Integrated Healthcare:
The Patient Blood Management (PBM) Case Study

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Board Member IFPBM | Basel - Switzerland

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Longevity:
Pushing the boundary to the Hayflick limit (and beyond?)
Proportion of persons surviving (on a period basis) to successive ages, according to mortality rates experienced or projected, persons born 1851-2031, England and Wales

Age

Proportion surviving

0.00

0.10

0.20

0.30

0.40

0.50

0.60

0.70

0.80

0.90

1.00

0

10

20

30

40

50

60

70

80

90

100

110

120

1851

1871

1891

1911

1931

1951

1971

1991

2031

2011

UK Office for National Statistics 2012

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Proportion of persons surviving (on a period basis) to successive ages, according to mortality rates experienced or projected, persons born 1851-2031, England and Wales

Improved child mortality

Improved treatment of communicable diseases
Pushing the Limits: Rectangularization of the Mortality Curve

Science & technology pushing the mortality towards the Hayflick limit
Hayflick Limit

Gerontologist Leonard Hayflick demonstrated that a population of normal human fetal cells in a cell culture will divide between 40 and 60 times. The length of the telomeres sets the limit for the number of mitoses.

→ achievable age in humans ≈ 120 years
Asia:
From aging to hyperaging
Baby Boomers: Public Health's Biggest Challenge
FIGURE 1.3 East Asian and Pacific economies are aging more quickly than other economies in the past
Years to move from 7 to 14 percent population share 65 and older and the start and end years of transition

Sources: World Bank estimates based on data from UN 2013 and Kinsella and He 2009.
Note: Figure shows starting and ending year for transition from 7 percent (aging) to 14 percent (aged) of population ages 65 and older. Aging and aged thresholds are based on United Nations definitions. East Asia and Pacific economies rounded to five-year increments.
From aging to hyperaging


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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>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>77</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>2020</td>
<td>71</td>
<td>7</td>
<td>7</td>
<td>15</td>
<td>29</td>
</tr>
<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
FIGURE 1.3  East Asian and Pacific economies are aging more quickly than other economies in the past

Years to move from 7 to 14 percent population share 65 and older and the start and end years of transition

Sources: World Bank estimates based on data from UN 2013 and Kinsella and He 2009.
Note: Figure shows starting and ending year for transition from 7 percent (aging) to 14 percent (aged) of population ages 65 and older. Aging and aged thresholds are based on United Nations definitions. East Asia and Pacific economies rounded to five-year increments.
The grey tsunami:
Surfing, swimming or drowning?
Tsunami size:
Integral of $\Delta P_{(65+)} \times \Delta L$ over time

$\Delta$ Population 65+

$\Delta$ Longevity (years)
And centenarians don’t die healthy!

Centenarians, though perceived to have been healthy just prior to death, succumbed to diseases in 100% of the cases examined. They did not die merely “of old age.”

The grey tsunami

More people than ever live longer than ever, with preceding (multi-)morbidity and disability

but at what cost?
Annual health care spending per capita in United States by age group in USD, 2004

- 85+: $25,691
- 75-84: $16,389
- 65-74: $10,778
- 55-64: $7,786
- 45-54: $5,211
- 35-44: $3,369
- 25-34: $2,650
- 19-24: $5,276
- All ages: $5,276
Cost change with the shift of boundaries

Disease free survival

Morbidity boundary
Disability boundary
Mortality boundary
Potential effects of falling mortality:

“The compression of morbidity hypothesis” (Fries):
Individuals continue to enjoy their quality of life for quite some time. **Morbidity and disability boundaries are faster pushed to the right than the mortality boundary (= compression).**

“The expansion of morbidity hypothesis” (Gruenberg, Olshansky et al.):
Disease fatality is reduced, but the prevalence of disease increases. **Morbidity and disability boundaries remain more or less, while mortality boundary shifts to the right.**

“The dynamic equilibrium hypothesis” (Manton):
Balance between the effects of compression and expansion.
Potential effects of falling mortality:

- Surfing
- Swimming
- Drowning

Policy makers need to pursue a compression strategy!
[I]ncreased longevity without quality of life is an empty prize ... health expectancy is more important than life expectancy

Message from the Director-General, WHO 1998
Options of how to pursue the compression strategy

- Precision Medicine?
- Healthy aging concepts?
- Improving medical communication?
- Tele medicine?
- Disruptive technologies?
- Next generation drugs?
- Reducing medical errors?
- Faster adoption of best practice/EBM?
- Faster patient access?
Lots of Room for Immediate Compression

Health financing March 2014

Key facts¹

- 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 2011²
The Cost of Health Care
How much are we spending?

$2.5 Trillion
spent in the U.S. on health care in 2009
The Cost of Health Care
How much is waste?

$765 Billion
30% of 2009 total health care spending

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

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The Cost of Health Care
How much is waste?

- Unnecessary Services: $210 Billion
- Fraud: $75 Billion
- Excessive Administrative Costs: $190 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*
Two hidden giants causing a multi billion dollar problem: ID and IDA
Claiming the $1 trillion prize in US health care

Tom Latkovic

By tying payments more aggressively to patient outcomes rather than to services rendered, the US health-care system could deliver substantial savings over the next decade.
Common disorders in the aging population

- Neurodegenerative diseases
- Cardiovascular diseases
- Gastrointestinal diseases
- Musculoskeletal disorder
- Rheumatologic diseases
- Endocrinal diseases
- Renal impairment
- Genitourinary diseases
- Psychiatric disorders
- Cancer

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Common disorders in the aging population

Iron deficiency

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Common disorders in the aging population

Iron deficiency

Negative impact on overall outcome

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A systematic analysis of global anemia burden from 1990 to 2010

Nicholas J. Kassebaum, Rashmi Jasrasaria, Mohsen Naghavi, Sarah Lozano, Mathilda Regan, David Weatherall, David P. Chou, Thomas P. Mulligan, Rachel L. Pullan, Simon J. Brooker and Christopher J. L. Murray

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

38.55m YLD in Asia-Pac (56% of anaemia burden)

Associated with:
- weakness
- fatigue
- difficulty concentrating
- poor work productivity
- infection
- heart failure
- preterm labor
- low birth weight
- child and maternal mortality
Targeted anemia surveillance and intervention should be a greater priority in high-risk populations, especially young children and females. 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
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

- The impairment that affected the greatest number of people in 2015 was anaemia, with 2.36 billion (2.35–2.37 billion) individuals affected.
- Iron deficiency was the cause of anaemia in more than half of all cases.
Incidence of Preoperative Anemia

65,788 patients (1980-2000)
Preoperative evaluation
WHO anemia definition


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# Anemia Prevalence in Surgical Populations

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>Prevalence of pre-operative anaemia (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective surgery</td>
<td>19–75</td>
</tr>
<tr>
<td>Cardiac surgery</td>
<td>24–26</td>
</tr>
<tr>
<td>Non-cardiac surgery</td>
<td>30–40</td>
</tr>
<tr>
<td>Orthopedic surgery</td>
<td>19–38</td>
</tr>
<tr>
<td>Colorectal surgery</td>
<td>70</td>
</tr>
</tbody>
</table>

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 $\uparrow$ - OR 2.90 (2.30 – 3.68, p< 0.001)
  - Acute kidney injury $\uparrow$ - OR 3.75 (2.95 – 4.76, p< 0.001)
  - Infections $\uparrow$ - OR 1.93 (1.06 – 1.55, p< 0.01)
  - Stroke in cardiac surgery $\uparrow$ - OR 1.28 (1.17 – 3.18, p< 0.01)
  - RBC transfusion $\uparrow$ - OR 5.04 (4.12 – 6.17, p< 0.001)


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Common disorders in the aging population

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- Cardiovascular diseases
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- Genitourinary diseases
- Gastrointestinal diseases
- Musculoskeletal disorders
- Psychiatric disorders
- Cancer
Iron deficiency

A Hidden Giant of Global Disease

Iron deficiency anemia
Pre-op anemia independently associated with increased
• Mortality (+ 40% for mild anemia)
• Major morbidity (+30% for mild anemia)
• Hospital length of stay
• Likelihood of transfusion (2-9 fold)

Spahn DR et al. Lancet 2013; 381:1855
Mussallam KM et al. Lancet 2011; 378:1396
Spahn DR. Anesthesiology 2010; 113(2) 1-14
Beattie WS, et al Anesthesiology 2009; 110(3) 574-81
Shander A. Am J Med 2004; 116(7A) 58S-69S
Anemia & Iron Deficiency

Independent Risk Factor for Adverse Outcomes
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 more than doubled since since 1997.

http://www.hcup-us.ahrq.gov/reports/statbriefs/sb165.pdf
## Reported adverse outcomes associated with transfusion

<table>
<thead>
<tr>
<th>Adverse Outcomes</th>
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</tr>
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<tbody>
<tr>
<td><strong>Infection (nosocomial/non-TT)</strong></td>
<td><strong>Thromboembolism (arterial, venous)</strong></td>
</tr>
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<td>Septicemia</td>
<td>Diminished postop functional recovery</td>
</tr>
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<td>Delayed wound healing</td>
<td>Bleeding requiring re-operation</td>
</tr>
<tr>
<td>Lung injury (TRALI, TACO)</td>
<td>Cancer recurrence</td>
</tr>
<tr>
<td>MOF</td>
<td>Tumor growth promotion</td>
</tr>
<tr>
<td>SIRS</td>
<td>Non-Hodgkin lymphoma</td>
</tr>
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<td>ARDS</td>
<td>Increased mortality</td>
</tr>
<tr>
<td>Vasospasm</td>
<td>Increased admission to ICU</td>
</tr>
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<td>Low-output heart failure</td>
<td>Prolonged mechanical ventilation</td>
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*Adapted from*


Spahn DR et al. Alternatives to blood transfusion. Lancet 2013; 381:1855
## Meta-analyses from RCTs comparing liberal vs. restrictive transfusion strategies

<table>
<thead>
<tr>
<th>RCTs included</th>
<th>Patients</th>
<th>Reductions in RBC Txns</th>
<th>Hospital mortality in restrictive group</th>
<th>Infections in restrictive group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson 2012</td>
<td>19</td>
<td>6’264</td>
<td>-39%</td>
<td>-23%</td>
</tr>
<tr>
<td>Rohde 2014</td>
<td>18</td>
<td>7’593</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Salpeter 2014</td>
<td>3</td>
<td>2’364</td>
<td>*-43%</td>
<td>-26%</td>
</tr>
<tr>
<td>Holst 2015</td>
<td>31</td>
<td>9’813</td>
<td>-46%</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

* Transfusion rate

---

* Carson J.L. et al., Cochrane Database of Systematic Reviews, 2012
  Holst L.B. et al., BMJ, 2015, 350:h1354

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**Adapted from**


Spahn DR et al. Alternatives to blood transfusion. Lancet 2013; 381:1855
Figure 5. Risk for myocardial infarction with liberal blood transfusion (Tx). M-H indicates Mantel-Haenszel. Diamond indicates the overall summary estimate for the analysis (width of the diamond represents the 95% CI); boxes, the weight of individual studies in the pooled analysis; whiskers, the 95% CIs: when they are to the left of the midline, representing a risk ratio of 1, it means that the risks of myocardial infarction (ie, are less with) liberal Tx/Tx; when they are to the right of the midline, representing a risk ratio of 1, it means that the risks of dying favor (ie, are less with) the comparator arm; if the lines touch the midline, representing a risk ratio of 1, it means that the risks of a myocardial infarction are comparable for the 2 arms.
Figure 2. Risk for all-cause mortality with liberal blood transfusion.

M-H indicates Mantel-Haenszel. Diamond indicates the overall summary estimate for the analysis (width of the diamond represents the 95% CI); boxes, the weight of individual studies in the pooled analysis; whiskers, the 95% CIs; when they are to the left of the midline, representing a risk ratio of 1, it means that the risks of dying favor (ie, are less with) transfusion; when they are to the right of the midline, representing a risk ratio of 1, it means that the risks of dying favor (ie, are less with) the comparator arm; if the lines touch the midline, representing a risk ratio of 1, it means that the risks of dying are comparable for transfusion and the comparators.
Original Investigation

Patterns and Outcomes of Red Blood Cell Transfusion in Patients Undergoing Percutaneous Coronary Intervention

Matthew W. Sherwood, MD; Yongfei Wang, MS; Jeptha P. Curtis, MD; Eric D. Peterson, MD, MPH; Sunil V. Rao, MD

Patterns and Outcomes of Red Blood Cell Transfusion in Patients Undergoing Percutaneous Coronary Intervention

Matthew W. Sherwood, MD; Yongfei Wang, MS; Jeptha P. Curtis, MD; Eric D. Peterson, MD, MPH; Sunil V. Rao, MD

Table 2. Association of Transfusion and Outcomes: Adjusted Odds Ratios From Inverse Probability-Weighted Analysis

<table>
<thead>
<tr>
<th>Visit Outcomes</th>
<th>Overall Population</th>
<th>Patients With Bleeding</th>
<th>Patients Without Bleeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>With RBCT, No. (%)</td>
<td>Without RBCT, No. (%)</td>
<td>With RBCT, No. (%)</td>
<td>Without RBCT, No. (%)</td>
</tr>
<tr>
<td>(n = 48,430)</td>
<td>(n = 2,210)</td>
<td>(n = 17,185)</td>
<td>(n = 18,650)</td>
</tr>
<tr>
<td>Myocardial infarction, stroke, or in-hospital death</td>
<td>2202 (4.54) [4.36-4.73]</td>
<td>950 (5.53) [5.19-5.87]</td>
<td>1252 (4.01) [3.79-4.22]</td>
</tr>
<tr>
<td></td>
<td>[1.82-1.85]</td>
<td>[3.59-4.15]</td>
<td>[1.80-1.84]</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>988 (2.04) [1.91-2.17]</td>
<td>337 (1.96) [1.75-2.17]</td>
<td>651 (2.08) [1.93-2.24]</td>
</tr>
<tr>
<td></td>
<td>[1.16-0.188]</td>
<td>[0.79-1.07]</td>
<td>[0.17-0.18]</td>
</tr>
<tr>
<td>In-hospital death</td>
<td>6052 (12.5) [12.2-12.8]</td>
<td>2207 (12.8) [12.3-13.3]</td>
<td>3845 (12.3) [11.9-12.7]</td>
</tr>
<tr>
<td></td>
<td>[1.15-1.18]</td>
<td>[1.01-1.13]</td>
<td>[1.12-1.15]</td>
</tr>
</tbody>
</table>

CONCLUSIONS AND RELEVANCE: Among patients undergoing PCI at US hospitals, there was considerable variation in blood transfusion practices, and receipt of transfusion was associated with increased risk of in-hospital adverse cardiac events. These observational findings may warrant a randomized trial of transfusion strategies for patients undergoing PCI.

Harms associated with single unit perioperative transfusion: retrospective population based analysis

Elizabeth L Whitlock,¹ Helen Kim,¹ Andrew D Auerbach²

Harms associated with single unit perioperative transfusion: retrospective population based analysis

Elizabeth L Whitlock,1 Helen Kim,1 Andrew D Auerbach2

Table 3 | Characteristics of patients undergoing surgery, stratified by composite outcome, and results from hierarchical logistic regression model for association between stroke/MI and perioperative transfusion of packed red blood cells (pRBC)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>No (%) without stroke/MI (n=1575775)</th>
<th>No (%) with stroke/MI (n=8044)</th>
<th>Multivariate OR (reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 524 850 (97.4)</td>
<td>7 548 (93.8)</td>
<td>2.33 (1.90 to 2.86)</td>
</tr>
<tr>
<td>1</td>
<td>12 715 (0.81)</td>
<td>132 (1.6)</td>
<td>2.37 (2.00 to 2.81)</td>
</tr>
<tr>
<td>2</td>
<td>21 420 (1.4)</td>
<td>222 (2.8)</td>
<td>3.13 (2.28 to 4.31)</td>
</tr>
<tr>
<td>3</td>
<td>2 881 (0.18)</td>
<td>45 (0.56)</td>
<td></td>
</tr>
<tr>
<td>≥4</td>
<td>3 909 (0.25)</td>
<td>97 (1.2)</td>
<td>4.87 (3.86 to 6.14)</td>
</tr>
</tbody>
</table>

WHAT IS ALREADY KNOWN ON THIS TOPIC

- Stored blood undergoes biochemical and morphological changes that could impair post-transfusion delivery of oxygen and contribute to ischemic outcomes
- Perioperative hemorrhage is associated with ischemic stroke and myocardial infarction, but the potential contribution of transfusion is unknown

WHAT THIS STUDY ADDS

- There is an association between perioperative transfusion of as little as one unit of blood and ischemic stroke or myocardial infarction

Morbidity and Mortality after High-dose Transfusion

Daniel J. Johnson, B.S., Andrew V. Scott, B.S., Viachaslau M. Barodka, M.D., Sunhee Park, M.D., Jack O. Wasey, B.M., B.Ch., Paul M. Ness, M.D., Tom Gniadek, M.D., Ph.D., Steven M. Frank, M.D.

Fig. 1. In-hospital morbidity and mortality rates according to the number of erythrocyte units transfused. In-hospital morbidity (a composite of all five morbid events shown in fig. 2) increased with erythrocyte dose in a curvilinear manner, reaching a 50% rate of morbidity at 10 or greater erythrocyte units. The slope was steepest up to 30 erythrocyte units, with an inflection point and plateau at higher doses. The formula defining the curve is \( y = 36.5 \ln(x) + 10.4 \) (\( R^2 = 0.962 \)). Mortality increased in a linear manner with a slope close to 10, indicating that for each 10-erythrocyte unit increment, mortality increased approximately 10%. After transfusion of 50 units, mortality exceeded 50%. The formula defining the curve is \( y = 9.47 (x) - 10.56 \) (\( R^2 = 0.99 \)). RBC = erythrocyte.
Fig. 2. Event rates for five morbid outcomes are plotted according to the number of erythrocyte units transfused. In high-dose transfused patients, hospital-acquired infections and thrombotic events were four to five times more prevalent than renal, respiratory, or ischemic events. The incidence of infection increased with erythrocyte dose up to 40% and then plateaued. Thrombotic events increased up to a rate of 50% before reaching a plateau. Renal, respiratory, and ischemic event rates increased gradually up to rates of 5 to 10% at an erythrocyte dose of 20 units. RBC = erythrocyte.
Large observational studies show RBC txn is independently associated in a dose-dependent relationship with

- Morbidity
- ALOS
- Mortality

Shaw et al. Transfusion 2014
Parsons J et al. Crit Care 2013
Horvath K et al. Ann Thorac Surg 2013
Linder et al. BJU Int 2013
Al-Refaie et al Surgery 2012
Stone GW et al. Am Heart J  2012
Xenos et al. Thromb Res 2012
Glance L et al. Anesthesiol 2011
Haijar LA et al. JAMA  2010
Beattie et al. Anesthesiology 2009
Bursi et al. Eur J Vasc Endovasc Surg 2009
Chaiwat O et al. Anesthesiology 2009
Karkouti et al. Circulation 2009
Gauvin et al Transfusion 2008
Ho et al. Spine 2007
Rogers et al. Am Heart J 2006
Surgenor SD, et al Circulation 2006
Leal-Noval et al. Anesthesiology 2003
Malone DL et al. J Trauma 2003
Chang et al. Vox Sang 2000
Vignali et al. Vox Sang 1996

RCTs (with some exceptions in specific surgical populations) and meta-analyses thereof show that liberal transfusion strategies appear to offer no benefit but result in increased adverse patient outcomes.

Holst et al. BMJ 2015
Rohde et al. JAMA 2014
Carson et al. Cochrane Review 2012
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.

DOCTOR’S ORDERS
By simply reminding doctors of the current guidelines when they order blood, a California hospital was able to save money and lives.

- Reducing the blood used for transfusions by nearly one-quarter saved the hospital US $1.6 million per year.
- The average length of stay for patients who received transfusions went from 10.1 days to 6.2.
- Mortality among people who had transfusions fell from 5.5% to 3.3%.
Triad of Independent Risk Factors for Adverse Outcomes

Anemia & Iron Deficiency

Induces or exacerbates anemia

Blood Loss & Bleeding

Triggers transfusion

Associated with re-bleeding

References:


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Restellini S, AP&T 2012
Hearnshaw SA, et al Aliment Pharmacol Ther 2010
• First study to assess clinical and health outcomes associated with blood product transfusion across the full spectrum of procedures and clinical conditions in hospitalised patients
• US Nationwide Inpatient Sample (NIS) Database: Retrospective cohort study of all hospitalizations in 2004 (n=38.66 million) to assess in-hospital outcomes associated with blood transfusion.

• Of all admissions 5.8% (2.33 million) were transfused. After adjustment for age, gender, comorbidities, admission type or DRG transfusion was associated with:
  – 1.7 increased odds of death (P<0.0001)
  – 1.9 increased odds of infection (P<0.0001)
  – 2.5 days longer LOS
  – $17,194 higher charges (P<0.0001)

Morton et al 2010

→ $57 billion in extra charges for transfused patients (2013 dollars, Medical Services CPI adjusted)
Retrospective cohort study of all multi-day acute-care inpatients discharged from a five hospital health service in Western Australia between July 2011 and June 2012.

- **89,996 multi-day, acute-care inpatient separations**,  
- **4,805 (5.3%)** were **transfused** at least one unit of red blood cells.
After adjusting for age, gender, admit type (emergency or elective), DRG and patient complexity (HRT complexity),

- the mean **inpatient cost was 1.83 times higher in the transfused group** compared with the non-transfused group (95% confidence interval 1.78 to 1.89; p<0.001)
- The estimated **total hospital associated cost of RBC transfusion was AUD $77 million** (US $72 million), representing 7.8% of total hospital expenditure on acute-care inpatients.
- There was a significant **dose-dependent** association between the number of RBC units transfused and increased costs after adjusting for confounders.
Appropriateness of Allogeneic Red Blood Cell Transfusion: The International Consensus Conference on Transfusion Outcomes

Aryeh Shander, Arlene Fink, Mazyar Javidroozi, Jochen Erhard, Shannon L. Farmer, Howard Corwin, Lawrence Tim Goodnough, Axel Hofmann, James Isbister, Sherri Ozawa, and Donat R. Spahn, for the International Consensus Conference on Transfusion Outcomes Group
## Transfusion Related Cost of Care Estimate 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>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>19,836,000</td>
<td></td>
<td></td>
<td>867</td>
<td>17,206,964,253</td>
<td></td>
</tr>
<tr>
<td>European Union</td>
<td>28,080,000</td>
<td></td>
<td></td>
<td>564</td>
<td>15,856,494,000</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>1,094,464</td>
<td></td>
<td></td>
<td>767.50</td>
<td>840,005,091</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19,836,000</td>
<td></td>
<td></td>
<td>867</td>
<td>33,903,463,344</td>
<td>151,471,565,118</td>
</tr>
</tbody>
</table>

*Estimate by Hofmann A.*

US$185 Billion

---

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


Triad of Independent Risk Factors for Adverse Outcomes

Anemia & Iron Deficiency

Blood Loss & Bleeding

Transfusion

ID/IDA treatment:
The first pillar of Patient Blood Management (PBM)
1st Pillar: Anemia, Iron Deficiency

2nd Pillar: Blood Loss & Bleeding

3rd Pillar: Harness & optimise physio logical reserve of anaemia

Transfusion

Axel Hofmann Beijing 10-2016
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

PREOP

INTRAOP

POSTOP

- Time surgery with haematological optimisation

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 cardiac output
- Optimise ventilation and oxygenation

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

Perioperative multidisciplinary multimodal patient-specific team approach

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Hofmann et al. Current Opinions in Anaesthesiology 2012
“Patient Blood Management (PBM) is an evidence-based bundle of care to optimize medical and surgical patient outcomes by clinically managing and preserving a patient's blood”
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/anaemia of chronic disease/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

- Minimise blood loss
- Be aware of drug interactions that can increase anaemia
- Meticulous haemostasis and surgical techniques
- Blood-sparing surgical devices
- Anaesthetic blood conserving strategies
- Autologous blood options
- Maintain normothermia
- Pharmacological/haemostatic agents
- 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

3rd Pillar
Harness & optimise physiological reserve of anaemia

- Optimise cardiac output
- Optimise ventilation and oxygenation
- Detect anaemia
- Identify underlying disorder(s) causing anaemia
- Minimise iatrogenic blood loss
- Haemostasis/anticoagulation management
- Prophylaxis of upper GI haemorrhage
- Avoid/treat infections promptly
- Be aware of adverse effects of medication

First line treatment pre-hospitalization:
- iron
- B12
- folic acid
- + EPO in non-responders

Perioperative multidisciplinary multimodal patient-specific team approach

**Preop**
- Time surgery with haematological optimisation

**Intraop**
- Optimise erythropoiesis
- Be aware of drug interactions that can increase anaemia

**Postop**
- 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

**Hofmann et al. Current Opinions in Anaesthesiology 2012**

Axel Hofmann Beijing 10-2016
PBM in the Fu Wai Hospital, Beijing: A template for the world
Presentation Prof. Ji
The global expansion of PBM: A new standard of care
Spahn D.R., Theusinger O., Hofmann A. Patient Blood Management is a win-win: Time to wake up! BJA 2012
Health Economic Perspective

no go quadrant!

prime quadrant!

Axel Hofmann Beijing 10-2016
**The Important Role for Intravenous Iron in Perioperative Patient Blood Management in Major Abdominal Surgery**

*A Randomized Controlled Trial*

Bernd Froessler, MD, M Clin Sc, Peter Palm, MD, Ingo Weber, MD, Nicolette A. Hodyl, PhD, Rajvinder Singh, MBBS, M Phil, and Elizabeth M. Murphy, PhD

### TABLE 2. Primary Outcome; Perioperative Red Blood Cell Transfusions

<table>
<thead>
<tr>
<th>Transfusion Events Occurring in Each Period</th>
<th>Intervention n = 40</th>
<th>Usual Care n = 32</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>0</td>
<td>2 (6%)</td>
<td>0.190</td>
</tr>
<tr>
<td>Units transfused</td>
<td>0</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Intraoperative</td>
<td>0</td>
<td>5 (16%)</td>
<td>0.014</td>
</tr>
<tr>
<td>Units transfused</td>
<td>n.a.</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Postoperative</td>
<td>5 (12%)</td>
<td>10 (31%)</td>
<td>0.079</td>
</tr>
<tr>
<td>Units transfused</td>
<td>8</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Total number of Patients transfused</td>
<td>5 (12.5%)</td>
<td>10 (31.25%)</td>
<td>0.079</td>
</tr>
<tr>
<td>Units transfused</td>
<td>8</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Total number of transfusion events</td>
<td>5</td>
<td>17</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

# The Important Role for Intravenous Iron in Perioperative Patient Blood Management in Major Abdominal Surgery

A Randomized Controlled Trial

Bernd Froessler, MD, M Clin Sc, *† Peter Palm, MD, * Ingo Weber, MD, * Nicolette A. Hodyl, PhD, ‡
Rajvinder Singh, MBBS, M Phil, § ¶ and Elizabeth M. Murphy, PhD ||

## TABLE 3. Secondary Outcomes; Hematological Indices Across Study Period

<table>
<thead>
<tr>
<th>Hematological Indices Across Study Period</th>
<th>Intervention n = 40</th>
<th>Usual Care n = 32</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin values, g/dL</td>
<td>10.7 ± 1.3, n = 40</td>
<td>10.6 ± 1.4, n = 32</td>
<td>0.76</td>
</tr>
<tr>
<td>Randomization</td>
<td>11.5 ± 1.3, n = 36</td>
<td>10.7 ± 1.7, n = 29</td>
<td>0.12</td>
</tr>
<tr>
<td>Admission</td>
<td>0.8 ± 0.8, n = 36</td>
<td>0.1 ± 1.3, n = 29</td>
<td>0.01</td>
</tr>
<tr>
<td>Difference between randomization and admission</td>
<td>10.3 ± 1.3, n = 37</td>
<td>10.2 ± 0.9, n = 31</td>
<td>0.34</td>
</tr>
<tr>
<td>Discharge</td>
<td>12.2 ± 1.2, n = 36</td>
<td>11.1 ± 1.2, n = 28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Postdischarge change (4 wk minus discharge value)</td>
<td>1.9 ± 1.4, n = 36</td>
<td>0.9 ± 1.4, n = 28</td>
<td>0.01</td>
</tr>
<tr>
<td>Iron status†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferritin at randomization, μg/L</td>
<td>19 (6–48), n = 40</td>
<td>37 (11–82), n = 32</td>
<td>0.06</td>
</tr>
<tr>
<td>Ferritin at 4 wk, μg/L</td>
<td>248 (137–546), n = 36</td>
<td>99 (35–228), n = 27</td>
<td>0.002</td>
</tr>
<tr>
<td>Transferrin saturation at randomization, %</td>
<td>6 (3–10), n = 40</td>
<td>9 (7–15), n = 32</td>
<td>0.03</td>
</tr>
<tr>
<td>Transferrin saturation at 4 wk, %</td>
<td>21 (16–26), n = 36</td>
<td>14 (7–18), n = 27</td>
<td>0.003</td>
</tr>
<tr>
<td>CRP‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRP at randomization, mg/L</td>
<td>7.2 (2.9–19.3), n = 40</td>
<td>7.7 (2.6–16.8), n = 32</td>
<td>0.99</td>
</tr>
<tr>
<td>CRP at 4 wk, mg/L</td>
<td>5.8 (2.3–12.6), n = 36</td>
<td>11 (3.1–23), n = 27</td>
<td>0.18</td>
</tr>
</tbody>
</table>

*†‡§ ¶ ||


Axel Hofmann Beijing 10-2016
The Important Role for Intravenous Iron in Perioperative Patient Blood Management in Major Abdominal Surgery

A Randomized Controlled Trial

Bernd Froessler, MD, MClInSc,* † Peter Palm, MD,* Ingo Weber, MD,* Nicolette A. Hodyl, PhD, ‡ Rajvinder Singh, MBBS, MPhil,§ ¶ and Elizabeth M. Murphy, PhD∥

TABLE 4. Other Secondary Outcomes of Interest

<table>
<thead>
<tr>
<th></th>
<th>Intervention n = 40</th>
<th>Usual Care n = 32</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stay, d*</td>
<td>6 (1–19)</td>
<td>9 (1–23)</td>
<td>0.05</td>
</tr>
<tr>
<td>Infection</td>
<td>4 (10%)</td>
<td>5 (16%)</td>
<td>0.5</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal impairment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readmission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharged on oral iron</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QoL (presurgery/intervention)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QoL (4 wk postsurgery)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference in QoL (pre–post)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RESULTS

An early interim data analysis was requested following concerns raised by the clinical investigator team after high rates of RBC transfusion, considered to be an independent risk factor for adverse clinical outcomes, noted after the 4-week follow-up in a subset of patients. This was performed by an independent statistician on the interim data-monitoring committee with the data blinded (intervention group n = 32, usual care group n = 26). The results of the interim analysis were forwarded to 2 independent experts in the field to assess safety concerns. Enrolment continued while waiting for a response. There was disagreement among the assessors, and a third independent expert opinion was sought. Based on advice from 2 of the 3 independent experts, the study was terminated early due to higher than expected rates of poor outcome in the usual care group.
Patient blood management in cardiac surgery results in fewer transfusions and better outcome

Irwin Gross,1 Burkhardt Seifert,2 Axel Hofmann,2 and Donat R. Spahn2

• Retrospective cohort study in 4’937 patients (2006-07 – 2012-09) undergoing cardiac surgery

• Outcomes
  ➔ RBC, FFP and platelet transfusion rates / amounts
  ➔ RBC loss
  ➔ Clinical outcomes
    • Mortality
    • Length of hospital stay
    • Cerebral vascular accident
    • Postoperative acute kidney injury
    • Total costs
Patient blood management in cardiac surgery results in fewer transfusions and better outcome

Irwin Gross,¹ Burkhardt Seifert,² Axel Hofmann,² and Donat R. Spahn²

Patient Blood Measurement measures implemented

- Preoperative anemia treatment
- Restrictive Hb transfusion trigger
- Volume of the bypass circuit
- Anti-fibrinolytic use
- Surgical hemostasis
- Perioperative testing / phlebotomy


Axel Hofmann Beijing 10-2016
<table>
<thead>
<tr>
<th></th>
<th>Pre-PBM epoch</th>
<th>PBM epoch</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RBC loss (mL)</strong></td>
<td>810 ± 426</td>
<td>605 ± 369</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>721 [538-993]</td>
<td>552 [370-756]</td>
<td></td>
</tr>
<tr>
<td><strong>Hb (g/dL)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before transfusion</td>
<td>7.2 ± 1.4</td>
<td>6.6 ± 1.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>After transfusion</td>
<td>8.3 ± 1.3</td>
<td>7.7 ± 1.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>% of patients transfused</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBCs</td>
<td>39.3</td>
<td>20.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>FFP</td>
<td>18.3</td>
<td>6.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PLTs</td>
<td>17.8</td>
<td>9.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>RBCs (units/patient)</td>
<td>1.28 ± 2.34</td>
<td>0.61 ± 1.57</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>0 [0-2]</td>
<td>0 [0-0]</td>
<td></td>
</tr>
<tr>
<td>FFP (units/patient)</td>
<td>0.78 ± 1.98</td>
<td>0.23 ± 1.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>0 [0-0]</td>
<td>0 [0-0]</td>
<td></td>
</tr>
<tr>
<td>PLTs (units/patient)</td>
<td>0.39 ± 1.03</td>
<td>0.17 ± 0.65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>0 [0-0]</td>
<td>0 [0-0]</td>
<td></td>
</tr>
<tr>
<td><strong>Discharge Hb (g/dL)</strong></td>
<td>9.1 ± 1.2</td>
<td>9.4 ± 1.5</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Data are mean ± SD and median [interquartile range] for nonnormally distributed data.
<table>
<thead>
<tr>
<th></th>
<th>Pre-PBM epoch</th>
<th>PBM epoch</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality (%)</td>
<td>3.9</td>
<td>4.4</td>
<td>0.642</td>
</tr>
<tr>
<td>CVA (%)</td>
<td>3.40</td>
<td>2.10</td>
<td>0.130</td>
</tr>
<tr>
<td>Kidney injury (%)</td>
<td>7.60</td>
<td>5.00</td>
<td>0.039</td>
</tr>
<tr>
<td>ICU LOS (days)</td>
<td>5.0 ± 7.1</td>
<td>5.0 ± 7.1</td>
<td>0.970</td>
</tr>
<tr>
<td></td>
<td>3 [1-6]</td>
<td>3 [1-6]</td>
<td></td>
</tr>
<tr>
<td>Hospital LOS (days)</td>
<td>12.2 ± 9.6</td>
<td>10.4 ± 8.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>10 [7-15]</td>
<td>8 [6-12]</td>
<td></td>
</tr>
<tr>
<td>30-day readmission rate (%)</td>
<td>0.3</td>
<td>0.1</td>
<td>0.467</td>
</tr>
<tr>
<td>Total direct costs ($)</td>
<td>48,375 ± 28,053</td>
<td>44,300 ± 25,915</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Data are mean ± SD and median [interquartile range] for nonnormally distributed data. LOS = length of stay.
2008

Government of Western Australia
World’s First Statewide PBM Program
[The Government of Western Australia] is to be congratulated ... to sustainably implement patient blood management.

[They are] leading the world in the battle against unnecessary erythrocyte transfusions and their burden—financially and in terms of morbidity and mortality.

A Programmatic Approach to Patient Blood Management – Reducing Transfusions and Improving Patient Outcomes

Shannon L. Farmer¹,², Kevin Trentino³, Axel Hofmann¹,²,⁴, James Semmens², S. Aqif Mukhtah², Gareth Prosser⁵, Jeffrey Hamdorf⁷, Sudhakar Rao⁸ and Michael F. Leahy⁹

Fig. (4). Red blood cell units issued per 1,000 population for the state of Western Australia 2008-09 to 2013-14 (published and unpublished data). Printed with permission National Blood Authority (Australia). Issuances have decreased every year since the beginning of the Western Australia Patient Blood Management Program, despite beginning with the lowest issuance rate per 1,000 population in the developed world.
2010

Geneva, Switzerland
World Health Assembly
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)”
Priorities for Action on

- Hospital/Institutional Level
- National Level
- International Level
2011-16

Commonwealth 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..." (Safari) or "Download Linked File As..." (Firefox).

- Low Quality [MP4, 4Kb/s] [With Subtitles] [37MB], [Without Subtitles] [25MB]
- Medium Quality [MP4, 720p] [With Subtitles] [88MB], [Without Subtitles] [64MB]
- High Quality [MP4, 1080p] [With Subtitles] [135MB], [Without Subtitles] [142MB]

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

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.
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.
2014-16

European Commission,
PBM Pilot Project
Information material

- PBM Homepage [www.europe-pbm.eu](http://www.europe-pbm.eu)
- PBM Flyer
- PBM Poster

Please follow the download links at [www.europe-pbm.eu](http://www.europe-pbm.eu)

Axel Hofmann Beijing 10-2016
PBM - Implementation Guide for Hospitals

Supporting Patient Blood Management (PBM) in the EU
A Practical 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
Hans Gombotz, Axel Hofmann,
Astrid Nørgaard and Peter Kastner

AIT Austrian Institute of Technology GmbH
Donau City Straße 1
1220 Vienna, Austria

www.ait.ac.at / www.europe-pbm.eu
PBM - Guide for Health Authorities

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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Donabedian’s Quality Framework

National Authorities

Demonstrating Urgency for PBM

Action

Quality of Structure

Quality of Process

• Body of Peer Reviewed Evidence
• EU-PBM Pilot Sites
• International PBM Reference Projects

Proof of principle

Evidence

Quality of Outcome

In Press, 2016

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Donabedian‘s Quality Framework

Quality of Structure → Quality of Process → Quality of Outcome

Reallocating/repurposing $$$

Improved Cost-Effectiveness

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Health Expenditures

OECD Health Data 2015

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

OECD Health Data 2015
Unsustainable Health Expenditures

Global Financial Crisis

Austerity → Cost Pressure

Abundance

OECD Health Data 2015

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The Potential of PBM in the Context of the Baby-Boomers

Population +65 Y  
Longevity ↑

Implementing PBM

No

ID/IDA ↑↑
Bleeding ↑↑
Transfusion ↑↑

Patient safety ↓↓
Outcome ↓↓
Cost ↑↑

Yes

ID/IDA ↓↓
Bleeding ↓↓
Transfusion ↓↓

Patient safety ↑↑
Outcome ↑↑
Cost ↓↓
THE CHALLENGES

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

THE SOLUTION

1st Pillar: Optimise red cell mass
2nd Pillar: Minimise Blood loss & bleeding
3rd Pillar: Harness & optimise physiological reserve of anaemia

Multidisciplinary team approach

THE EXPANSION
"There is nothing more difficult to take in hand, more perilous to conduct, nor uncertain in its success, than to take the lead in the introduction of a new order of things. For the innovator has for enemies all of those who have done well under the old, and lukewarm defenders in all of those who may do well under the new."

Niccolo Macchiavelli, 1469-1527 CE, historian, politician, diplomat, philosopher, humanist, and writer
Workshop Contents

• Pushing the boundary to the Hayflick limit
• From aging to hyperaging
• The grey tsunami: surfing, swimming or drowning
• Two hidden giants causing a multi billion dollar problem
• The first pillar of Patient Blood Management: ID/IDA treatment
• PBM in the Fu Wai Hospital, Beijing: A template for the world
• The global expansion of PBM: A newstandard of care
• Discussion