

Quick Cheap Wins in PBM



- Mr Toby Richards
- Professor of Surgery
- Vascular Surgeon
- University College London
- Monash University, Melbourne



PREVENTT

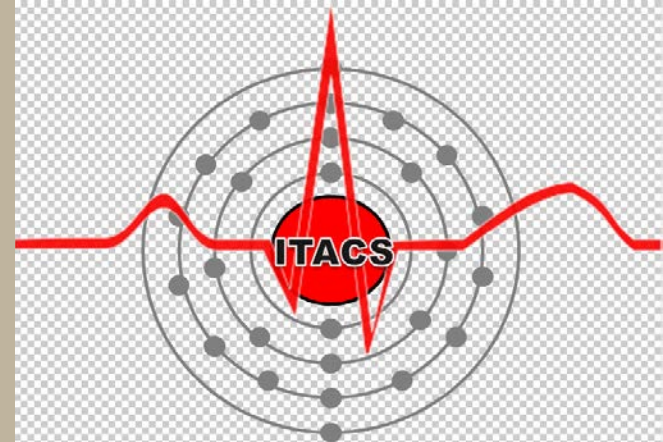
Preoperative intravenous iron to treat
anaemia in major surgery

UK/FER/17/0122

<https://www.youtube.com/watch?v=oVWjAeAa52o>

PREVENTT

Preoperative intravenous iron to treat
anaemia in major surgery



toby.richards@ucl.ac.uk

@tobyrichardsUCL

www.theironclinic.co.uk

FB theironclinic

THE
IRON
CLINIC





Thank You / Disclosures

*National Institute for
Health Research*

Grants:

NHMRC
NIHR – HTA
SHINE award for Innovation
Rosetree Foundation
NIAA
Mason Trust
UCH vascular charity
UCH friends charity
Vifor Pharma
Covidien / UCL
Vifor Pharma / UCL
Pharmocosmos UCL
Acelity

NIHR – RfPB
Stoke Association

CRN

Industry:

The Iron Clinic
18 week wait
Frontiere Medical
Veniti
Gideon-Ricter
Pharmocosmos
Vifor Pharma
Medtronic
Covidien
Acelity
Saatchi & Saatchi Health
Veniti
Cook
Gore
Baxter
KCI

Associations:

K-PBM
LATM
AAGBI
ASGBI
FIGO
BBTS
NHSBT
NATA
Biolron
ACTA / STS
VS
CX iLegx
ESVES
LSHTM
UCL

@tobyrichardsUCL

Facebook: theironclinic
anemia-irondeficiency

toby.richards@ucl.ac.uk

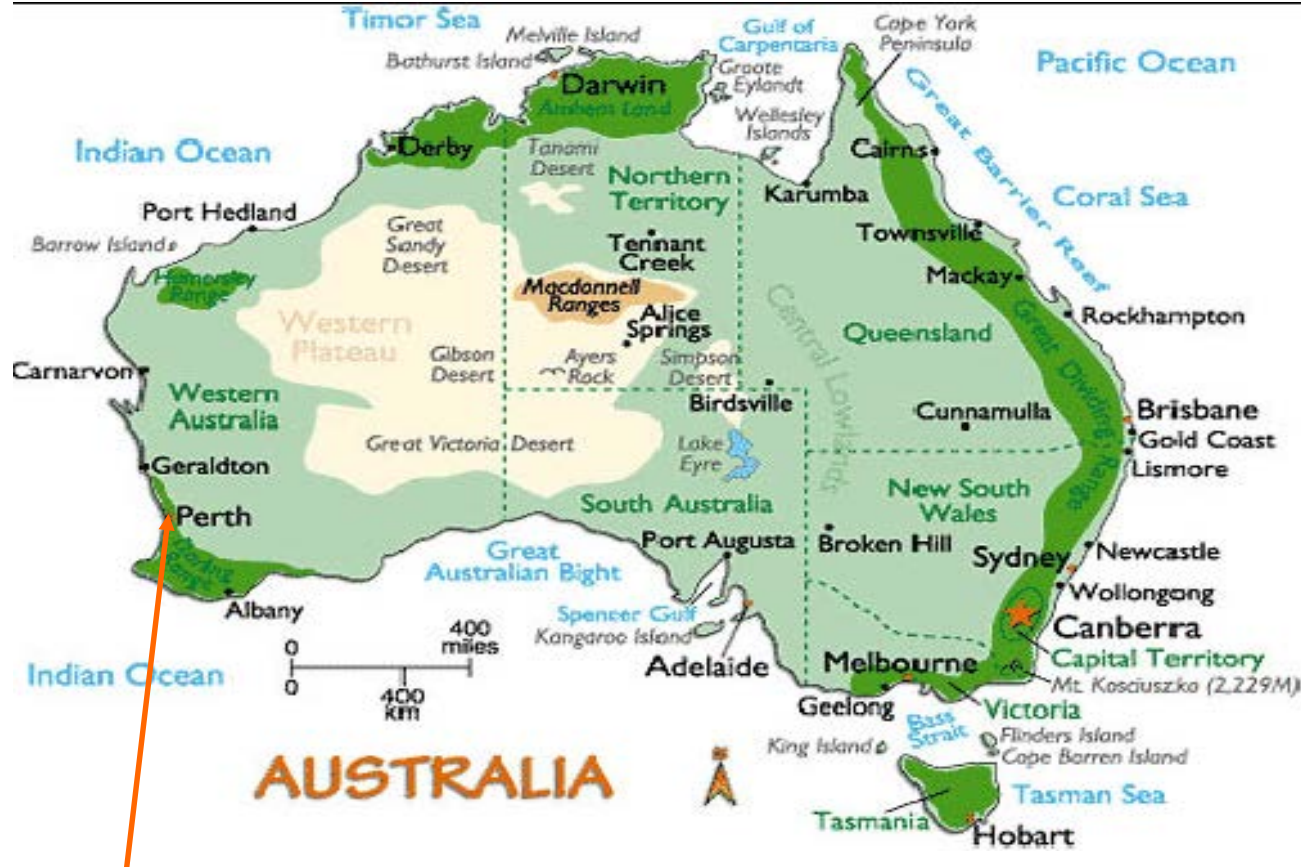


**The
Health
Foundation**
Inspiring
Improvement



THE
IRON
CLINIC

Western Australia



77 % of the population
resides in the Perth
Metropolitan Area



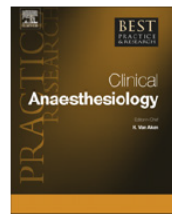


ELSEVIER

Contents lists available at SciVerse ScienceDirect

Best Practice & Research Clinical Anaesthesiology

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



- 2008 W.A. Government PBM program

- Jurisdictional Change Management
- Quality improvement & Patient Safety
- 5 years

- Literature Review

- Multidisciplinary
- Multimodal

Patient Blood Management
Guidelines: Module 2

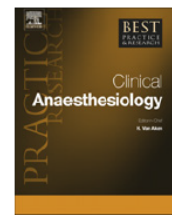
Perioperative



Contents lists available at SciVerse ScienceDirect

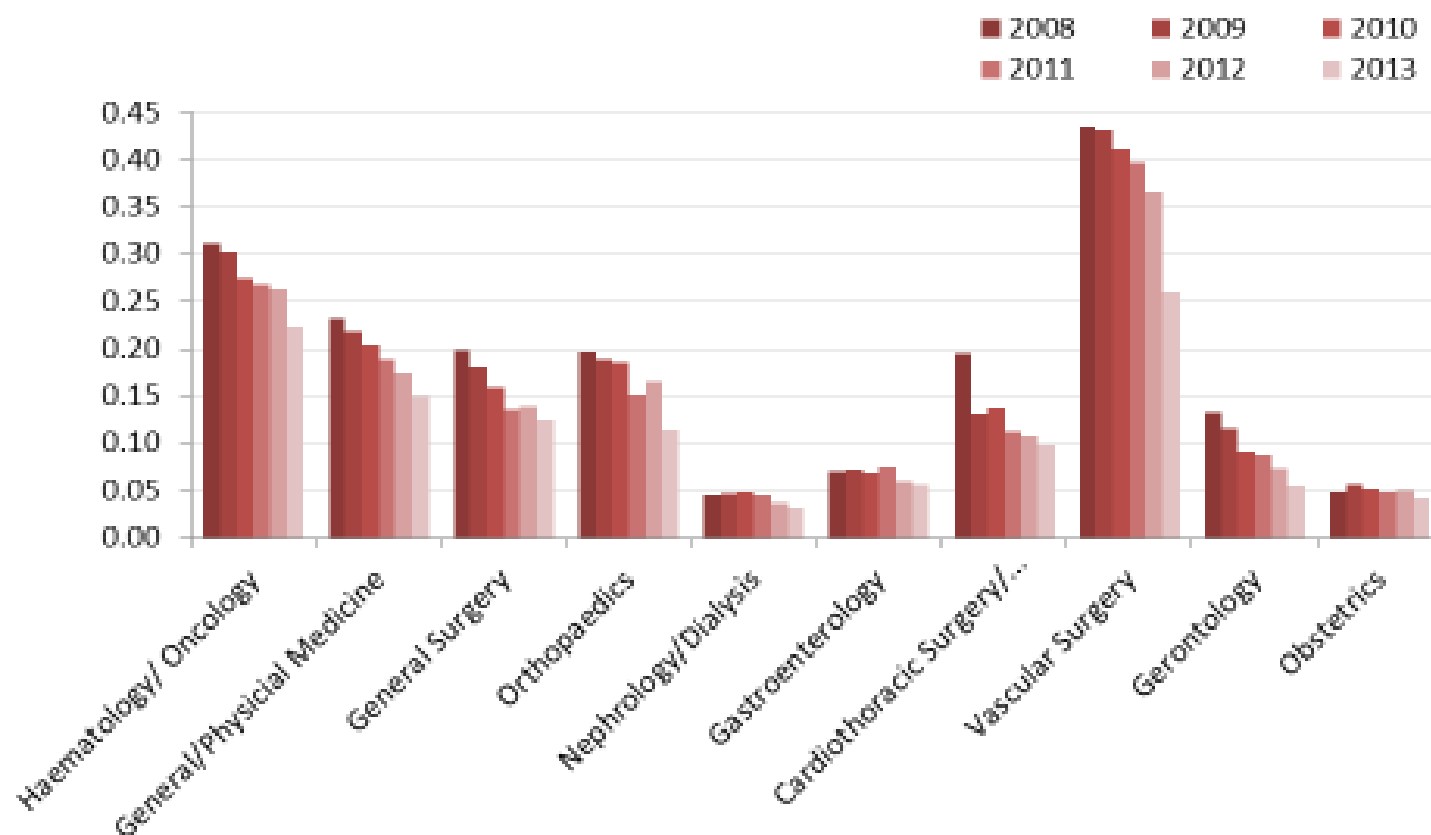
Best Practice & Research Clinical Anaesthesiology

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



Mean red cells transfused per discharge

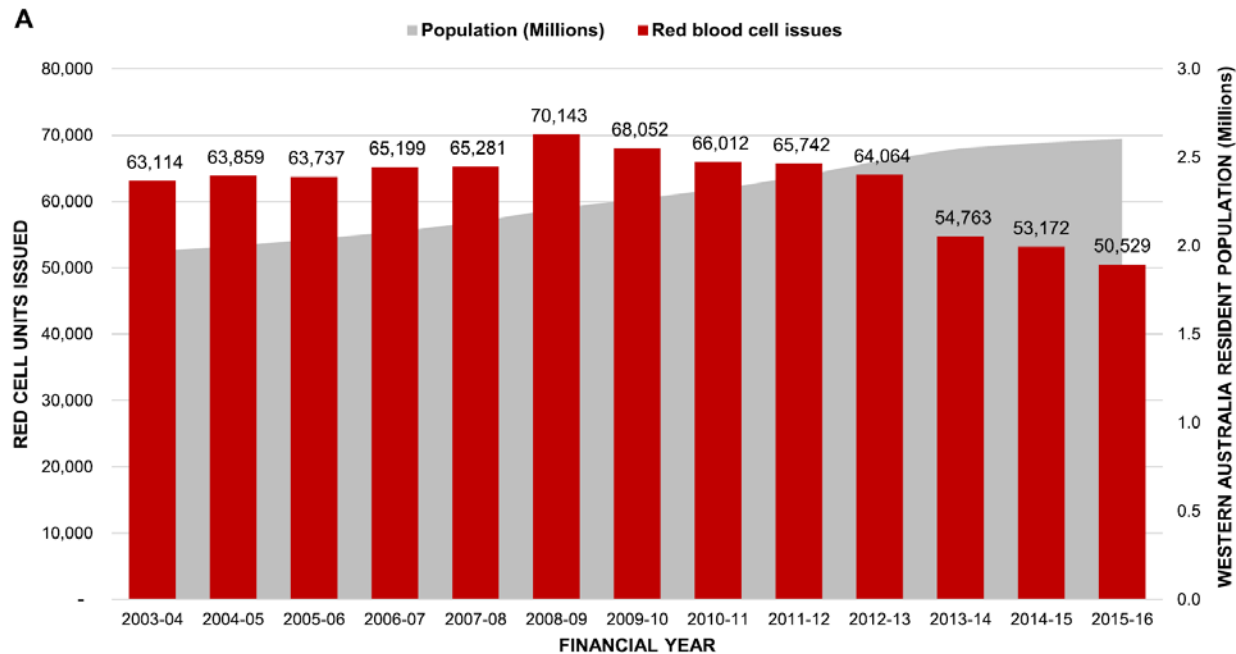
WA Public Metro Hospitals, discharges 2008-2013



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}*

PATIENT BLOOD MANAGEMENT OUTCOMES



Patient Blood Management (PBM)

NHS
Blood and Transplant

PATIENT BLOOD
MANAGEMENT –
THE FUTURE OF
BLOOD TRANSFUSION

Programme

Monday 18th June 2012

A joint initiative with The Department of Health
and The National Blood Transfusion Committee

Patient Blood Management

Individuelles Behandlungskonzept zur Reduktion und Vermeidung von
Anämie und Blutverlust sowie zum rationalen Einsatz von Blutprodukten

Herausgegeben von
Hans Gombotz
Kai Zacharowski
Donat R. Spahn

Patient Blood Management

Thieme

Patient Blood Management
Guidelines: Module 3

Medical

GETTING
STARTED in
PATIENT
BLOOD
MANAGEMENT

BB

Advancing Transfusion and
Cellular Therapies Worldwide

**An evidence-based, multidisciplinary
approach to optimising the care
of patients who might need a
blood transfusion**

PBM includes:-

- Managing pre-op anaemia
- Intra- and post-op management
cell salvage, assessing and
managing abnormal haemostasis
- Minimising blood sample volume
- Appropriate transfusion triggers
- Restrictive Transfusion

HOW:

- Why?
- Which patients?
- Provide feedback to clinicians
- Provide 'decision support'

1st Pillar Optimise erythropoiesis

2nd Pillar Minimise blood loss & bleeding

3rd Pillar Harness & optimise physiological reserve of anaemia

Preoperative

- Detect anaemia
- Identify underlying disorder(s) causing anaemia
- Manage disorder(s)
- Refer for further evaluation if necessary
- Treat suboptimal iron stores/iron deficiency/anemia of chronic disease/iron-restricted erythropoiesis
- Treat other haematinic deficiencies
- Note: Anaemia is a contraindication for elective surgery

- Identify and manage bleeding risk
- Minimising iatrogenic blood loss
- Procedure planning and rehearsal
- Preoperative autologous blood donation (in selected cases or when patient choice)
- Other

- Assess/optimize 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
- Restrictive transfusion thresholds

Intraoperative

- Timing surgery with haematological optimisation

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

- Optimise cardiac output
- Optimise ventilation and oxygenation
- Restrictive transfusion thresholds

Postoperative

- Stimulate 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
- Minimising 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

Benchmarking

- Audit
- Anaemia
- Anaemia management
- Transfusion protocol
 - Major Haemorrhage
 - Single unit
- Transfusion usage



RESULTS

- Locations 190
 - N= 2853
 - RBC = 6284 units RBC
-
- Age 72 years (62-80)
 - Female 62%
-
- Blood Loss= 1200 (726-2000) mL.
 - [Hb]= 83 (75-97) g/L



PRE –Operative PBM

PBM1	Pre-operative anaemia management
PBM2	Pre-operative transfusion allowed – Restrictive use
PBM3	Pre-operative transfusion allowed (PBM 2) - but PBM 1 attempted where appropriate
PBM4	Pre-operative transfusion - single unit transfusion policy
PBM5	Pre-operative anticoagulant and antiplatelet management



TYPE OF PROCEDURE	listing - Surgery: Median (IQR)	PAC - Surgery: Median (IQR)
• THR	77 (38-129), n=393	29 (16-65), n=401
• THR - bilateral	80 (21-191), n=16	47 (15-93), n=12
• TKR	87 (50-137), n=251	33 (16-79), n=271
• TKR - bilateral	60 (34-127), n=21	38 (23-59), n=22
• Revision THR	47 (12-98), n=200	28 (10-55), n=180
• Revision TKR	55 (25-108), n=75	40 (17-83), n=76
• Colorectal	15 (6-27), n=182	10 (6-16), n=172
• Vascular	21 (7-47), n=107	16 (6-46), n=107
• CABG	23 (6-56), n=82	24 (8-54), n=76
• Valve +/- CABG	51 (20-95), n=259	22 (9-48), n=266
• TAH	27 (13-56), n=242	13 (7-25), n=249
• Cystectomy	30 (17-48), n=26	12 (6-20), n=30
• Nephrectomy	22 (13-33), n=82	12 (6-21), n=86

PBM 1 – Preop Anaemia

Preop [Hb]	14 days	49%
	7 days	94%
		122 (109-134) g/dl

Half Anaemic

THE LANCET

Articles

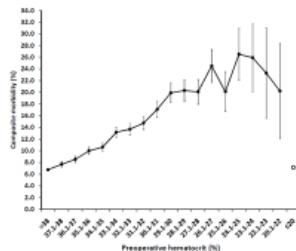
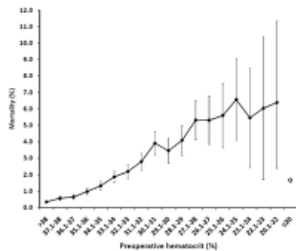
37% (191/522) cardiac

69% (195/283) colorectal surgery

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



Khaled M Moustafa, Hani M Tansim, Toby Richards, Donat R Sporer, Frits R Rosendaal, Aislinn Hebbel, Mohammed Khreis, Fadi S Dahdaleh, Karwan Khanavali, Pierre M Sfeir, Asaad Sawaid, Jamal J Holakia, Ali T Taher, Fadi R Jassal



PBM 1 – Preop Anaemia

Anaemic patients had associated higher Blood Transfusion

Odds Ratio 1.78

CI: 1.48 -2.14, $p < 0.0005$).

logistic regression, adjusting for age, sex and surgery type

Anaemic patients had associated higher mortality

Odds Ratio 3.41

CI: 1.74 -6.68, $p < 0.0001$).

	Alive		Died		Total
Anaemic	1,335	(97.2)	39	(2.8)	1,374
Not Anaemic	1,283	(99.1)	11	(0.9)	1,294
Total	2,618	(98.2)	50	(1.9)	2,668

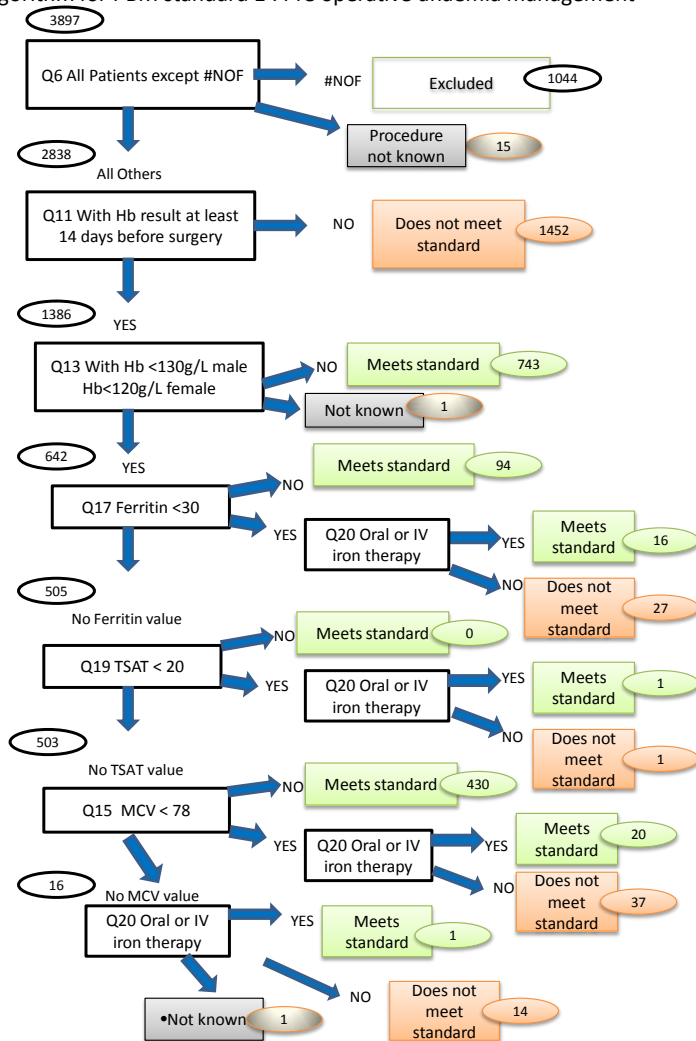


• PBM 1 – Iron Def. Anaemia

- Microcytosis 11%
- Ferritin 15%

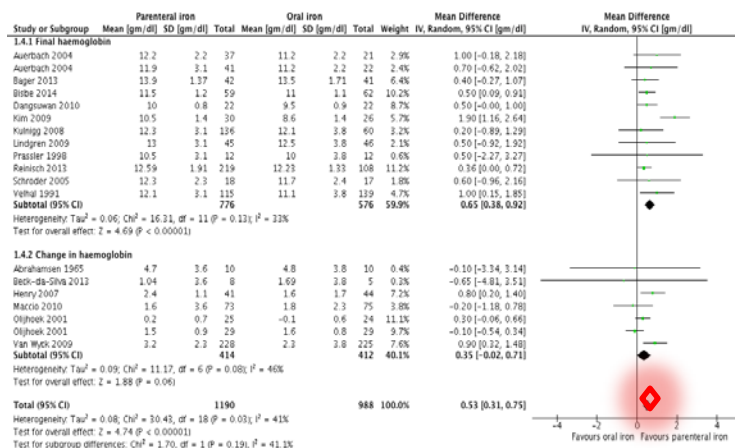


Algorithm for PBM standard 1 : Pre operative anaemia management



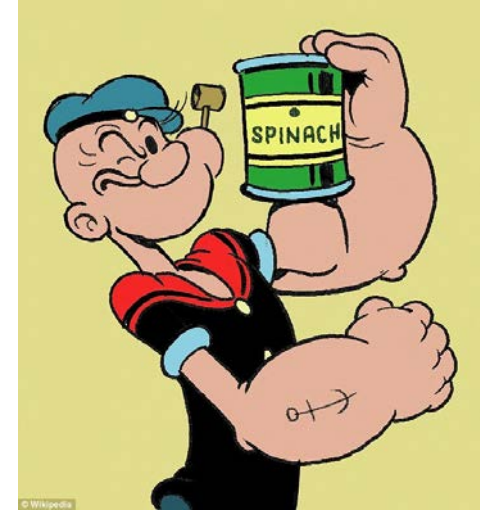
Iron to treat Anaemia

- [Hb] IV iron v oral (MD 0.78 g/dl; 95% CI 0.54 to 1.02)
- IV iron v control (MD 1.37 g/dl; 95% CI 1.20 to 1.53)



- Oral Iron reduced transfusion (RR 0.71; 95% CI 0.54 to 0.94)
- No clinical benefit in QALY
- No clinical benefit in mortality (RR 1.08; 95% CI 0.50 to 2.32)

Preoperative Iron



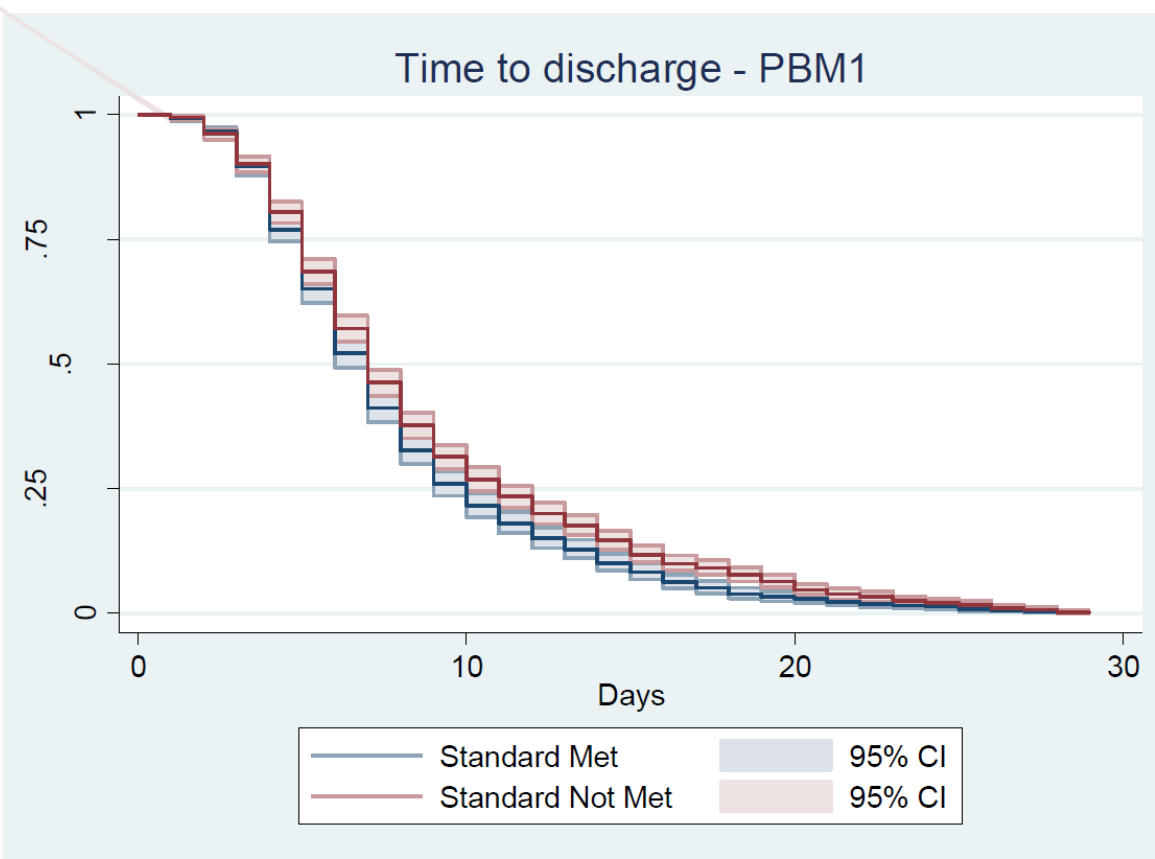
- 18.3% had oral iron

Explanatory Variables	Mean change in haemoglobin	p-value	95% CI
Iron Supplements (IV and/or Oral)	0.22	0.70	(-0.91, 1.35)
Pre-operative anaemic status			(-0.18, -0.14)
Not anaemic	Baseline	<0.0005	
Mild	0.84		(-0.04, 1.71)
Moderate	3.76		(2.86, 4.67)
Severe	20.38		(17.77, 22.98)

- 1% had IV iron (n=27)

Explanatory Variables	Mean change in haemoglobin	p-value	95% CI
Iron Supplements (IV only)	4.62	0.001	(1.30, 7.94)
Pre-assessment anaemic status			(-0.17, -0.14)
Not anaemic	Baseline	<0.0005	
Mild	0.82		(-0.05, 1.69)
Moderate	3.73		(2.84, 4.61)
Severe	20.01		(17.43, 22.59)

PBM 1 – Preop Anaemia Management



- Overall 7% Longer LOS

- LOS anaemia 7 days (5-12)
- LOS non-anaemia 7 days (5-10)

Figure 5- time to discharge, PBM1 by adherence

PREVENTT

Preoperative intravenous iron to treat
anaemia in major surgery



Richards et al. *Trials* (2015) 16:254
DOI 10.1186/s13063-015-0774-2



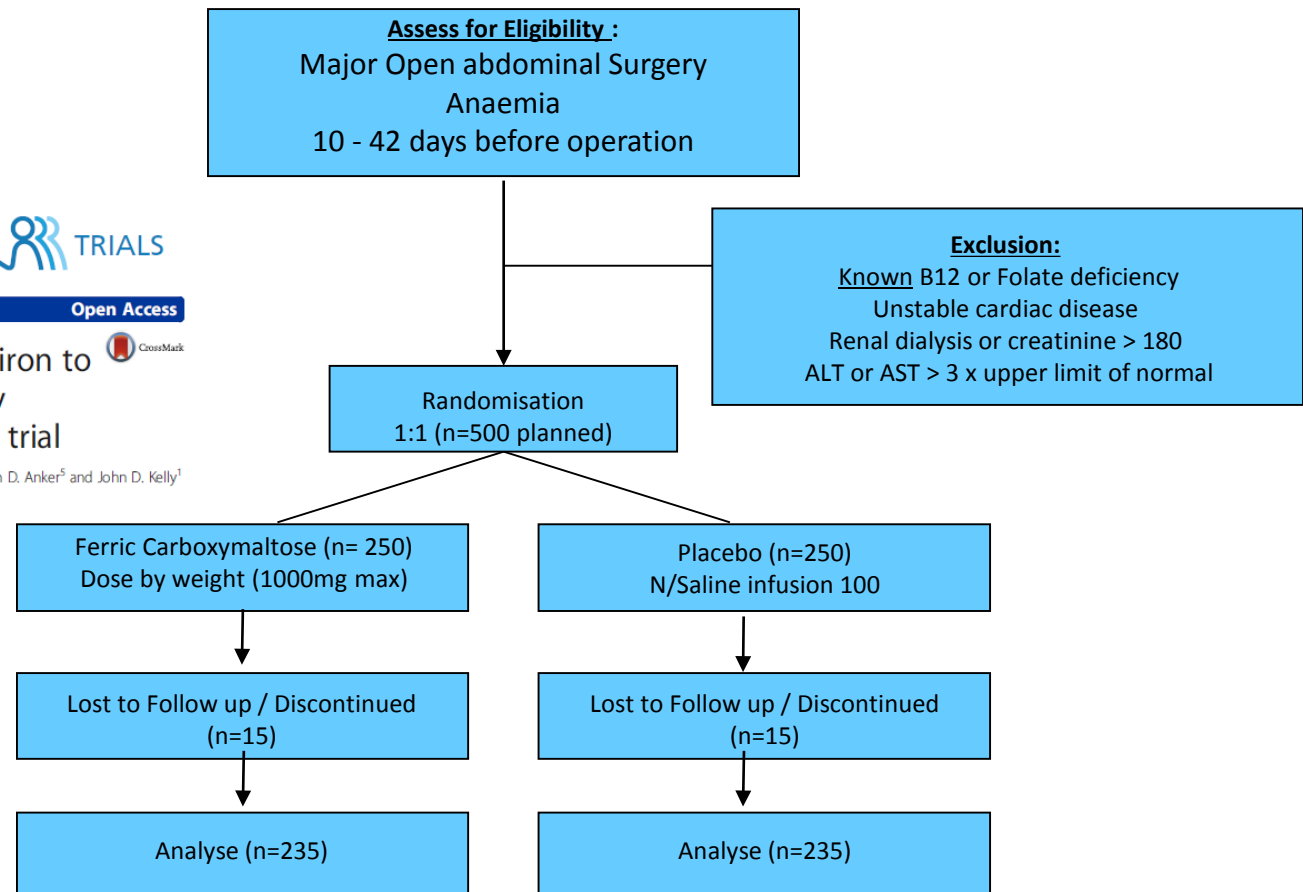
STUDY PROTOCOL

Open Access



PREVENTT: preoperative intravenous iron to
treat anaemia in major surgery: study
protocol for a randomised controlled trial

Toby Richards¹, Ben Clevenger^{1,6*}, Jane Keidan², Tim Collier³, Andrew A. Klein⁴, Stefan D. Anker⁵ and John D. Kelly¹



12th September

Toby Richards
Division of Surgery & Interventional Science
UCL
74 Huntley Street
London
WC1E 6AA

Dear Prof Richards,

Re: PREVENTT trial

Thank you for alerting NICE to the difficulties you are having in recruiting to the PREVENTT trial. I understand that part of the reason for this is a recommendation in NICE's guideline on blood transfusion (NG24) to consider intravenous iron before or after surgery when specific conditions are met.

The recommendation in the guideline was underpinned by 5 RCTs (outcomes ranged from low to very low quality as assessed by GRADE). Also, one health economics paper was included in the systematic review which suggested that IV iron was less costly and more effective than no intervention. The committee's use of 'consider' in the guideline recommendations reflects that there was uncertainty in the evidence base.

NICE recognises the importance of ongoing NIHR research and fully supports the HTA funded PREVENTT clinical trial. NICE encourages centres and Trusts to enrol patients to this trial. NICE regards enrolment into the trial as being compliant with NICE QS 138.

Yours sincerely,



Professor Mark R Baker
Director, NICE Centre for Guidelines

PREVENTT

**Preoperative intravenous iron to treat
anaemia in major surgery**

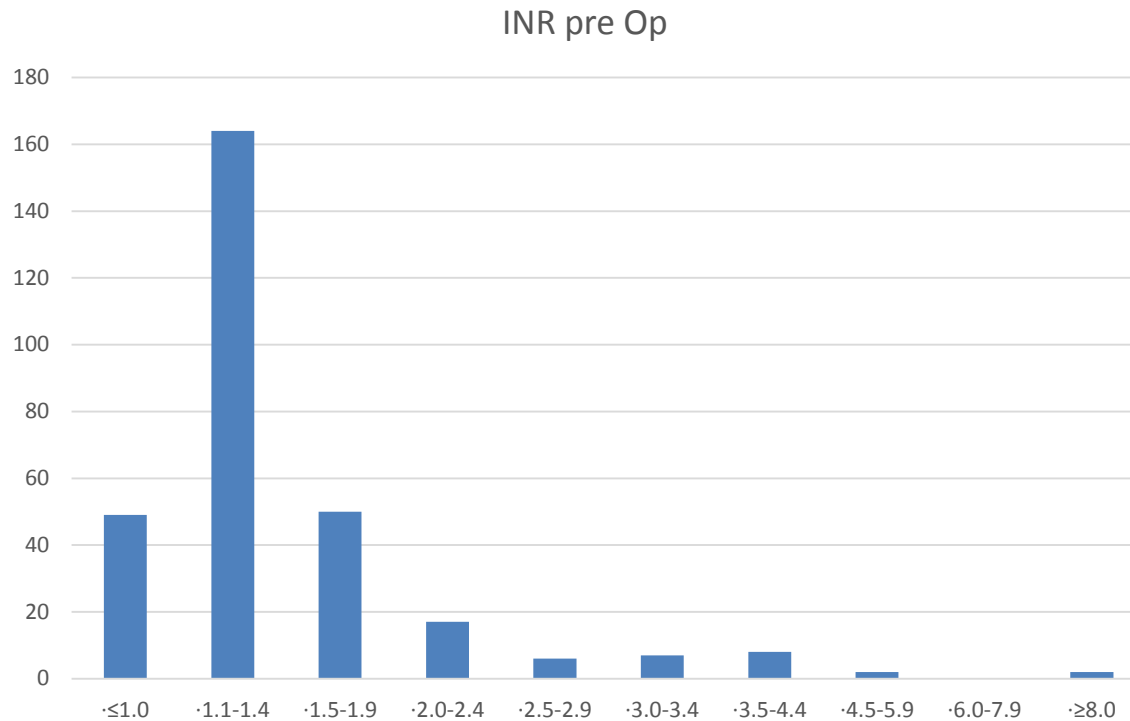
PBM 5: Anti-Coagulation & Anti Platelets

18%	patients	<u>Stopped > 5day Preop</u>
258	anti-coagulant	59%
249	anti-platelet	70%
14	both	

'Whats the bleeding time?'



PBM 5: Anti-Coagulation



INR	
• ≤1.0	49
• 1.1-1.4	164
• 1.5-1.9	50
• 2.0-2.4	17
• 2.5-2.9	6
• 3.0-3.4	7
• 3.5-4.4	8
• 4.5-5.9	2
• 6.0-7.9	-
• ≥8.0	2

Stopping vs. Continuing Aspirin before Coronary Artery Surgery

Paul S. Myles, M.P.H., M.D., Julian A. Smith, F.R.A.C.S., Andrew Forbes, Ph.D.,

N Engl J Med 2016;374:728-37.

DOI: 10.1056/NEJMoa1507688

Copyright © 2016 Massachusetts Medical Society.

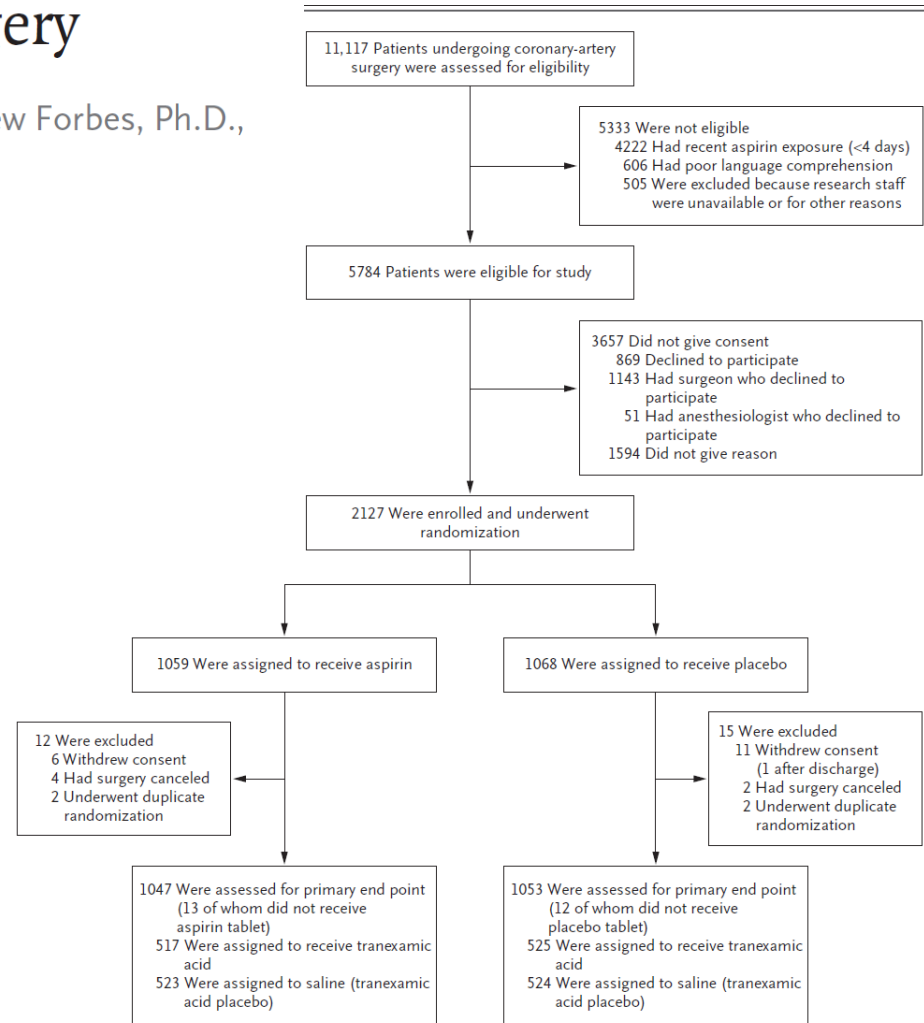
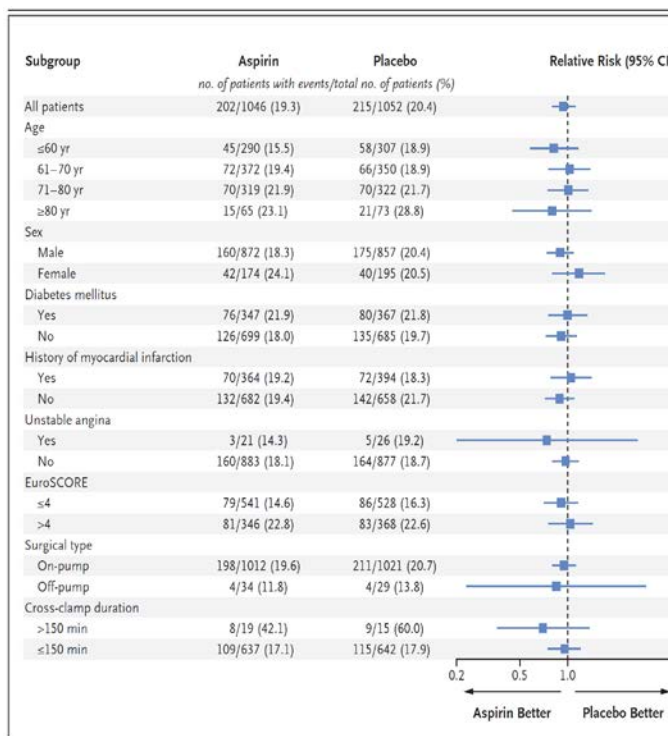


Figure 1. Enrollment, Randomization, and Assessment.

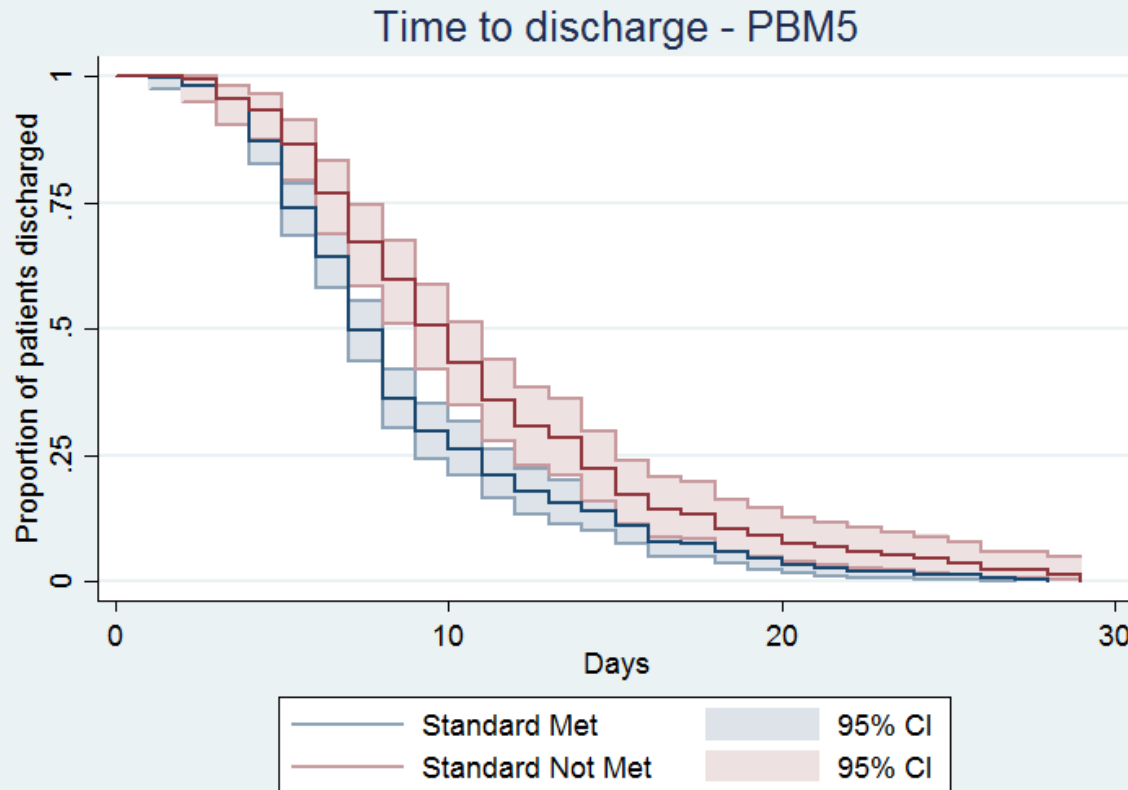
ATACAS TRIAL

Table 2. Outcomes.*

Event	Aspirin (N = 1047)	Placebo (N = 1053)	Risk Ratio (95% CI)	P Value
Primary outcome: death, myocardial infarction, stroke, renal failure, pulmonary embolism, or bowel infarction — no./total no. (%)	202/1046 (19.3)	215/1052 (20.4)	0.94 (0.80–1.12)	0.55
Death	14 (1.3)	9 (0.9)	1.56 (0.68–3.60)	0.30
Myocardial infarction	144 (13.8)	166 (15.8)	0.87 (0.71–1.07)	0.20
Stroke	14 (1.3)	12 (1.1)	1.17 (0.55–2.52)	0.70
Renal failure	49 (4.7)	41 (3.9)	1.20 (0.80–1.80)	0.39
Pulmonary embolism	8 (0.8)	10 (1.0)	0.81 (0.32–2.03)	0.81
Bowel infarction	0	2 (0.2)	—	0.50
Reoperation for hemorrhage — no. (%)	19 (1.8)	22 (2.1)	0.87 (0.47–1.60)	0.75
Cardiac tamponade — no. (%)	11 (1.1)	4 (0.4)	2.77 (0.88–8.66)	0.08
ICU stay — hr				
Initial admission			—	0.61
Median	30	29		
Interquartile range	22–64	21–64		
Total stay, including readmission			—	0.37
Median	36	30		
Interquartile range	22–69	22–67		
Duration of mechanical ventilation — hr			—	0.58
Median	9	9		
Interquartile range	6–16	6–16		
Reintubation during hospital stay — no. (%)	30 (3.5)	28 (3.3)	1.08 (0.65–1.78)	0.79
New episode of peptic ulceration — no. (%)	13 (1.2)	11 (1.0)	1.19 (0.53–2.64)	0.69
Hospital stay — days			—	0.32
Median	7	7		
Interquartile range	6–12	6–11		

* Plus-minus values are means \pm SD. ICU denotes intensive care unit.

PBM 5: Stopping Anti-Coag & Anti-Plt



- Reduced BT

Units of blood transfused				
N	Mean	SD	95% CI	p-value
293	1.62	1.38	1.47, 1.78	0.03
162	2.01	1.96	1.70, 2.31	

- 30% Shorter LOS
P<0.0005 [1.16-1.51]

Intra – Operative PBM 25% BT

- Anti-fibrionlytics 41%
- Cell Salvage 18%
 - Blood Loss 1200 (726-2000) mL
- POC 20%
- (SUT 28%)
 - Pre BT [Hb] 83 (75-97) g/L.
 - Post Bt [Hb] 100 (88=112) g/L

10% > 4 BT

Cell salvage for minimising perioperative allogeneic blood transfusion (Review)

Carless PA, Henry DA, Moxey AJ, O'Connell D, Brown T, Fergusson DA



- 75 trials (n=6025)
 - Reduction BT 0.62 (0.55-0.70)
 - ARR 21%
 - NNT 4.8
 - Allogenic Tx saving 0.68 units pp
 - Ortho 54%
 - Cardiac 23%



Surgical Tips and Tricks



1 L N/saline
5000u Heparin



Should intraoperative cell-salvaged blood be used in patients with suspected or known malignancy?

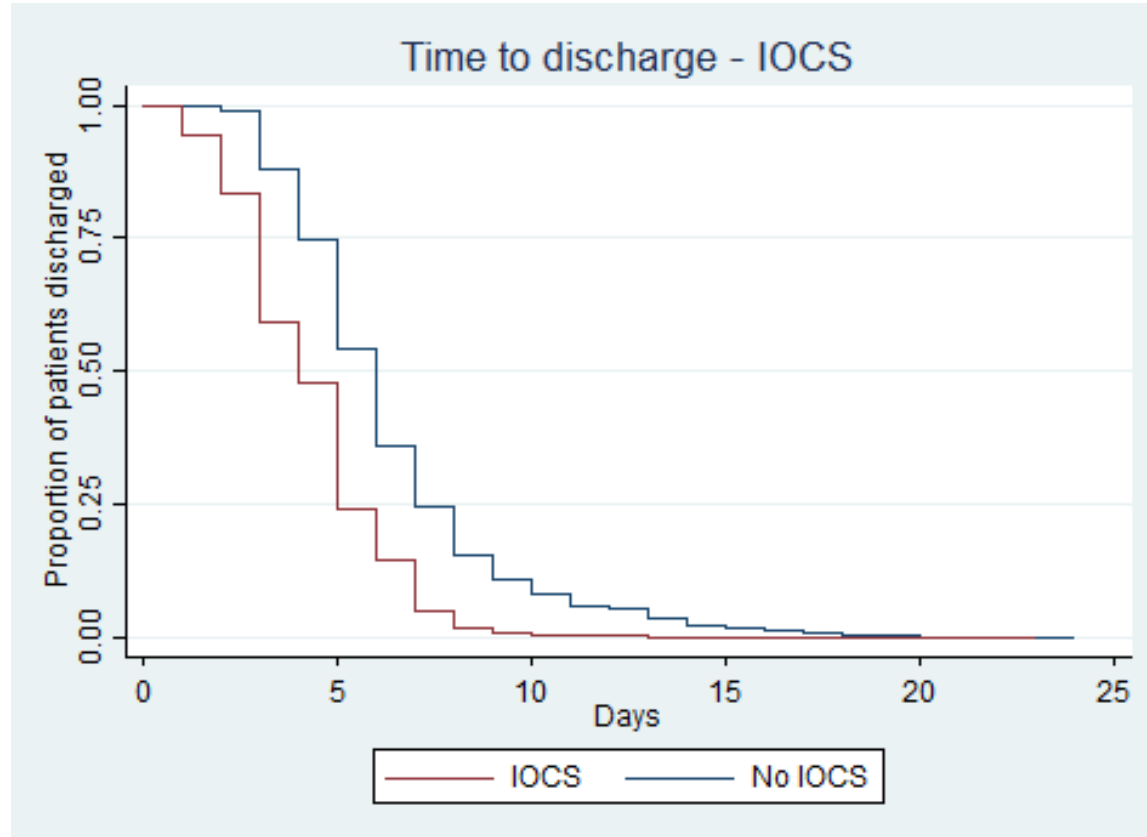
Les cellules sanguines épargnées en peropératoire doivent-elles être réutilisées chez des patients ayant des processus malins connus ou suspectés?

Jacqueline D. Trudeau, MD, PhD · Terrence Waters, MD ·
Kate Chipperfield, MD



Conclusion *Transfusion of autologous blood harvested via ICS should be considered a viable option for reduction or avoidance of allogeneic product during many oncologic surgeries and may be a lifesaving option for those patients who refuse allogeneic blood products.*

PBM 6: IOCS - RESULTS



- 497 (314-719) mls
- Reduced BT
OR 0.58 $p < 0.0005$, C.I. [0.47-0.71]
- Reduced LOS
9.8%, $p = 0.005$, C.I. [3% - 16.2%]
- Orthopaedics LOS
18.9% $P = 0.047$, C.I. [0% - 34.1%]



Intra – Operative PBM

25% BT

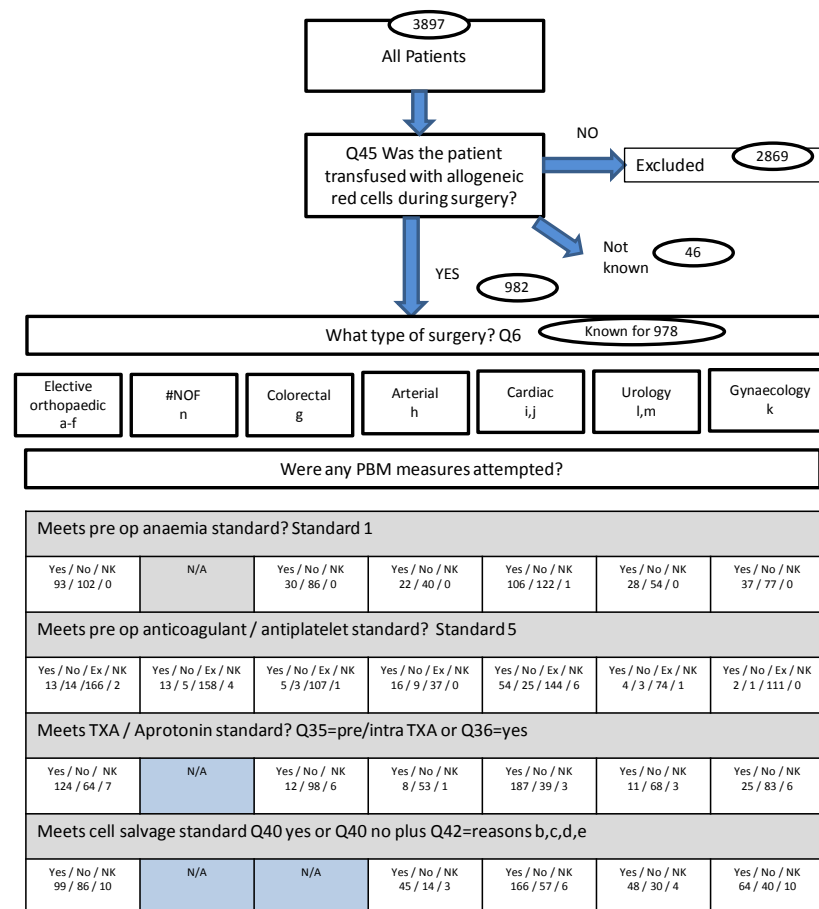
PBM 6: Any PBM
measure before operative BT

83%

PBM 7: All PBM
measure before operative BT

15%

Algorithm for PBM standard 6 :



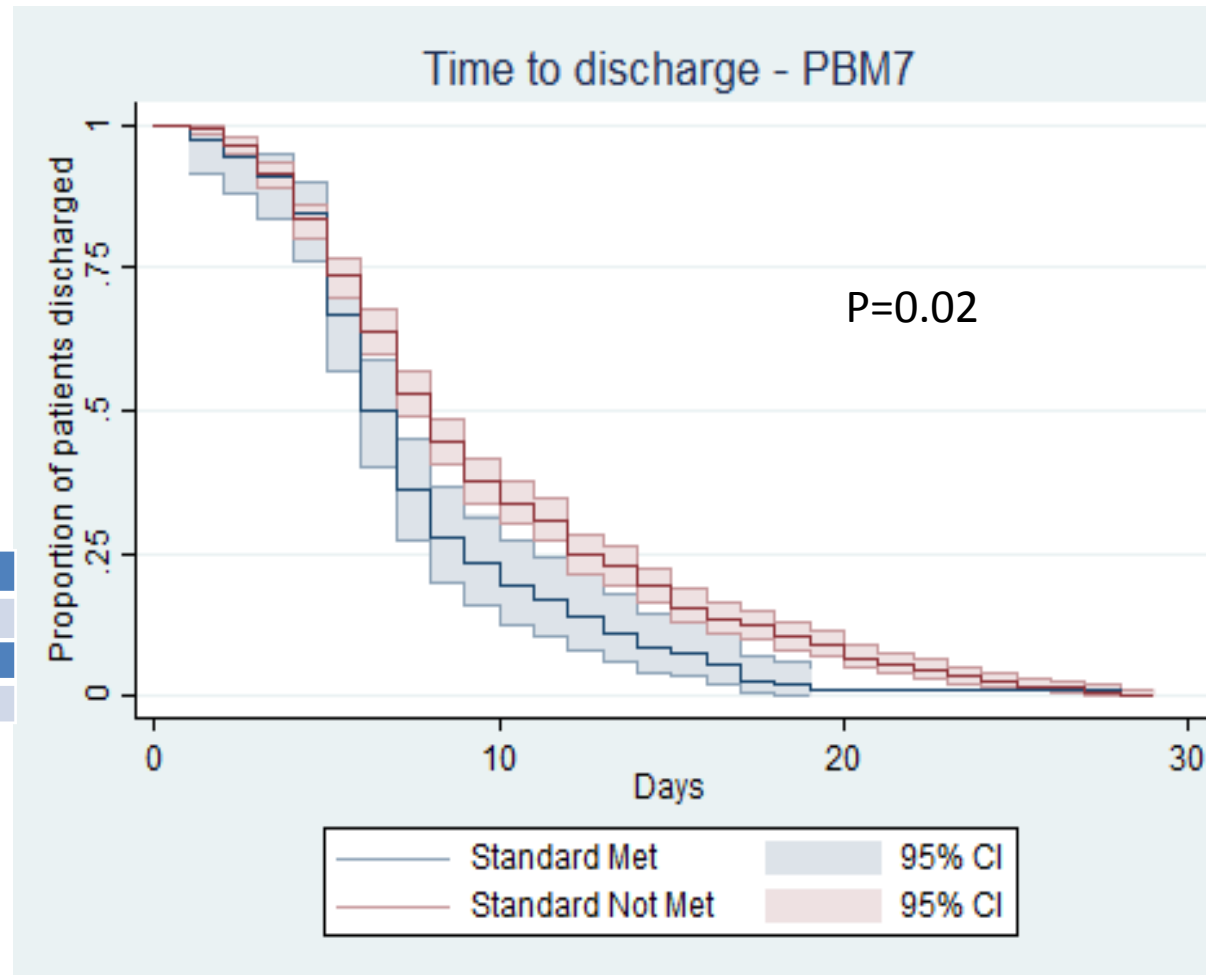
If yes to any (where applicable) standard is met
If no to all (where applicable) standard is not met

Intra – Operative PBM

25% BT

- Anti-fibrionlytics
- Cell Salvage
- POC

Units of blood transfused				
N	Mean	SD	95% CI	p-value
293	1.62	1.38	1.47, 1.78	0.03
162	2.01	1.96	1.70, 2.31	



Post Operative PBM BT-75%

- [Hb] 92 (84-103) g/L

- SUT 41% (673)

Units of blood transfused				
N	Mean	SD	95% CI	p-value
27	2.52	1.22	2.04, 3.00	<0.01
102	3.38	1.70	3.05, 3.72	

- Iron 17% (460)

- PBM 8/9 – confounded by bleeding



Surgical PBM

Pre OP

Anaemia Rx

Warfarin

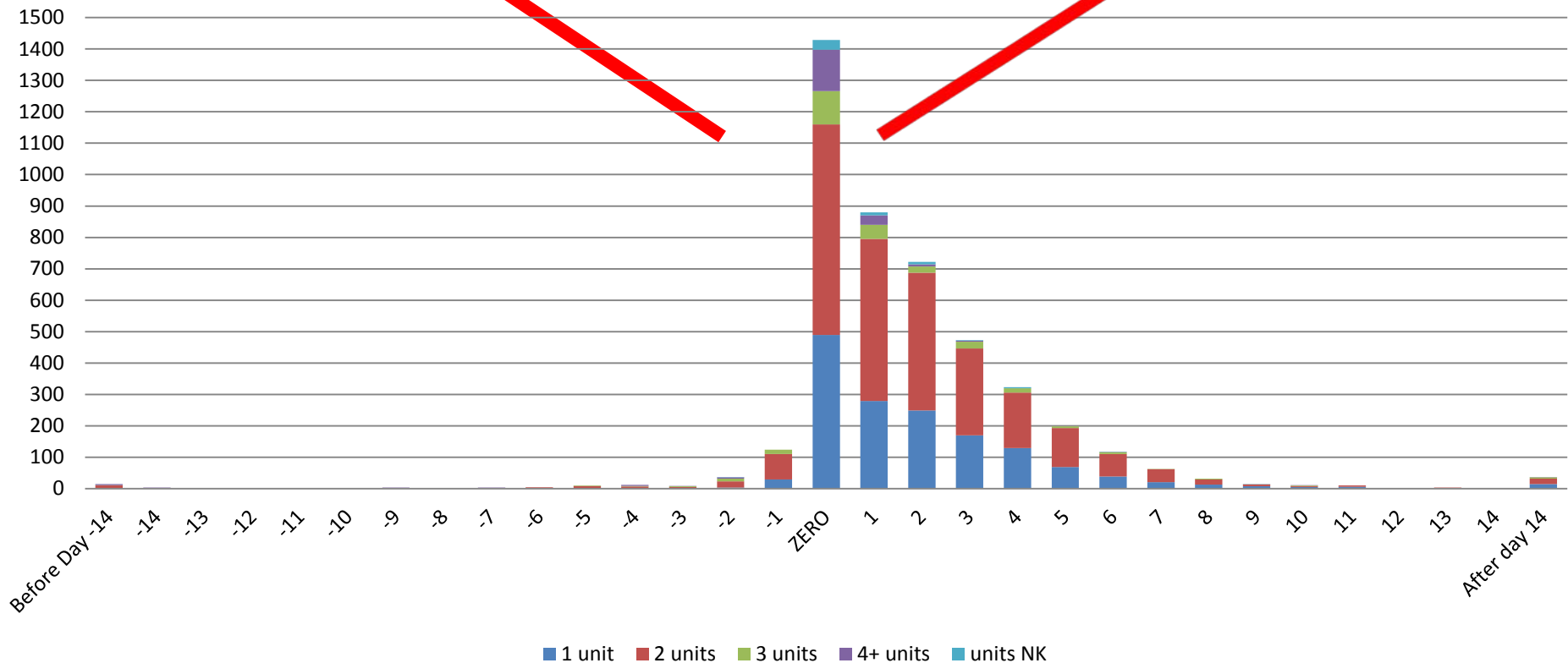
Anti Plts

OP

Cell Salvage

Tranexamic acid

POC



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

2 APRIL 2015 | VOL 520 | NATURE |

**“WEANING DOCTORS OFF
THEIR LOVE AFFAIR WITH
BLOOD IS GOING TO BE
HARDER THAN WE THINK.”**

DOCTOR'S ORDERS

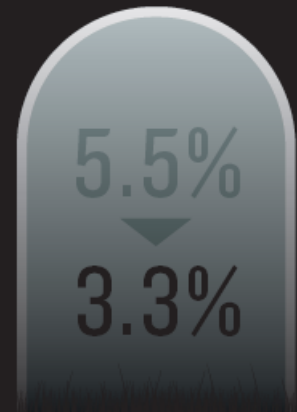
By simply reminding doctors of the current guidelines when they order blood, a California hospital was able to save money and lives.



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%.

		N	Crude difference in Length of stay	Adjusted difference in length of stay	p-value	95% CI
PBM1	Standard met	1259	Baseline			
	Standard not met	1449	1.11	1.07	0.01	1.02, 1.12
PBM2	Standard met	18	Baseline			
	Standard not met	94	1.13	1.03	0.88	0.70, 1.51
PBM3	Standard met	3	Baseline			
	Standard not met	116	2.51	0.48	0.09	0.21, 1.12
PBM4	Standard met	23	Baseline			
	Standard not met	94	0.85	0.93	0.67	0.65, 1.33
PBM5	Standard met	280	Baseline			
	Standard not met	148	1.33	1.31	<0.01	1.14, 1.49
PBM6	Standard met	616	Baseline			
	Standard not met	119	1.02	0.99	0.92	0.85, 1.15
PBM7	Standard met	115	Baseline			
	Standard not met	631	1.17	1.18	0.02	1.03, 1.35
PBM8	Standard met	492	Baseline			
	Standard not met	1390	0.89	0.88	<0.01	0.83, 0.94
PBM9	Standard met	642	Baseline			
	Standard not met	952	0.93	1.03	0.45	0.96, 1.09
PBM10	Standard met	1623	Baseline			
	Standard not met	262	1.14	1.06	0.21	0.97, 1.15
PBM11	Standard met	136	Baseline			
	Standard not met	1802	0.93	1.07	0.21	0.96, 1.20

		N	Crude difference in Length of stay	Adjusted difference in length of stay	p-value	95% CI
PBM1	Standard met	1259	Baseline			
	Standard not met	1449	1.11	1.07	0.01	1.02, 1.12
PBM2	Standard met	18	Baseline			
	Standard not met	94	1.13	1.03	0.88	0.70, 1.51
PBM3	Standard met	3	Baseline			
	Standard not met	116	2.51	0.48	0.09	0.21, 1.12
PBM4	Standard met	23	Baseline			
	Standard not met	94	0.85	0.93	0.67	0.65, 1.33
PBM5	Standard met	280	Baseline			
	Standard not met	148	1.33	1.31	<0.01	1.14, 1.49
PBM6	Standard met	616	Baseline			
	Standard not met	119	1.02	0.99	0.92	0.85, 1.15
PBM7	Standard met	115	Baseline			
	Standard not met	631	1.17	1.18	0.02	1.03, 1.35
PBM8	Standard met	492	Baseline			
	Standard not met	1390	0.89	0.88	<0.01	0.83, 0.94
PBM9	Standard met	642	Baseline			
	Standard not met	952	0.93	1.03	0.45	0.96, 1.09
PBM10	Standard met	1623	Baseline			
	Standard not met	262	1.14	1.06	0.21	0.97, 1.15
PBM11	Standard met	136	Baseline			
	Standard not met	1802	0.93	1.07	0.21	0.96, 1.20

Conclusions NHSBT PBM Audit

- Quick wins: -

- PBM 5 Stop Anticoag / Antiplt 31%
- PBM 7 IntraOP PBM - IOCS 18%
- PBM 1 Management Anaemia 7%

- **THESE WORK** - Thank you for your hard work