gov.au



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

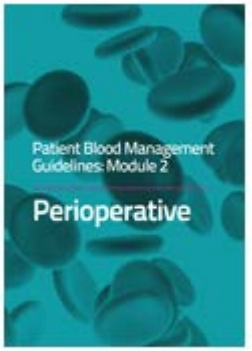
Thalassaemia Australia

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.

Patient Blood Management Why important?



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?

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

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

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

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

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

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 >

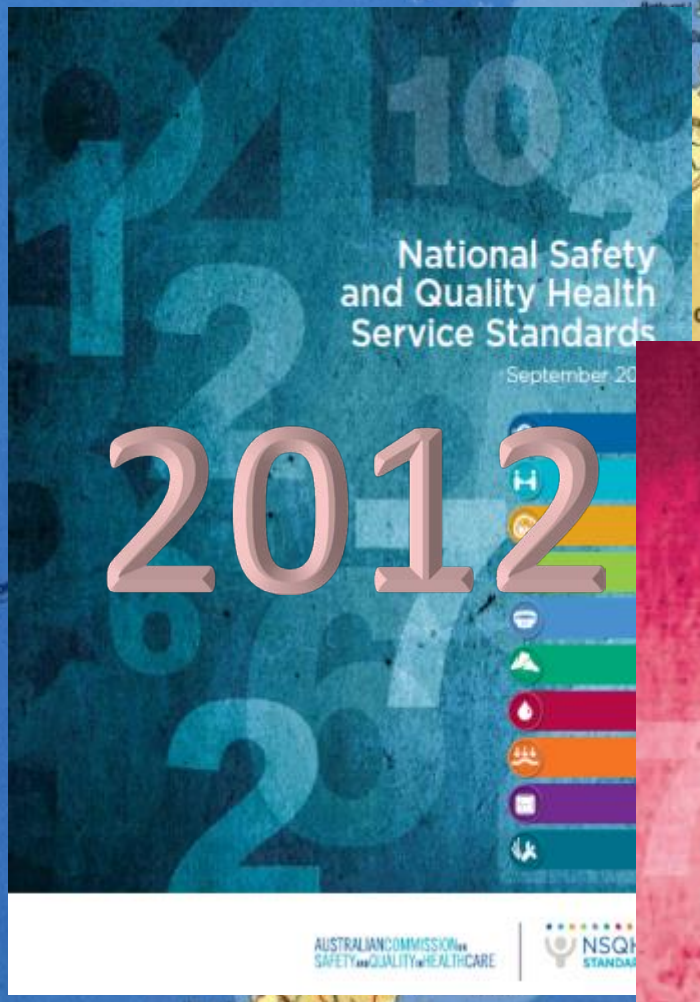
National Priorities

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.

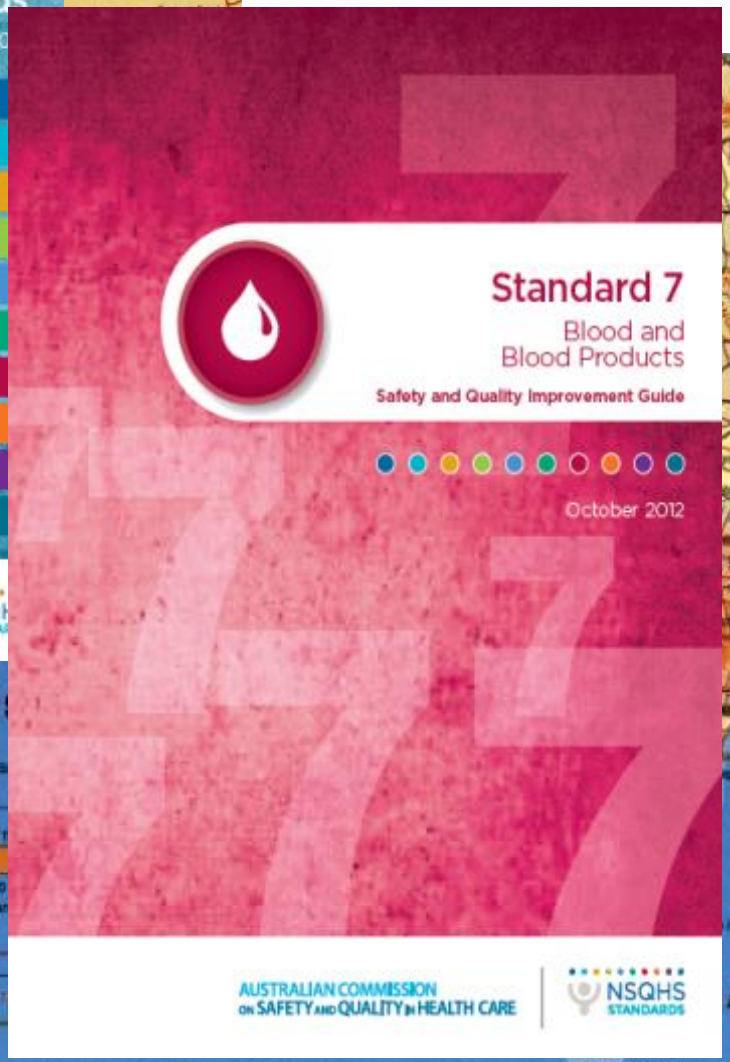
A collaborative and consultative approach is undertaken in priorities of the health system that benefit from national coordination. Under its legislation the Commission has wide raging functions that also include the formulation of safety and quality standards and indicators.

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.



NSQHS STANDARDS



WHY Patient Blood Management

"PBM aims to improve clinical outcomes by avoiding unnecessary exposure to blood and blood products. Decisions on whether to transfuse should be carefully considered, taking into account the full range of available therapies, and balancing the evidence for efficacy and improved clinical outcome against the potential risks."

"PBM improves patient outcomes by improving the patient's medical and surgical management in ways that boost and conserve the patient's own blood. As a consequence of better management, patients usually require fewer transfusions… thus avoiding transfusion-associated complications."

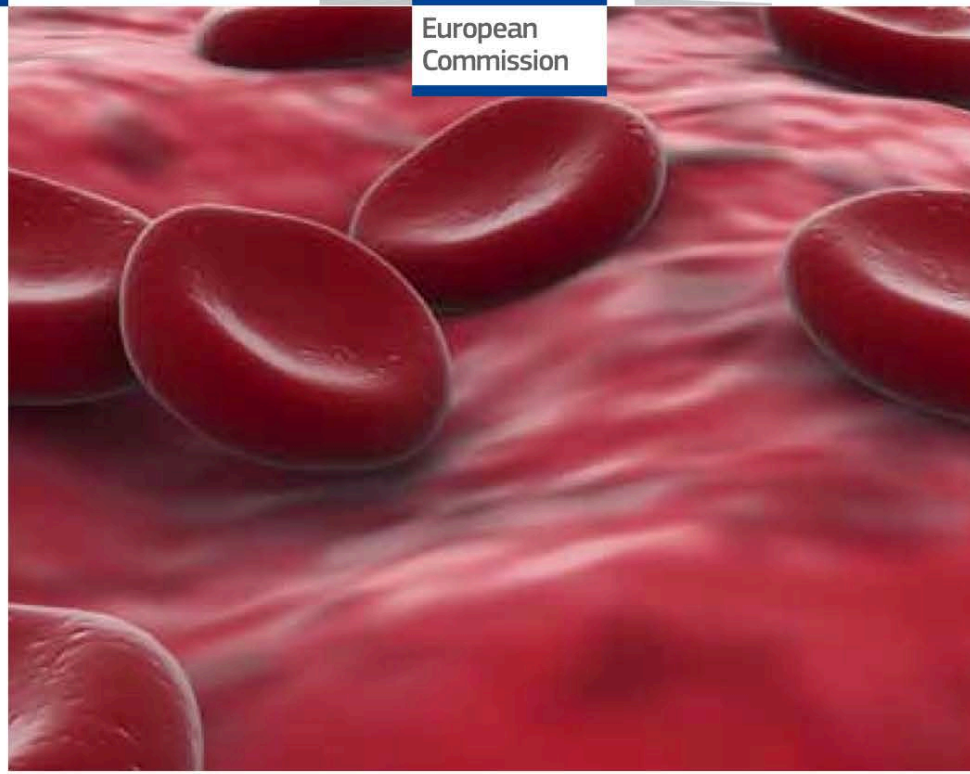
AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE
National Priorities

PBM is a multidisciplinary approach that promotes appropriate care for patients and reduces exposure to unnecessary blood transfusions.

European Union

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

European Commission



Core Project Team

- Hans Gombotz, Linz
- Axel Hofmann, Zurich
- Kai Zacharowski, Frankfurt
- Günter Schreier, Graz
- Peter Kastner, Graz

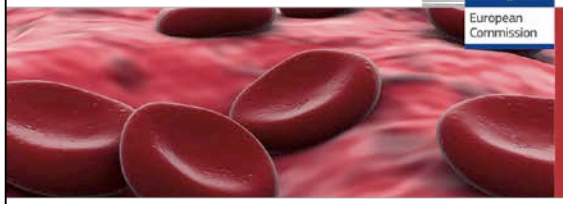
Expert Panel

- Philippe Van der Linden, Brussels
- Donat Spahn, Zurich
- Peter Rehak, Graz
- Astrid Nørgaard, Copenhagen
- Shannon Farmer, Perth
- Jens Meier, Linz
- Johann Kurz, Vienna

Teaching Hospitals

- Rigshospitalet / University Hospital Copenhagen
  Astrid Nørgaard
- University Hospital Centre, Zagreb
  Branka Golubić-Ćepulić
- Hospital Universitario de Santa Maria, Lisbon
  Hugo Pinto Vilela, Lucindo Ormonde
- Medical University of Vienna / Vienna General Hospital
  Klaus Markstaller
- Universitätsklinikum Frankfurt
  Kai Zacharowski

EU-PBM



European Commission

EU-PBM

European Patient Blood Management

Patient safety is of primary concern to the European Commission. An important element related to patient safety is the safe and adequate use of substances derived from human blood. In autumn 2013, the Commission launched a tender on "Good practices in the field of blood transfusion" via its Consumers, Health and Food Executive Agency (Chafea).

Definition and Rationale of Patient Blood Management

PBM is a multidisciplinary concept that primarily focuses on patient safety by avoiding and/or treating anaemia, minimising blood loss and bleeding and optimising the physiological reserve of anaemia. Studies have shown that this comprehensive strategy significantly minimises the use of allogeneic blood products and therefore reduces their adverse effects on patient outcome. It has also been demonstrated that PBM saves costs for health care systems.

Aims

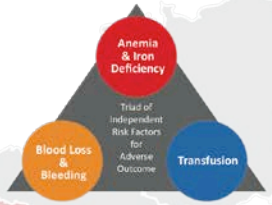
The aims of the project are to

- study and map blood use for different medical disciplines
- identify and map local and national differences in PBM strategies and blood utilisation,
- identify good practices in PBM and
- develop an EU guide on good practices for PBM based on the three pillars PBM concept
- implementing a PBM pilot program in 5 European teaching hospitals

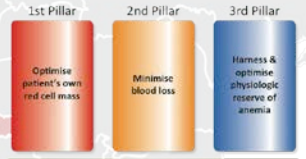
Implementation Strategy

Teaching Hospitals (Coordinator)

- Rigshospitalet / University Hospital Copenhagen (Astrid Nørgaard)
- University Hospital Centre, Zagreb (Branka Golubić-Čepulić)
- Hospital Universitario de Santa Maria, Lisbon (Lucindo Ormonde)
- Medical University of Vienna / Vienna General Hospital (Klaus Markstaller)
- University Hospital Frankfurt (Kai Zacharowski)



Adapted from Farmer SL., et al. Best Pract Res Clin Anaesthesiol, 2013. 27(1): p. 43-58



Three Pillars of Patient Blood Management

Core Project Team

- Hans Gombotz, Linz
- Axel Hofmann, Zurich
- Kai Zacharowski, Frankfurt
- Günter Schreier, Graz
- Peter Kastner, Graz

PBM
PATIENT BLOOD MANAGEMENT

EU-PBM project office

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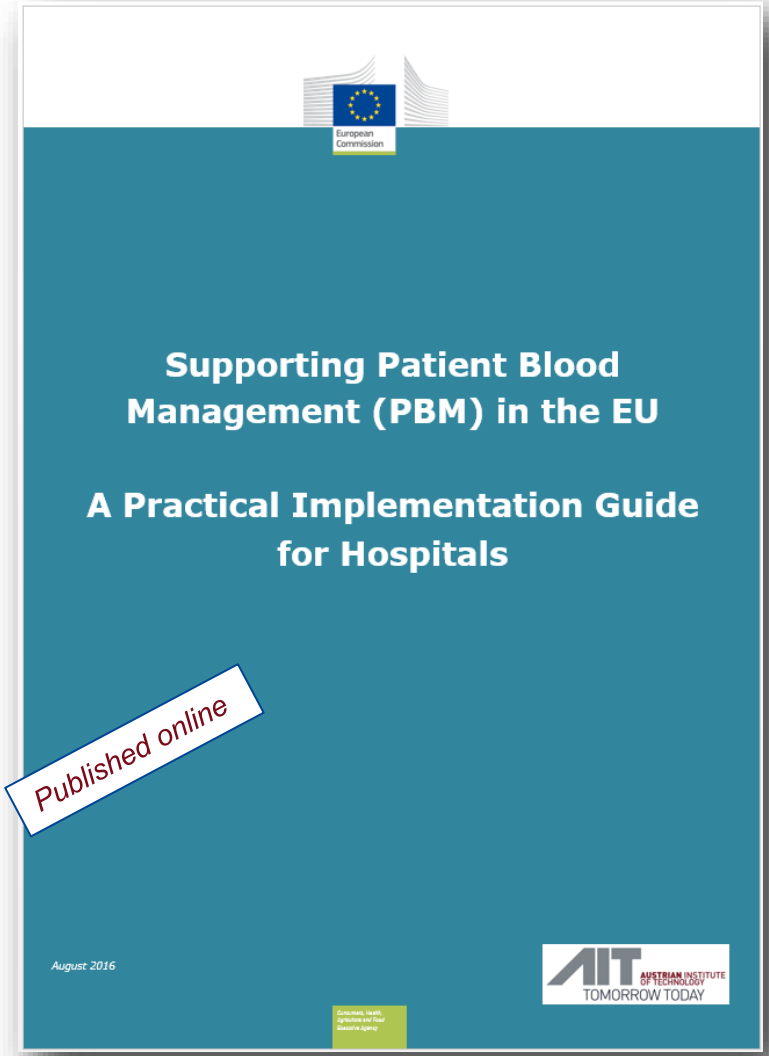
PBM - Implementation Guide for Hospitals



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

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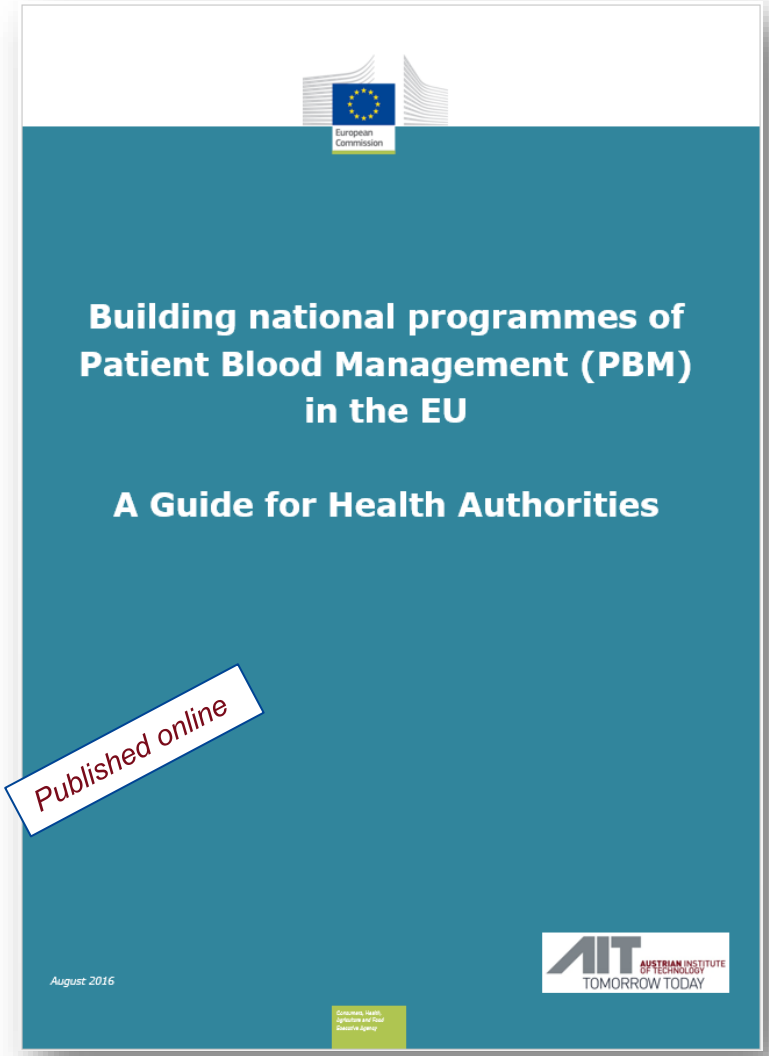
www.ait.ac.at / www.europe-pbm.eu

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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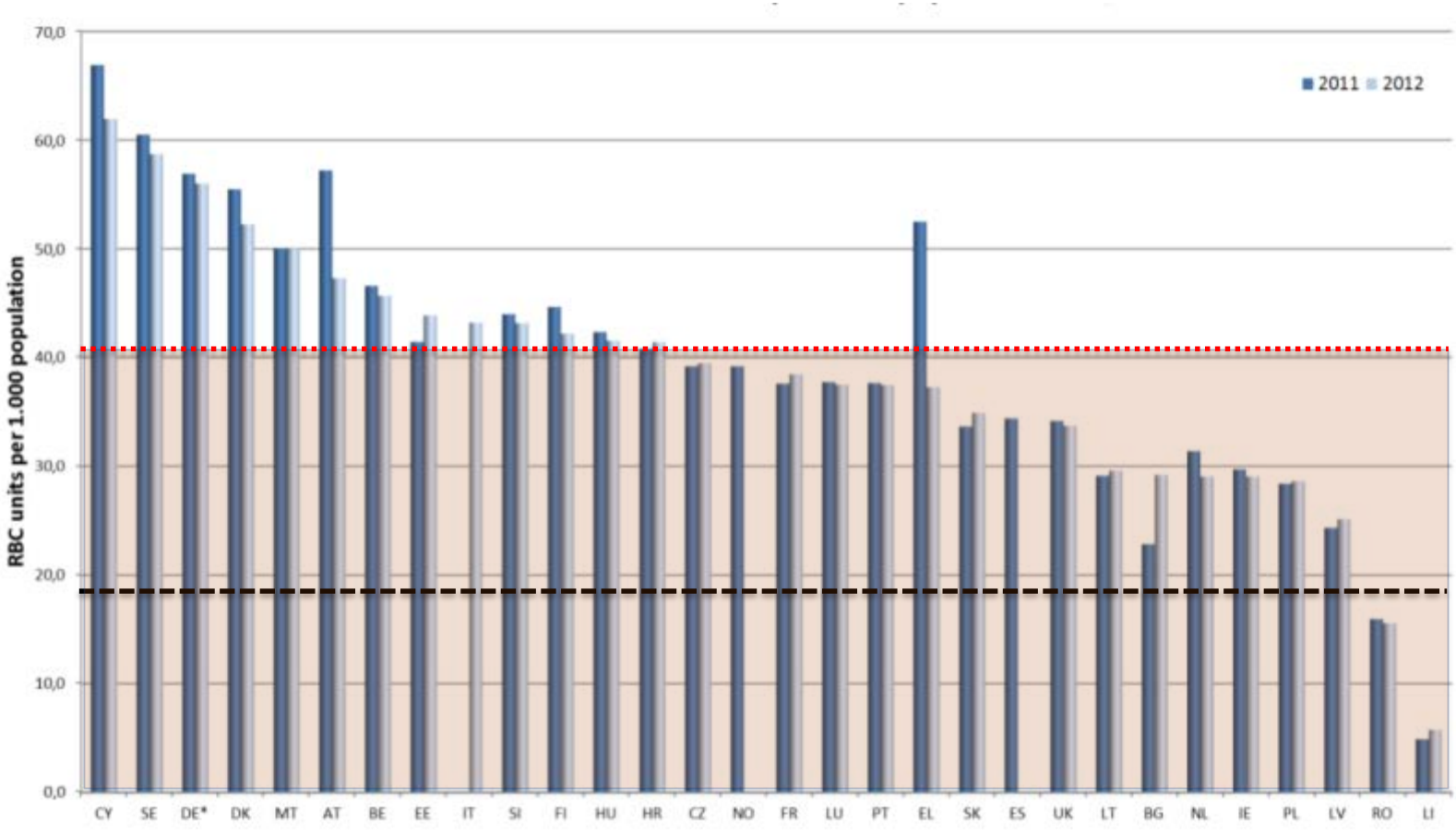
RBC units issued in EU member states, U.S. and WA

(per 1,000 population)



U.S. 2016

Western Australia 2016

Gross cost estimate related to the missed opportunity of PBM for the US, EU and Australia (2011)

	Units of packed blood components	Acquisition cost (US$)	Activity based cost (ABC) multiplier	Activity based cost/unit transfused (US$)	Total activity based cost (US$)	Additional cost associated w/matched transfused patients
United States	**19‘836‘000**			**867.00**	**17‘206‘964‘253**	
European Union	**28‘080‘000**			**564.00**	**15‘856‘494‘000**	
Australia	**1‘094‘464**			**767.50**	**840‘005‘091**	
Total	**19‘836‘000**			**867**	**33‘903‘463‘344**	**151‘471‘565‘118**

Estimate by Hofmann A.

US$185 Billion

Trentino K.M., et al., Increased hospital costs associated with red blood cell transfusion. Transfusion 2015
Shander A. et al. Activity-based costs of plasma transfusions in medical and surgical inpatients at a US hospital. Vox Sang 2016
Shander A. et al. Activity-based costs of blood transfusions in surgical patients at four hospitals. Transfusion 2010
Hofmann A. et al. Economic considerations on transfusion medicine and patient blood management. Best Pract Res Clin Anaesthesiol 2013

Conclusion

Costs ($)

BJA
British Journal of Anaesthesia
Volume 108, Number 6, June 2012

British Journal of Anaesthesia 108 (6): 889–92 (2012)
doi:10.1093/bja/aes166

EDITORIAL

Patient blood management is a win-win: a wake-up call

D. R. Spahn[1]*, O. M. Theusinger[2] and A. Hofmann[3]
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[3]Faculty of Health Sciences, Curtin University, Perth, Australia
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Outcome

1st Pillar	2nd Pillar	3rd Pillar
Optimise red cell mass	Minimise blood loss & bleeding	Harness & optimize physio-logical reserve of anemia

Prime Quadrant

Summary

- The global health care crisis is real
- The grey tsunami is aggravating the crisis
- The current imperative is to improve productivity
- The cost-effectiveness approach guides to productivity improvements
- The 3-Pillar-PBM concept targets the burden of anaemia, blood loss and transfusion
- PBM significantly improves outcome while lowering cost of
  - allogeneic blood product consumption
  - transfusion related clinical services (activity based cost)
  - prevented complications
- The implementation of PBM is increasingly requested by national health authorities

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