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

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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
- CSL Behring GmbH, Marburg, Deutschland
- IL Werfen, Spain, USA
- International Foundation for Patient Blood Management
- MEDahead GmbH, Vienna, Austria
- MedEd Global Solutions, France
- 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)

Competing with
- Housing
- Food
- Transportation
- Education
- Recreation
- Energy
- Insurance
- Social welfare
- etc.

OECD Health Data 2017
The 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.
The Grey Tsunami: Aggravating the Crisis
Baby Boomers: Public Health's Biggest Challenge
### Japanese population by age group, %

<table>
<thead>
<tr>
<th>Year</th>
<th>0–64</th>
<th>65–69</th>
<th>70–74</th>
<th>75+</th>
<th>Total 65+</th>
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<tbody>
<tr>
<td>2010</td>
<td>77</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>22</td>
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<tr>
<td>2020</td>
<td>71</td>
<td>7</td>
<td>7</td>
<td>15</td>
<td>29</td>
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<tr>
<td>2030</td>
<td>68</td>
<td>6</td>
<td>6</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>2040</td>
<td>64</td>
<td>8</td>
<td>7</td>
<td>21</td>
<td>36</td>
</tr>
</tbody>
</table>

1 Figures do not sum to 100%, because of rounding.

Source: e-Stat (Japan’s portal for government statistics); IHS Global Insight World Market Monitor

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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

- 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.

WHO Global Health Expenditure Atlas

September 2014
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?

Total 2009 health care spending*:

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

*Stats.OECD.org

Source: Data from workshop presentations and discussions summarized in The Healthcare Imperative.
The Cost of Health Care
How much is waste?

- Unnecessary Services: $210 Billion
- Excessive Administrative Costs: $190 Billion
- Fraud: $75 Billion
- Inefficiently Delivered Services: $130 Billion
- Prices That Are Too High: $105 Billion
- Missed Prevention Opportunities: $55 Billion

Source: Data from workshop presentations and discussions summarized in "The Healthcare Imperative"
Cost-Effectiveness Plane

Costs ($)

Outcome

Prime Quadrant

E

Unnecessary Services
$210 Billion

Excessive Administrative Costs
$190 Billion

Prices That Are Too High
$105 Billion

Missed Prevention Opportunities
$25 Billion

Fraud
$75 Billion

Inefficiently Delivered Services
$130 Billion

-$50,000

A

B

C

D

1

2
Focus on one of the bigger issues
The triad of anaemia, bleeding & transfusion
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)

“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
Vivacqua et al Ann Thorac Surg 2011
Christensen et al J Thorac Cardiovasc Surg 2009
Ye, X., et al BMC Health Serv Res, 2013
Blood transfusion: most common procedure performed during hospitalizations in 2011 (12% of stays with a procedure); rate of hospitalizations with blood transfusion doubled 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”


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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Odds ratio</th>
<th>C.I.</th>
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<tbody>
<tr>
<td>Composite infection</td>
<td>3.38</td>
<td>2.60 - 4.40</td>
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<td>Ischaemic events</td>
<td>3.35</td>
<td>2.68 - 4.35</td>
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<table>
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<tr>
<th>Infectious Events</th>
<th>Adjusted OR; CI</th>
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<tr>
<td>RBC units txd</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>AOR 1.0; 95% CI, ...</td>
</tr>
<tr>
<td>1</td>
<td>AOR 1.46; 95% CI, 0.92–2.11</td>
</tr>
<tr>
<td>2</td>
<td>AOR 2.36; 95% CI, 1.42–3.30</td>
</tr>
<tr>
<td>3 or 4</td>
<td>AOR 3.82; 95% CI, 2.22–5.47</td>
</tr>
<tr>
<td>5-9</td>
<td>AOR 10.75; 95% CI, 5.83–15.9</td>
</tr>
<tr>
<td>&gt;9</td>
<td>AOR 45.44; 95% CI, 22.6–73.6</td>
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<tbody>
<tr>
<td>Parsons 2013&lt;sup&gt;12&lt;/sup&gt;</td>
<td>ICU</td>
<td>124</td>
<td>Decreased muscle strength</td>
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<tr>
<td>Zilberberg 2007&lt;sup&gt;13&lt;/sup&gt;</td>
<td>ICU</td>
<td>4’892</td>
<td>ARDS</td>
</tr>
<tr>
<td>Gong 2005&lt;sup&gt;14&lt;/sup&gt;</td>
<td>ICU</td>
<td>688</td>
<td>ARDS &amp; ARDS mortality</td>
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<tr>
<td>Shorr 2005&lt;sup&gt;15&lt;/sup&gt;</td>
<td>ICU</td>
<td>4’892</td>
<td>Blood stream infection</td>
</tr>
<tr>
<td>Corwin 2004&lt;sup&gt;16&lt;/sup&gt;</td>
<td>ICU</td>
<td>4’892</td>
<td>Mortality, ARDS, ICU and hospital LOS</td>
</tr>
<tr>
<td>Taylor 2006&lt;sup&gt;17&lt;/sup&gt;</td>
<td>ICU</td>
<td>2’085</td>
<td>Nosocomial infection, ICU &amp; hospital LOS, mortality</td>
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<tr>
<td>Kneyber 2007&lt;sup&gt;18&lt;/sup&gt;</td>
<td>Pediatric ICU</td>
<td>295</td>
<td>Mortality</td>
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<tbody>
<tr>
<td>Goobie 2016</td>
<td>Non-cardiac surgery, pediatrics</td>
<td>114'395</td>
<td>Mortality, Infection</td>
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<tr>
<td>Ferraris 2012</td>
<td>Non-cardiac surgery</td>
<td>941'496</td>
<td>Morbidity, mortality, resource use</td>
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<tr>
<td>Ferraris 2011</td>
<td>Thoracic surgery</td>
<td>8'728</td>
<td>Morbidity &amp; mortality</td>
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<td>Al-Refaie 2012</td>
<td>Cancer surgery</td>
<td>38'926</td>
<td>Mortality, complications, hospital LOS</td>
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<td>Linder 2013</td>
<td>Nephrectomy</td>
<td>2'318</td>
<td>Mortality</td>
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<td>Bernard 2009</td>
<td>General surgery</td>
<td>125'177</td>
<td>Morbidity &amp; mortality</td>
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<td>Beattie 2009</td>
<td>Non-cardiac surgery</td>
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<td>Mortality</td>
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<td>Bursi 2009</td>
<td>Vascular surgery</td>
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<td>Mortality, MI, composite MI/mortality</td>
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<td>Dunne 2002</td>
<td>Non-cardiac surgery</td>
<td>6'301</td>
<td>Pneumonia, hospital LOS, mortality</td>
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<td>Gauvin 2008</td>
<td>Paediatrics</td>
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<td>Mortality</td>
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<td>Jagoditsch 2006</td>
<td>Rectal surgery</td>
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<td>Mortality</td>
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<td>Xenos 2012</td>
<td>Colorectal surgery</td>
<td>21'943</td>
<td>VTE</td>
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<td>Chang 2000</td>
<td>Colorectal surgery</td>
<td>1'349</td>
<td>Infection</td>
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<td>Vignali 1996</td>
<td>Colorectal surgery</td>
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<td>Infection</td>
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<tr>
<td>Ho 2007</td>
<td>Spinal surgery</td>
<td>1'046</td>
<td>Delayed infection</td>
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<td>Carson 1999</td>
<td>Hip fracture surgery</td>
<td>9'598</td>
<td>Infection, pneumonia</td>
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<td>Palmieri 2006</td>
<td>Burns</td>
<td>666</td>
<td>Infection &amp; mortality</td>
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<tr>
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<tbody>
<tr>
<td>Jones¹</td>
<td>Massive Bleeding/Trauma</td>
<td>1’538</td>
<td>Organ failure, ventilator-associated pneumonia, sepsis, blood stream infection, catheter-related bloodstream infection, UTI, ARDS and nosocomial infection</td>
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<tr>
<td>Johnson 2016²</td>
<td>Massive Bleeding</td>
<td>272’592</td>
<td>Mortality, Infection, kidney injury, thrombotic, respiratory, ischemic events and composite morbidity</td>
</tr>
<tr>
<td>Patel³</td>
<td>Massive Bleeding/Trauma</td>
<td>106’477</td>
<td>Mortality, MOF, ARDS/ ALI</td>
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<td>Chaiwat 2009⁴</td>
<td>Trauma</td>
<td>14’070</td>
<td>ARDS</td>
</tr>
<tr>
<td>Salim 2008⁵</td>
<td>Traumatic Brain Injury</td>
<td>1’150</td>
<td>Mortality, ARDS, ARF, acute respiratory failure, bacteremia or fungemia, MOF, pulmonary embolism, pneumonia, sepsis</td>
</tr>
<tr>
<td>Bochicchio 2008⁶</td>
<td>Trauma</td>
<td>1’172</td>
<td>Infection, hospital &amp; ICU LOS, mechanical ventilations, mortality</td>
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<tr>
<td>Weinberg 2008⁷</td>
<td>Trauma</td>
<td>1’624</td>
<td>Morbidity &amp; mortality</td>
</tr>
<tr>
<td>Charles 2007⁸</td>
<td>Trauma</td>
<td>8’215</td>
<td>Mortality</td>
</tr>
<tr>
<td>Malone 2003⁹</td>
<td>Trauma</td>
<td>15’534</td>
<td>Mortality</td>
</tr>
<tr>
<td>Claridge 2002¹⁰</td>
<td>Trauma</td>
<td>1’593</td>
<td>Infection</td>
</tr>
<tr>
<td>Moore 1997¹¹</td>
<td>Trauma</td>
<td>513</td>
<td>MOF</td>
</tr>
</tbody>
</table>

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
Triad of Independent Risk Factors for Adverse Outcomes

Anemia & Iron Deficiency

Induces or exacerbates anemia

Blood Loss & Bleeding

Transfusion

Triggers transfusion

Associated with re-bleeding

PBM: Breaking the viscous cycle
Triad of Independent Risk Factors for Adverse Outcomes

- Anemia & Iron Deficiency
- Blood Loss & Bleeding
- Transfusion

MODIFYING THE RISK FACTORS

1st Pillar

Anemia, Iron Deficiency

2nd Pillar

Blood Loss & Bleeding

3rd Pillar

Harvest & optimise physiological reserve of anaemia

Transfusion
### 1st Pillar
**Optimise red cell mass**

- 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 haematologic deficiencies
- Note: Anaemia is a contraindication for elective surgery

### 2nd Pillar
**Minimise blood loss & bleeding**

- Identify and manage bleeding risk
- Minimise iatrogenic blood loss
- Procedure planning and rehearsal

- Meticulous haemostasis and surgical techniques
- Blood-sparing surgical devices
- Anaesthetic blood conserving strategies
- Autologous blood options
- Maintain normothermia
- Pharmacological/haemostatic agents

- 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

### 3rd Pillar
**Harness & optimise physiological reserve of anaemia**

- 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

- Optimise anaemia reserve
- Maximise oxygen delivery
- Minimise oxygen consumption
- Avoid/treat oxygen consumption promptly
- Restrictive transfusion thresholds

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**Perioperative multidisciplinary multimodal patient-specific team approach**

*Hofmann et al. Current Opinions in Anaesthesiology 2012*
Anaemia and Bleeding

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

Donor Blood Management
(treating the patient with transfusion)

... because

Our own blood is still the best thing to have in our veins
Tim Frenzel, Hugo Van Aken and Martin Westphal


EDITORIAL COMMENT
Patient Blood Management (PBM) is an evidence-based bundle of care to optimize patient outcomes by managing and preserving a patient's blood.
Patient Blood Management: the new standard

Preoperative anemia, surgical loss, and transfusion of allogeneic blood products all adversely affect patient outcome. Patient Blood Management (PBM) aims to reduce the need for blood transfusions preemptively to improve patient safety and outcome. 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.

Implementing one or more PBM measures has indeed improved certain patient outcomes in the past, and some of these studies included well over 100,000 patients. What is then so unique in the landmark study by Leahy and colleagues 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$11.6M and a reduction of activity-based transfusion costs of more than US$600M.
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
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,1,3 Axel Hofmann,4,5,6 Simon Touler,7 Kevin M. Trentino,8 Sally A. Burrous,1 Stuart G. Siwain,9 Jeffrey Hamdörf,9,10 Trudi Gallagher,11,12 Audrey Koy,11 Gary C. Geelhoed,11,13 and Shannon L. Farmer9,14

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 AUD18,507,062 (US$18,078,258) and between AUD80 million and AUD100 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 20.6% 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, 0.59-0.82; 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.
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.
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

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.

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

Utilization Rate

PBM as a new standard of care
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
Patient Blood Management (PBM)

WHAT IS THE EVIDENCE TELLING US?

To download this video, with or without subtitles, please right-click on one of the following links and select 'Save Link As...'. (Chrome and Firefox), "Save target as..." (Internet Explorer), "Save linked content as..." (Opera) or "Download linked File As..." (Safari).

- Low Quality (MP4, 480p) With Subtitles: 17MB, Without Subtitles: 19MB
- Medium Quality (MP4, 720p) With Subtitles: 30MB, Without Subtitles: 31MB
- High Quality (MP4, 1080p) With Subtitles: 139MB, Without Subtitles: 142MB

Quick links to sections on this page:
- Patient Blood Management Guidelines
- What is PBM?
- Implementing PBM
- PBM Steering Committee (PBMSC)

Patient Blood Management Guidelines
Visit Patient Blood Management Guidelines to access the latest modules in the Guidelines or click on the images below to go directly to the relevant module.
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

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.
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.

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.
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 ranging 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.
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.”

PBM is a multidisciplinary approach that promotes appropriate care for patients and reduces exposure to unnecessary blood transfusions.
European Union
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
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  Astrid Nørgaard
- University Hospital Centre, Zagreb
  Branka Golubić-Čepulić
- 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
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 "Glad 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 allo-genic 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
- 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

1. Create Urgency for PBM
2. Form a Powerful PBM Group
3. Communicate the PBM Vision
4. Remove Obstacles
5. Create Short Term Wins
6. Audit on the Change
7. Anchor PBM in Culture

Teaching Hospitals (Coordinator)

- Rigshospitalet / University Hospital Copenhagen (Astrid Nergaard)
- University Hospital Centre, Zagreb (Branica Golubcic-Cepulic)
- Hospital Universitario de Santa Maria, Lisbon (Lucindo Ormonde)
- Medical University of Vienna / Vienna General Hospital (Klaus Markstaller)
- University Hospital Frankfurt (Kai Zacharowski)

Core Project Team

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- Kai Zacharowski, Frankfurt
- Gunter Schreiner, Graz
- Pelle Rastner, Graz

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
Building national programmes of Patient Blood Management (PBM) in the EU

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

<table>
<thead>
<tr>
<th></th>
<th>Units of packed blood components</th>
<th>Acquisition cost (US$)</th>
<th>Activity based cost (ABC) multiplier</th>
<th>Activity based cost/unit transfused (US$)</th>
<th>Total activity based cost (US$)</th>
<th>Additional cost associated w/matched transfused patients</th>
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</thead>
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<td>United States</td>
<td>19‘836‘000</td>
<td></td>
<td>867.00</td>
<td></td>
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<td>European Union</td>
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<td></td>
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<td></td>
<td>767.50</td>
<td></td>
<td>840‘005‘091</td>
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<tr>
<td>Total</td>
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<td></td>
<td>867</td>
<td></td>
<td>33‘903‘463‘344</td>
<td>151‘471‘565‘118</td>
</tr>
</tbody>
</table>

**Estimate by Hofmann A.**

US$185 Billion

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*Trentino K.M., et al., Increased hospital costs associated with red blood cell transfusion. Transfusion 2015*


*Shander A. et al. Activity-based costs of blood transfusions in surgical patients at four hospitals. Transfusion 2010*

Conclusion
EDITORIAL

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

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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