Patient Blood Management
Are you providing this?

Jeannie Callum, BA, MD, FRCPC

Associate Professor, University of Toronto

Disclosures

- **Relevant relationships with commercial entities:**
  - Octapharma, CSL Behring = cardiac and trauma trials
  - Canadian Blood Services = trial funding
- **Potential for conflicts within this presentation:**
  - RBC use
- **Steps taken to review and mitigate potential bias:**
  - Advocating using less of CBS' and HQ's products!

Objectives

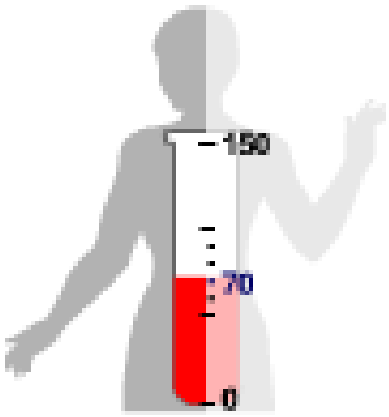
1) **What is patient blood management?**
2) Is blood really that bad for you?
3) Does PBM save money?
4) Does PBM improve outcomes?
5) Is this an expectation of your hospital?

PBM is not just…

Epo and iv iron before surgery to correct anemia

What is PBM?

A multifaceted approach designed so that transfusion is unnecessary



Not just elective surgery!

- Trauma patients
  - Tranexamic acid reduces death rate
  - If given appropriately = 100,000 preventable deaths
- Cancer patients
  - iv iron reduces transfusion rate when added to ESAs (Cochrane review 2016; Mhaskar et al)
- Pregnancy
  - Oral iron decreases the risk of anemia at delivery
- GI hemorrhage
  - Tranexamic acid, restrictive blood use, OGD, PPIs
  - 15% of blood is used for GI bleeds

Oral Fe in pregnancy prevents anemia

Milman N, et al. Acta Obstet Gyn Scand 2005; 84: 238-247.

- *60 mg of elemental iron (on an empty stomach) is enough*
  - 427 women randomized to 20 mg, 40 mg, 60mg, 80 mg from 18 weeks to delivery

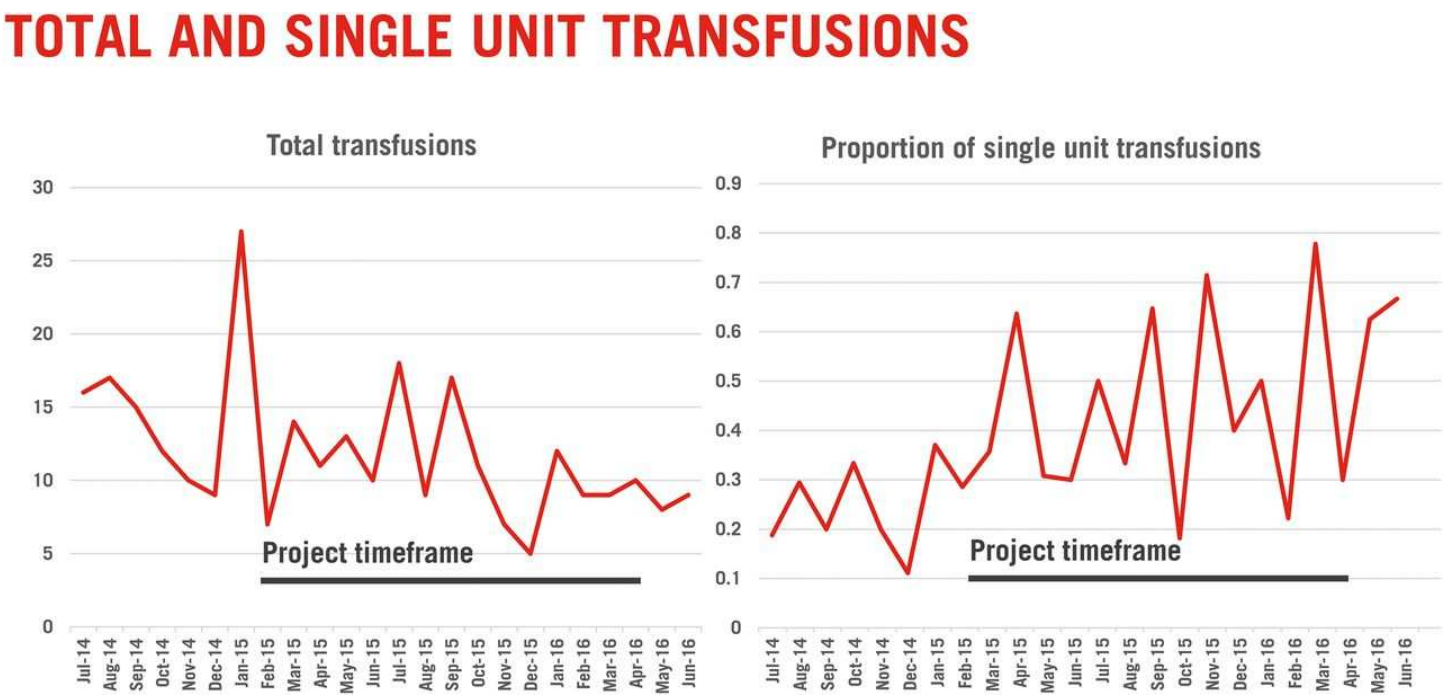
Dose	Iron Deficiency	IDA
20	29%	10%
40	11%	5%
60	10%	0%
80	9%	1.5%

Gluconate

Sulfate

Anemia management in pregnancy

- CBC, ferritin at 12 weeks; iron treatment (po or iv as needed); restrictive single unit tx



Flores C, et al. BMJ Qual Improv Rep. 2017 Jun 23;6(1):e000009.

Analysis 1.1. Comparison 1 Tranexamic acid vs placebo, Outcome 1 Mortality.

Review: Tranexamic acid for upper gastrointestinal bleeding

Comparison: 1 Tranexamic acid vs placebo

Outcome: 1 Mortality

MORTALITY!

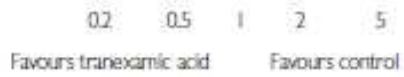
Study or subgroup	Tranexamic acid n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Bagnenko 2011	1/22	3/25		2.9 %	0.38 [0.04, 3.38]
Barer 1983	16/256	35/260		42.7 %	0.46 [0.26, 0.82]
Bergqvist 1980	3/25	5/25		7.9 %	0.60 [0.16, 2.25]
Biggs 1976	2/103	4/97		4.9 %	0.47 [0.09, 2.51]
Cormack 1973	3/76	3/74		5.6 %	0.97 [0.20, 4.67]
Engquist 1979	11/102	12/102		23.0 %	0.92 [0.42, 1.98]
Hawkey 2001	4/103	5/103		8.3 %	0.80 [0.22, 2.89]
Holstein 1987	2/164	4/164		4.8 %	0.50 [0.09, 2.69]
Total (95% CI)	**851**	**850**		**100.0 %**	**0.60 [0.42, 0.87]**

Total events: 42 (Tranexamic acid), 71 (Control)

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 2.81$, $df = 7$ ($P = 0.90$); $I^2 = 0.0\%$

Test for overall effect: $Z = 2.68$ ($P = 0.0073$)

Test for subgroup differences: Not applicable



Cochrane Review, Bennett et al, 2014

HALT-IT
Upper or Lower GI bleeding
1 + 3 gram TXA
Mortality endpoint

7768 of 8000 patients

32 to go!

It should not include

- Pre-operative autologous donation
- Directed blood donations
- Acute normovolemic hemodilution

8 **Don’t routinely order perioperative autologous and directed blood collection.**

Choosing Wisely Canada™
In partnership with the Canadian Medical Association

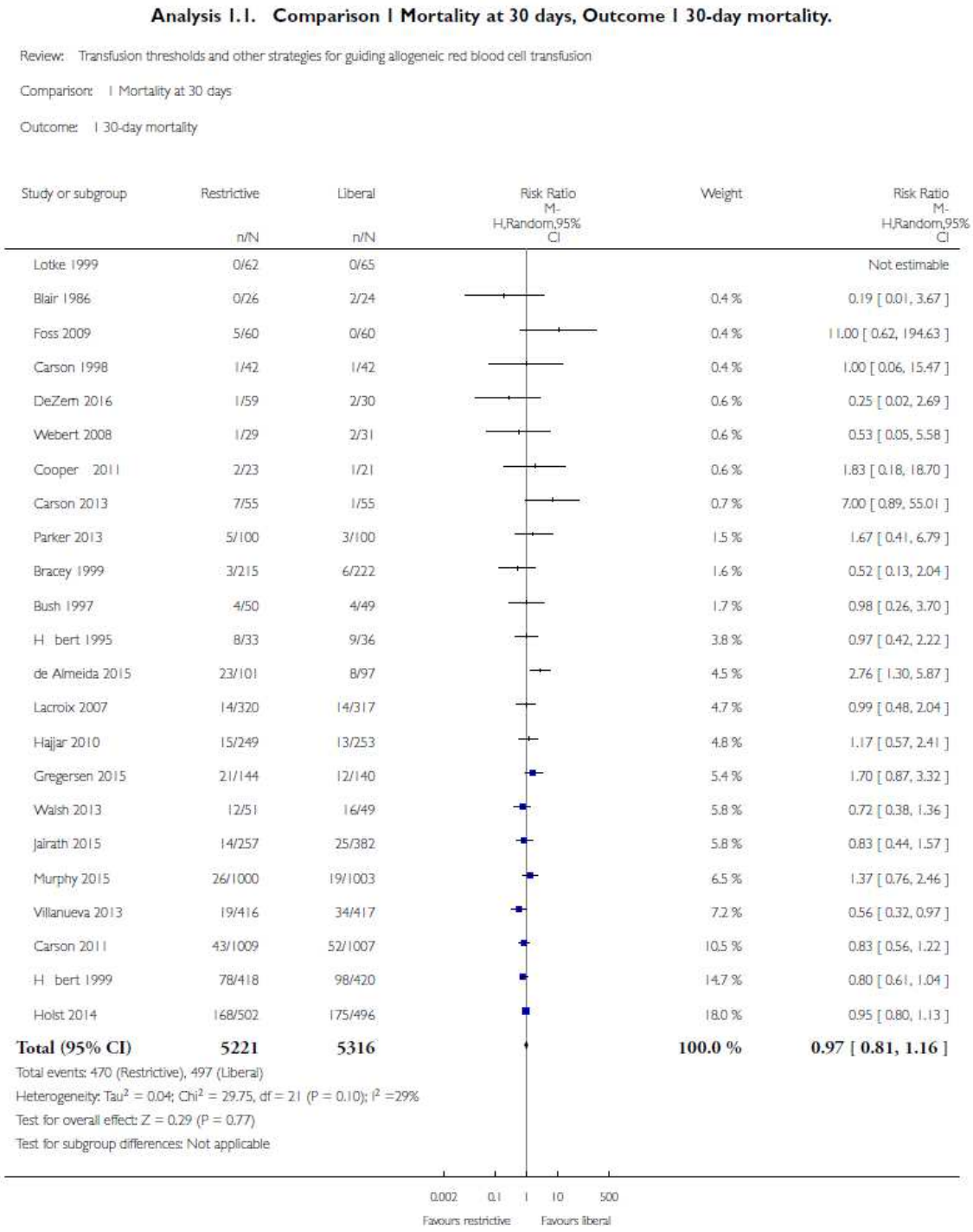
Objectives

1) What is patient blood management?
2) **Is blood really that bad for you?**
3) Does PBM save money?
4) Does PBM improve outcomes?
5) Is this an expectation of your hospital?

Is liberal use of blood bad for you? MAYBE

Outcome	N	RR	Range	NNT
Mortality	2364	0.80	0.65-0.98	33
Acute CS	1727	0.44	0.22-0.89	50
CHF	2364	0.48	0.33-0.73	33
Rebleeding	889	0.64	0.45-0.90	17
Bacterial	2364	0.86	0.73-1.00	33
Transfusion	2364	0.57	0.46-0.70	2

The American Journal of Medicine (2014) 127, 124-131



A restrictive strategy reduces the risk of transfusion by OR=0·57

No improvement in mortality with liberal use of blood

No difference for any subgroups

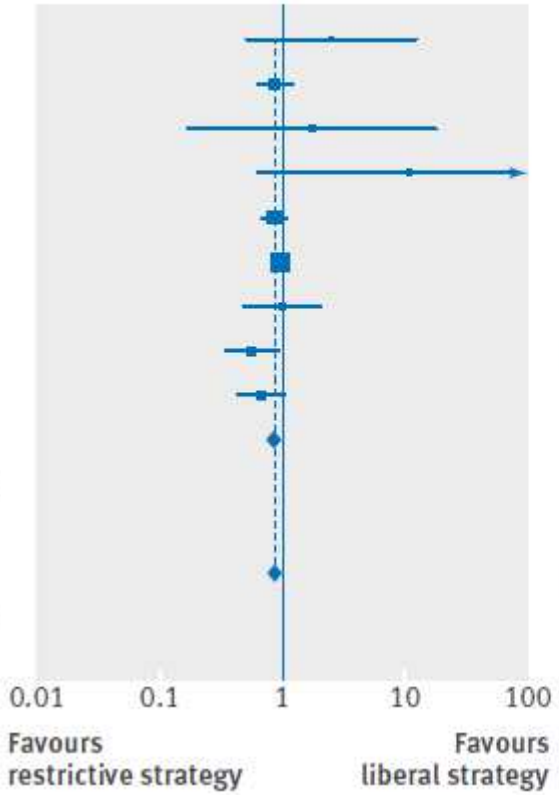
OR 0.97 (0.81-1.16)

Carson et al. Cochrane Database 2016 Oct 12

BMJ 2015;350:h1354

Relative risk 0.86 (low risk of bias)
NNT 53 (to prevent 1 death)

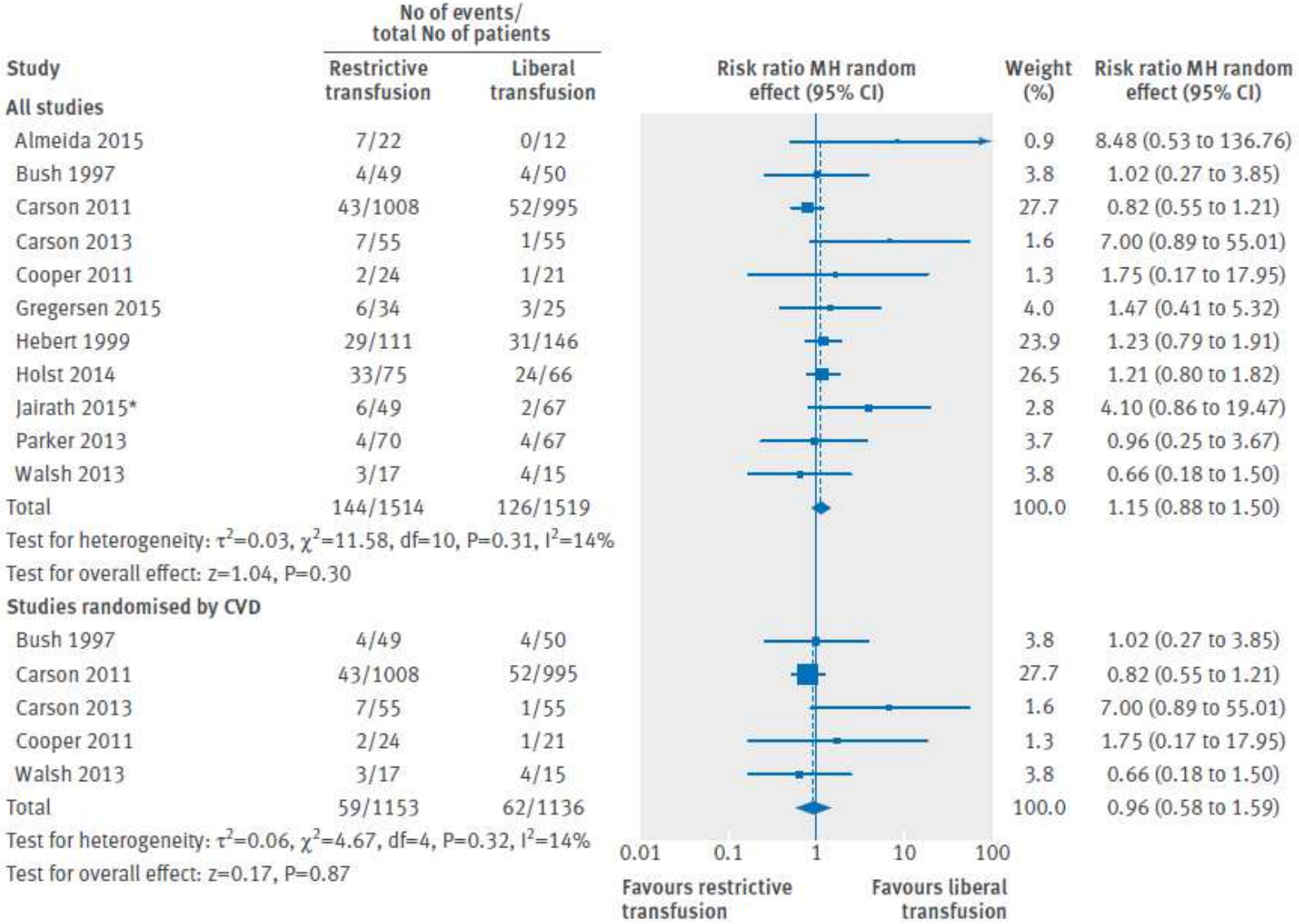
Study or subgroup	No of events/total: Restrictive transfusion	No of events/total: Liberal transfusion	Risk ratio M-H to random (95% CI)	Weight (%)	Risk ratio M-H to random (95% CI)
1.2.1 Low risk of bias					
Carson 1998[32]	5/42	2/42		1.0	2.50 (0.51 to 12.17)
Carson 2011[25]	66/1001	76/998		16.5	0.87 (0.63 to 1.19)
Cooper 2011[71]	2/24	1/21		0.5	1.75 (0.17 to 17.95)
Foss 2009[28]	5/60	0/60		0.3	11.00 (0.62 to 194.63)
Hébert 1999[4]	95/416	111/419		23.2	0.86 (0.68 to 1.09)
Holst 2014[9]	216/502	223/496		35.2	0.96 (0.83 to 1.10)
Lacroix 2007[5]	14/320	14/317		4.4	0.99 (0.48 to 2.04)
Villanueva 2013[6]	23/444	41/445		8.5	0.56 (0.34 to 0.92)
Walsh 2013[10]	19/51	27/49		10.4	0.68 (0.44 to 1.05)
Subtotal	445/2860	495/2847		100.0	0.86 (0.74 to 1.01)
Test for heterogeneity: τ^2=0.01, χ^2=10.96, df=8, P=0.20, I^2=27%					
Test for overall effect: z=1.79, P=0.07					
Total (95% CI)	445/2860	495/2847		100.0	0.86 (0.74 to 1.01)
Test for heterogeneity: τ^2=0.01, χ^2=10.96, df=8, P=0.20, I^2=27%					
Test for overall effect: z=1.79, P=0.07					
Test for subgroup differences: not applicable					



BMJ 2016;352:i1351

Restrictive use may not be as beneficial to CVD patients?

But not harmful!

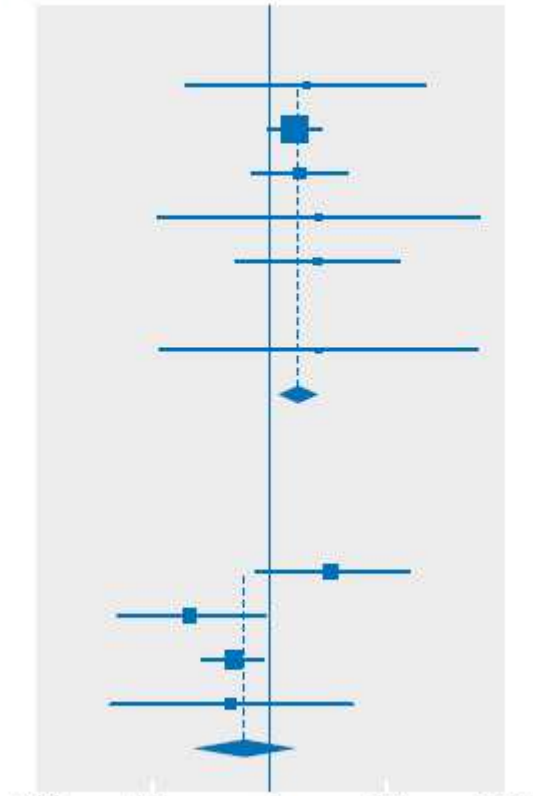


Study	No of events/ total No of patients: Restrictive transfusion	Liberal transfusion	Weight (%)	Risk ratio MH random effect (95% CI)
All studies				
Almeida 2015	7/22	0/12	0.9	8.48 (0.53 to 136.76)
Bush 1997	4/49	4/50	3.8	1.02 (0.27 to 3.85)
Carson 2011	43/1008	52/995	27.7	0.82 (0.55 to 1.21)
Carson 2013	7/55	1/55	1.6	7.00 (0.89 to 55.01)
Cooper 2011	2/24	1/21	1.3	1.75 (0.17 to 17.95)
Gregersen 2015	6/34	3/25	4.0	1.47 (0.41 to 5.32)
Hebert 1999	29/111	31/146	23.9	1.23 (0.79 to 1.91)
Holst 2014	33/75	24/66	26.5	1.21 (0.80 to 1.82)
Jairath 2015*	6/49	2/67	2.8	4.10 (0.86 to 19.47)
Parker 2013	4/70	4/67	3.7	0.96 (0.25 to 3.67)
Walsh 2013	3/17	4/15	3.8	0.66 (0.18 to 1.50)
Total	144/1514	126/1519	100.0	1.15 (0.88 to 1.50)
Test for heterogeneity: τ^2=0.03, χ^2=11.58, df=10, P=0.31, I^2=14%				
Test for overall effect: z=1.04, P=0.30				
Studies randomised by CVD				
Bush 1997	4/49	4/50	3.8	1.02 (0.27 to 3.85)
Carson 2011	43/1008	52/995	27.7	0.82 (0.55 to 1.21)
Carson 2013	7/55	1/55	1.6	7.00 (0.89 to 55.01)
Cooper 2011	2/24	1/21	1.3	1.75 (0.17 to 17.95)
Walsh 2013	3/17	4/15	3.8	0.66 (0.18 to 1.50)
Total	59/1153	62/1136	100.0	0.96 (0.58 to 1.59)
Test for heterogeneity: τ^2=0.06, χ^2=4.67, df=4, P=0.32, I^2=14%				
Test for overall effect: z=0.17, P=0.87				

BMJ 2016;352:i1351

More MI, less TACO

Study	No of events/ total No of patients: Restrictive transfusion	Liberal transfusion	Risk ratio MH random effect (95% CI)	Weight (%)	Risk ratio MH random effect (95% CI)
Myocardial infarction, acute coronary syndrome, cardiac arrest					
Almeida 2015	0/22	0/12			Not estimable
Bush 1997	2/49	1/59		3.4	2.04 (0.19 to 21.79)
Carson 2011	38/1008	23/1005		72.5	1.65 (0.99 to 2.74)
Carson 2013	11/54	6/54		22.3	1.83 (0.73 to 4.60)
Cooper 2011	1/24	0/21		1.9	2.64 (0.11 to 61.54)
Holst 2014	6/75	2/66		0.0	2.64 (0.55 to 12.64)
Parker 2013	0/70	0/67			Not estimable
Walsh 2013	1/17	0/15		0.0	2.67 (0.12 to 60.93)
Total	59/1319	32/1290		100.0	1.78 (1.18 to 2.70)
Test for heterogeneity: τ^2=0.00, χ^2=0.47, df=5, P=0.99, I^2=0%					
Test for overall effect: z=2.43, P=0.01					
Acute pulmonary oedema					
Carson 2013	7/55	2/55		23.0	3.50 (0.76 to 16.11)
Cooper 2011	2/24	8/21		24.3	0.22 (0.05 to 0.92)
Hebert 1999	14/160	35/197		39.1	0.49 (0.27 to 0.88)
Parker 2013	1/70	2/67		13.6	0.48 (0.04 to 5.16)
Total	24/309	47/340		100.0	0.63 (0.22 to 1.81)
Test for heterogeneity: τ^2=0.65, χ^2=7.42, df=3, P=0.06, I^2=60%					
Test for overall effect: z=0.86, P=0.39					



Is liberal transfusion harmful?

- Probably YES
  - NNT to prevent 1 death = 53 patients
- Disclosure: We really don't have a clue about how to transfuse different populations with CVD (ACS, previous MI, PVD, stroke, etc)
  - MINT Study enrolling patients!
- If transfusion is really killing patients, we don't have a clue as to how
  - My money is riding on TACO

TACO incidence (perioperative)

- The electronic algorithm identified 510 (12.5%) of 4,070 patients as having a high probability of TACO
- Dual review showed that 176 (34.5%) of these 510 patients had experienced TACO
- Rate of 4.3% (95% CI, 3.7 to 5.0%)
- Odds ratio of death for TACO cases compared with transfused controls of 3.8 (95% CI, 2.2 to 6.7) ($P<0.001$)

Leanne Clifford et al. Anesthesiology. 2015 January ; 122(1): 21–28.

If my calculations are correct:

2000 patients die in Canada annually because of our failure to enforce restrictive transfusion guidelines

(0.5 M * 0.22 ÷ 53)

(Patients transfused X percent inappropriate ÷ NNT to prevent 1 death)

5 Airbus 330 crashes per year in Canada

Objectives

1) What is patient blood management?
2) Is blood really that bad for you?
3) **Does PBM save money?**
4) Does PBM improve outcomes?
5) Is this an expectation of your hospital?

About $1200/patient
Certainly: IT DOES NOT COST MORE

	PBM	Matched controls	P value
Total Charges*	14,046	15,634	0.09
Range	(8,685-27,687)	(8,646-33,657)	
Direct Costs	5,666	6,912	0.02
Range	(3,479-11,798)	(3,565-15,045)	

* Includes indirect costs (hospital overhead)

TRANSFUSION 2014;54:2668-2677.

Tranexamic acid for knee replacement

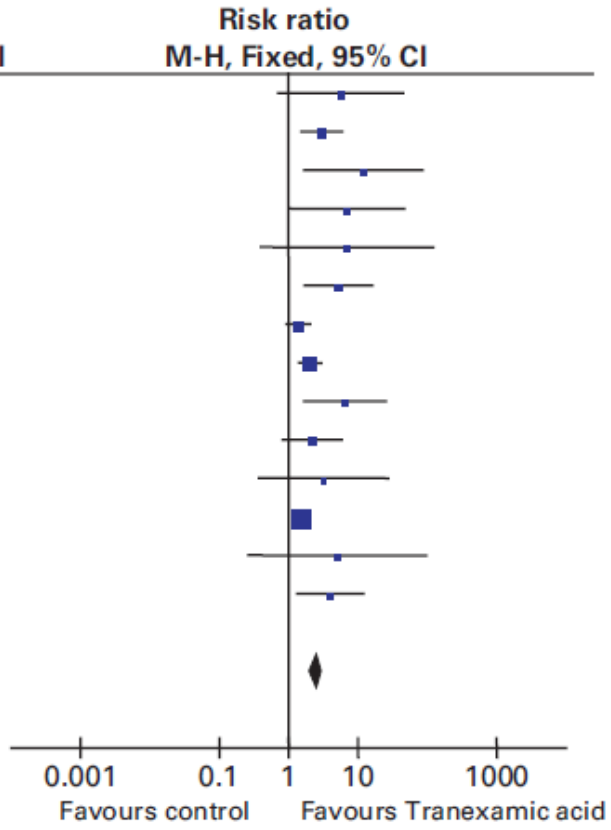
NNT = 4

Put $40 dollars in and get $1000 out

Study or Subgroup	Control Events	Control Total	Tranexamic acid Events	Tranexamic acid Total	Weight	Risk ratio M-H, Fixed, 95% CI
Alvarez[25]	6	49	1	46	1.3%	5.63 [0.70, 45.01]
Benoni[26]	24	43	8	43	10.3%	3.00 [1.52, 5.92]
Camarasa[27]	23	68	1	35	1.7%	11.84 [1.67, 84.06]
Ellis[21]	7	10	1	10	1.3%	7.00 [1.04, 46.95]
Engel[28]	3	12	0	12	0.6%	7.00 [0.40, 122.44]
Good[22]	14	24	3	27	3.6%	5.25 [1.71, 16.08]
Hiippala[29]	12	13	10	15	12.0%	1.38 [0.94, 2.05]
Hiippala[3]	34	38	17	39	21.6%	2.05 [1.41, 2.98]
Jansen[30]	13	21	2	21	2.6%	6.50 [1.67, 25.33]
Molloy[24]	11	50	5	50	6.4%	2.20 [0.82, 5.87]
Orpen[31]	3	14	1	15	1.2%	3.21 [0.38, 27.40]
Tanaka[32]	26	26	47	73	32.7%	1.53 [1.28, 1.83]
Veien[33]	2	15	0	15	0.6%	5.00 [0.26, 96.13]
Zohar[18]	12	20	3	20	3.9%	4.00 [1.33, 12.05]
Total (95% CI)		**403**		**421**	**100.0%**	**2.56 [2.10, 3.11]**
Total events	190		99			

Heterogeneity: $Chi^2 = 51.97$, $df = 13$ ($P < 0.00001$); $I^2 = 75\%$

Test for overall effect: $Z = 9.44$ ($P < 0.00001$)



J Bone Joint Surg Br 2011;93-B:1577–85.

Without causing DVTs

Study or Subgroup	Tranexamic acid Events	Total	Control Events	Total	Weight	Risk difference M-H, Fixed, 95% CI
Kakar[35]	0	12	0	12	3.1%	0.00 [-0.15, 0.15]
Engel[28]	2	12	0	12	3.1%	0.17 [-0.07, 0.41]
Hiippala[29]	0	15	1	13	3.6%	-0.08 [-0.26, 0.11]
Orpen[31]	0	15	0	14	3.8%	0.00 [-0.12, 0.12]
Jansen[30]	0	21	2	21	5.5%	-0.10 [-0.24, 0.05]
Ido[23]	0	21	0	22	5.6%	0.00 [-0.09, 0.09]
Good[23]	2	27	2	24	6.6%	-0.01 [-0.16, 0.14]
Tanaka[32]	34	73	12	26	10.0%	0.00 [-0.22, 0.23]
Hiippala[3]	2	39	2	38	10.0%	-0.00 [-0.10, 0.10]
Benoni[26]	4	43	3	43	11.2%	0.02 [-0.09, 0.14]
Camarasa[27]	0	35	0	68	12.0%	0.00 [-0.04, 0.04]
Alvarez[25]	0	46	0	49	12.4%	0.00 [-0.04, 0.04]
Molloy[24]	0	50	0	50	13.0%	0.00 [-0.04, 0.04]
Total (95% CI)		**409**		**392**	**100.0%**	**-0.00 [-0.04, 0.03]**
Total events	44		22			

Heterogeneity: $Chi^2 = 4.34$, $df = 12$ ($P = 0.98$); $I^2 = 0\%$
Test for overall effect: $Z = 0.03$ ($P = 0.98$)

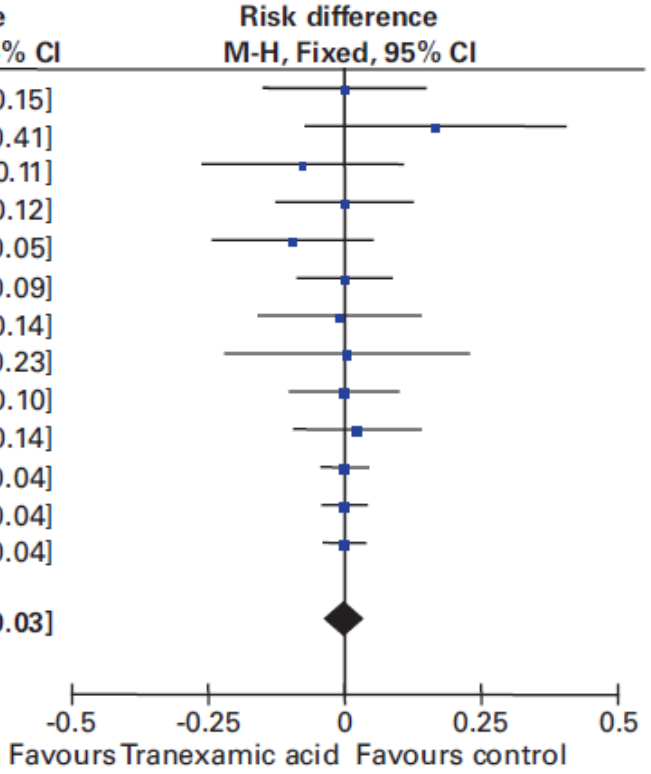


Fig. 6

Trials of tranexamic acid (TXA) *vs* placebo: forest plot of deep-vein thrombosis (DVT) rate. In 13 trials the use of TXA was not associated with an increased risk of DVT ($p = 0.98$). There was no evidence of heterogeneity between trials (Q; $p = 0.98$; $I^2 = 0\%$) (M-H, Mantel-Haenszel; CI, confidence interval).

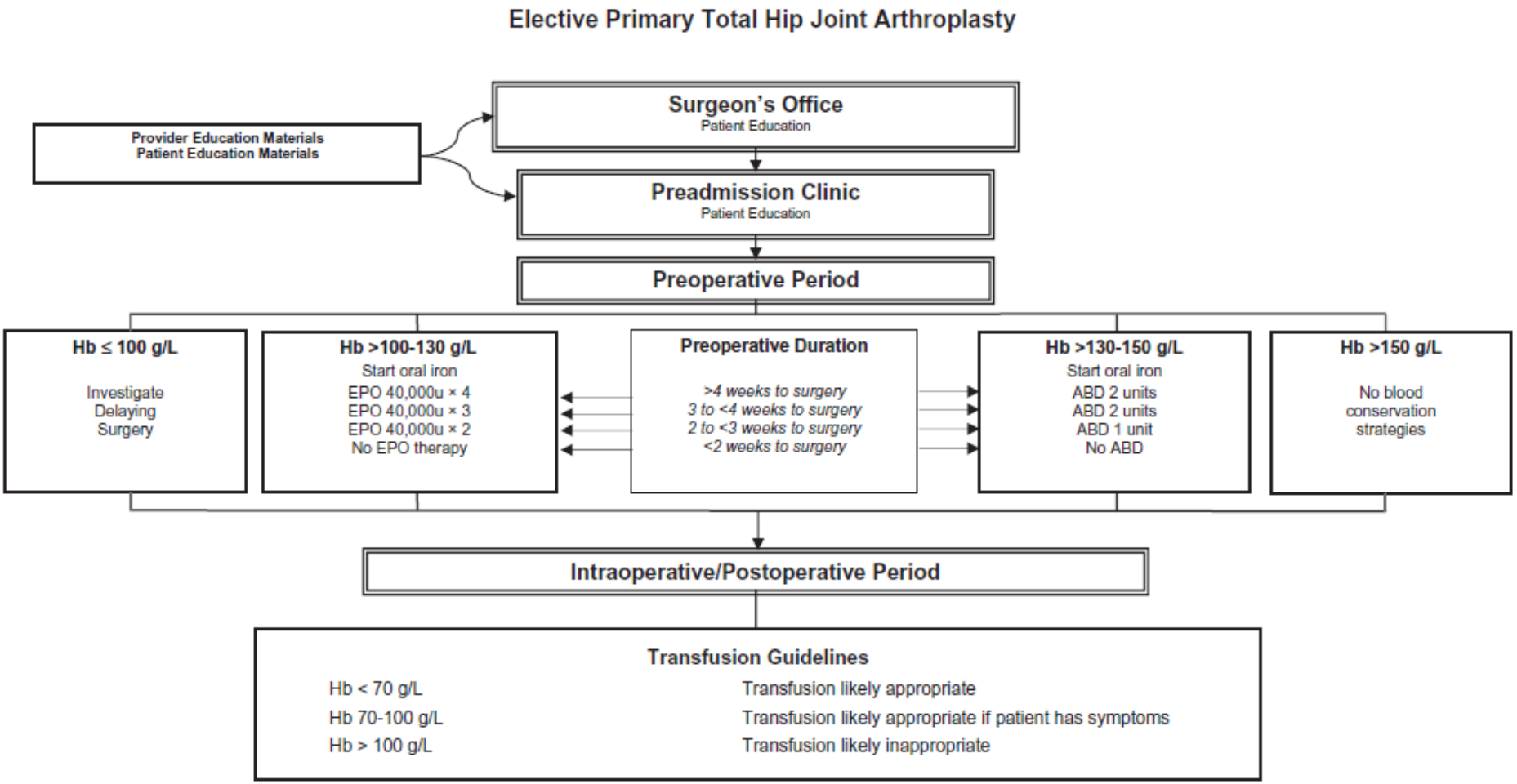
Objectives

1) What is patient blood management?
2) Is blood really that bad for you?
3) Does PBM save money?
4) **Does PBM improve outcomes?**
5) Is this an expectation of your hospital?

But does PBM improve outcomes (in addition to saving money)?

Maybe

Ontario Cluster RCT



TRANSFUSION 2007;47:832-841.

Ontario Cluster RCT
No improvement in patient outcomes

(other than allogeneic transfusion decreased from 26% to 16% and reduced length of stay)

Outcome	PBM	Usual care
Length of stay	5.8 days	6.3 days
Major complications	1.1%	1.2%

TRANSFUSION 2007;47:832-841.

Englewood vs. Other hospitals

Table 2. Outcomes and Patient Risk Factors[a]

Variable	EH (n = 586)	OH-M (n = 586)	OH (n = 31,863)
Complications			
Very serious complication (%)	10.6	13.7	10.5
Serious complication (%)	0.5	5.0	4.0
Neither (%)	88.9	81.4	85.5
Blood products (%)	10.6	42.5	

(Ann Thorac Surg 2010;90:451–9)

Cardiac surgery (before vs. after intraoperative PBM)

TABLE 2. Blood product and blood component use (n = 1032)

Units/patient	Group I (N = 481)	Group II (N = 551)	*P* value*
Allogeneic PRBCs	2.1 ± 2.4	1.5 ± 2.2	<.001
Median (range)	1 (0–10)	0 (0–10)	
Platelets	0.4 ± 0.9	0.5 ± 0.9	.75
Median (range)	0 (0–5)	0 (0–5)	
FFP	1.5 ± 3.1	0.9 ± 2.3	.019
Median (range)	0 (0–14)	0 (0–18)	
Cryoprecipitate	1.8 ± 4.7	0.6 ± 2.9	<.001
Median (range)	0 (0–32)	0 (0–23)	
Total blood product use	5.8 ± 9.8	3.5 ± 6.9	<.001
Median (range)	2 (0–57)	1 (0–47)	
Proportion receiving transfusion			
Allogeneic PRBCs	60%	47%	<.001
Platelets	26%	27%	.80
FFP	24%	20%	.078
Cryoprecipitate	16%	5%	<.001
Any blood product use	63%	53%	.003

J Thorac Cardiovasc Surg 2012; 143: 926-35

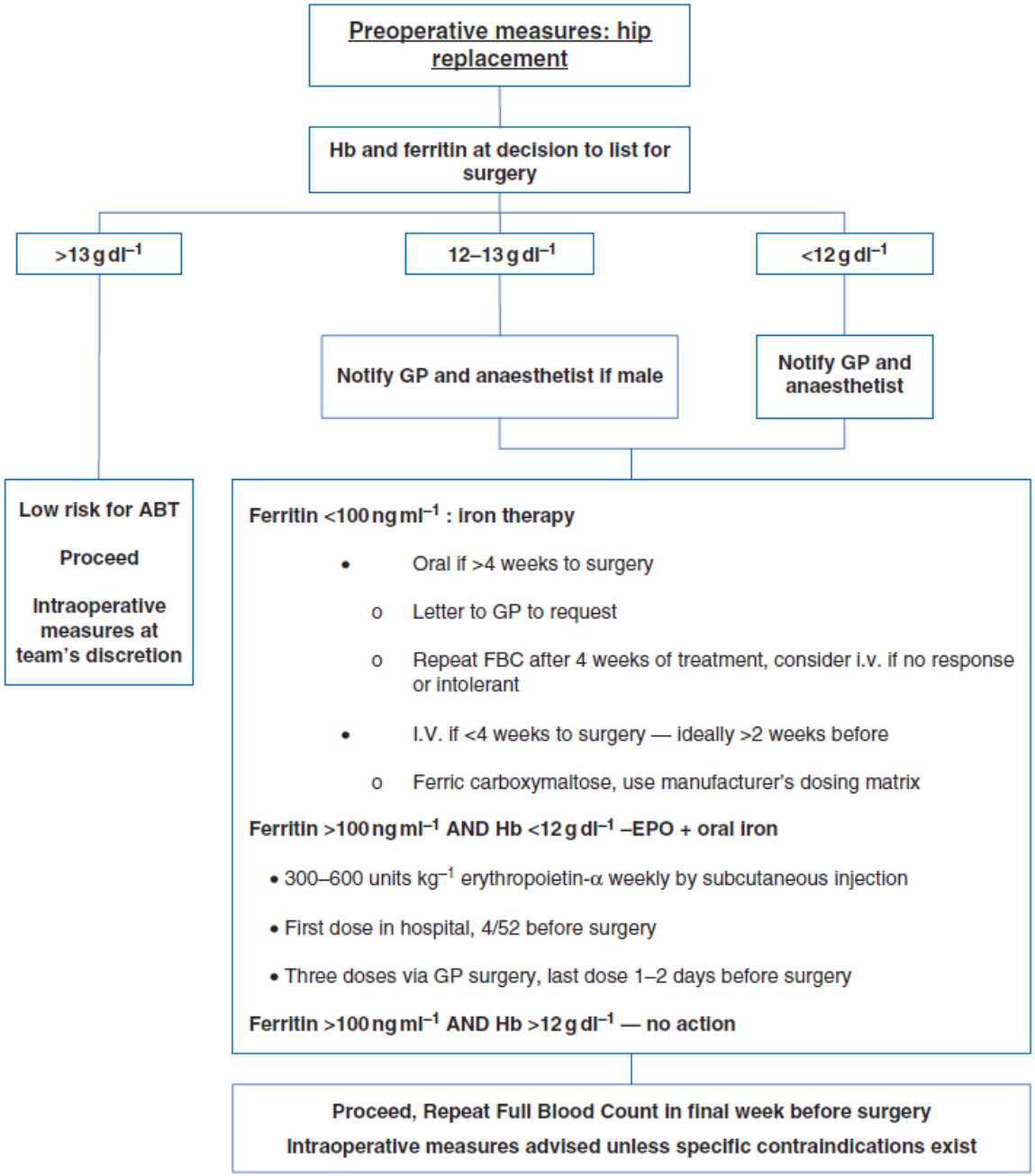
No change in any outcomes

TABLE 3. Postoperative patient outcomes (n = 1032)

Variable	Group		Difference (95% CI)*	*P* value†
	Group I (N = 481)	Group II (N = 551)		
Hospital mortality (%)	4 (1%)	5 (1%)	<–1% (–1% to 1%)	1.00
Mortality 30 d (%)	4 (1%)	9 (2%)	<–1% (–2% to 1%)	.25
Postoperative LOS (d)	6 (0–48)	6 (2–70)	0 (–0.0001 to 0.0001)	.97
Postoperative bleeding with Reoperation (%)	20 (4%)	22 (4%)	<1% (–2% to 3%)	.89
Myocardial infarction (%)	1 (<1%)	0 (0%)		.47
Deep sternal wound infection (%)	1 (<1%)	3 (1%)		.63
Sepsis (%)	5 (1%)	4 (1%)	<1% (<–1% to 1%)	.74
Transient ischemic attack (%)	3 (1%)	4 (1%)	<–1% (–1% to 1%)	1.00
Prolonged ventilator support (% with >24 h)	44 (9%)	57 (10%)	–1% (–4% to 2%)	.52
Pulmonary embolism (%)	1 (<1%)	3 (1%)		.63
Renal failure (%)	15 (3%)	17 (3%)	<1% (–2% to 2%)	.98
Dialysis (%)	6 (2%)	4 (1%)	1% (<–1% to 2%)	.53
Cardiac arrest (%)	8 (2%)	5 (1%)	1% (–1% to 2%)	.28
Multiorgan system failure (%)	1 (<1%)	0 (0%)		.47
Atrial fibrillation (%)	112 (23%)	125 (23%)	1% (–4% to 6%)	.82
Predischarge hemoglobin (g/dL)	9.9 (8–15)	9.5 (7.5–13.3)	0.4 (0.2–0.5)	<.001

CI, Confidence interval; *LOS*, length of stay. *Difference in rate and 95% CI are not shown for comparisons with small event numbers (≤1 event). †Based on the chi-square test/Fisher exact test for categoric variables and the Mann–Whitney *U* test for continuous variables.

J Thorac Cardiovasc Surg 2012; 143: 926-35



British Journal of Anaesthesia **108** (6): 943–52 (2012)

Plus intraoperative management

Intraoperative measures: hip or knee replacement

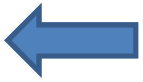
- **Spinal anaesthesia over GA**
- **Anti-fibrinolytic drug treatment**
  - Tranexamic acid 1 g i.v. over 15 min
  - At induction for hips, before tourniquet release (if used) for knees
- **Cell salvage**
  - If intraoperative blood loss anticipated to exceed 1000 ml OR during unexpected significant haemorrhage
- **Induced hypotension**
  - Mean arterial pressure (MAP) 55 mm Hg OR 30% less than usual MAP, whichever is higher

British Journal of Anaesthesia **108** (6): 943–52 (2012)

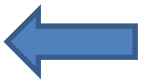
Table 6 Before-and-after comparisons. Continuous data expressed as median (IQR). †$P=0.02$; *$P<0.01$; **$P<0.001$

	Before	After
Female:male ratio	412:305	155:126
TKR:THR ratio	356:361	123:158
ASA score	2 (2–2)	2 (2–3)
Age (yr)	72 (65–78)	74* (66–80)
Anaemia prevalence at decision for surgery	166/684	73/281
Nadir Hb in transfused patients (g dl^{-1})	7.8 (7.2–8.7)	7.6 (7.3–9.2)
Discharge Hb (g dl^{-1})	10.4 (9.5–11.4)	10.4 (9.4–11.0)
Hb loss: THR (g dl^{-1})	3.8 (2.9–4.9)	3.1** (1.9–4.6)
Hb loss: TKR (g dl^{-1})	3.1 (1.9–4.6)	2.6* (2.0–3.3)
Received ABT: THR	83/361	12**/158
Received ABT: TKR	24/356	0**/123
Length of stay (days): THR	6 (5–8)	5** (3–7)
Length of stay (days): TKR	6 (5–8)	4** (3–6)
Readmitted within 30 days	49/717	12/281
Readmitted within 90 days	97/717	23†/281

23% to 8%
7% to 0%



1 day
2 days



14% to 8%

17 cardiac programs in Virginia (14K patients)

Outcome	No PBM	PBM	p
Re-op bleed	2.1%	1.2%	<0.001
Pneumonia	2.7%	2.0%	0.01
Renal failure	3.8%	3.1%	0.03
Death	1.8%	1.0%	<0.001
Total cost	30K	26K	<0.001

NNT to prevent one death = 125 patients

(J Thorac Cardiovasc Surg 2013;145:796-804)

Bloodless medicine vs. usual care

Parameter	All inpatients: Bloodless patients (n = 294)	All inpatients: Matched controls (n = 1157)	p value
In-hospital death	2 (0.7)	31 (2.7)	0.046
LOS (days)	4 (2-7)	4 (2-8)	0.50
LOS (days)	6.9 ± 14.4	7.4 ± 10.6	0.46
Morbid outcomes			
Infection	14 (4.8)	88 (7.6)	0.08
Thrombotic	12 (4.1)	61 (5.3)	0.39
Renal	2 (0.7)	9 (0.8)	0.86
Respiratory	3 (1.0)	5 (0.4)	0.21
Myocardial infarction	4 (1.4)	15 (1.3)	0.93
Any morbid outcome	40 (13.6)	166 (14.4)	0.74
Any morbid outcome or death	40 (13.6)	178 (15.4)	0.44

TRANSFUSION 2014;54:2668-2677.

ROTEM/PlateletWorks impact - Cardiac Surgery Step-wedge cluster RCT (7402 patients)

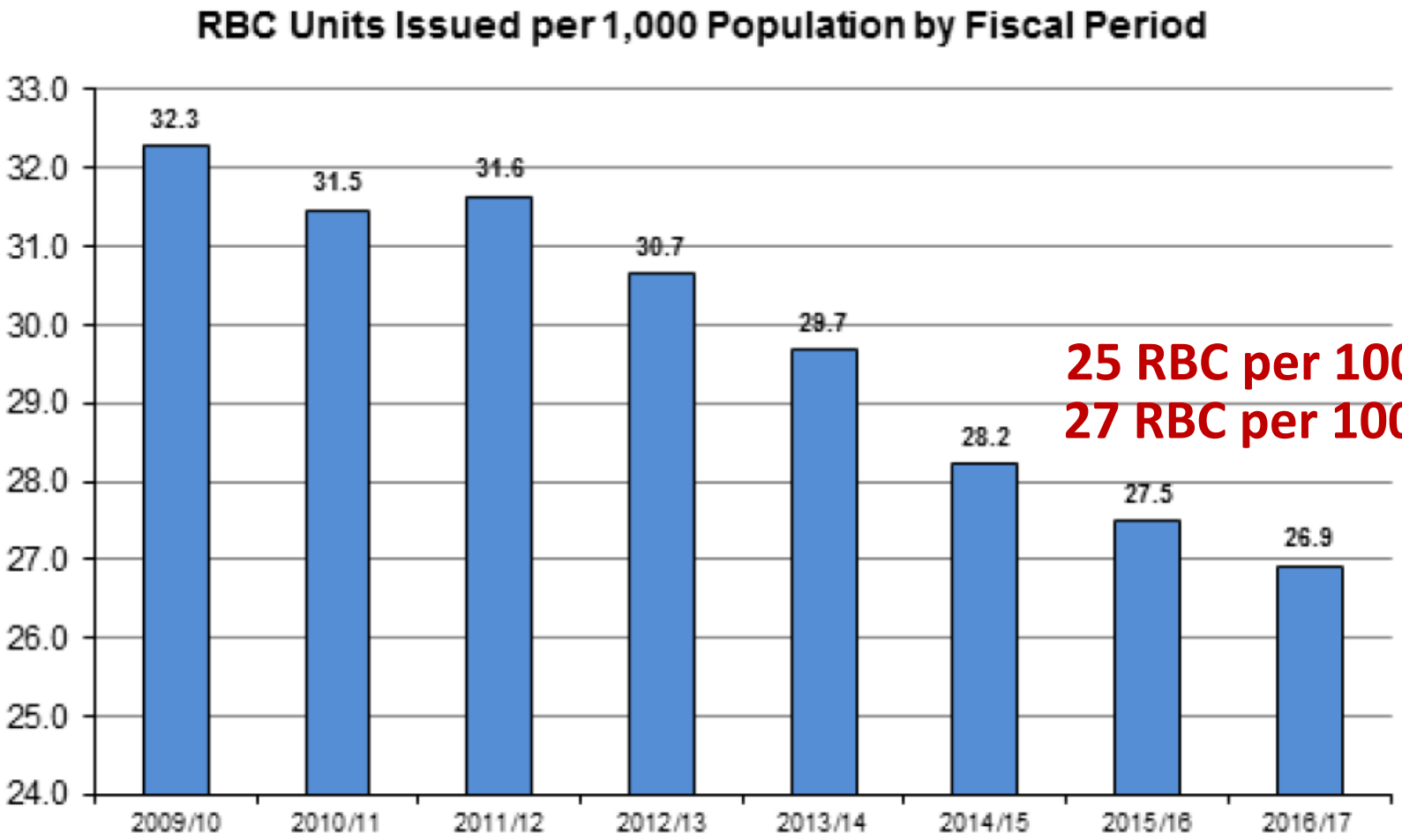
Outcome	Relative Risk (95% CI)	P-value
Red cell transfusions	**0.91 (0.84, 0.98)**	**0.01**
Platelet transfusions	**0.81 (0.72, 0.91)**	**<0.001**
Plasma transfusions	1.04 (0.91, 1.18)	0.57
Cryoprecipitate or fibrinogen concentrate transfusions	1.19 (0.89, 1.59)	0.24
Major bleeding	**0.86 (0.75, 0.98)**	**0.02**
Major complications	1.01 (0.80, 1.26)	0.97

Circulation. 2016 Oct 18;134(16):1152-1162. Epub 2016 Sep 21.

We have a long way to go
to catch Western Australia

We are not going to catch them without patient blood management

How are we doing with RBC use?



25 RBC per 1000 Q
27 RBC per 1000 C-Q

Comparison to the Rest of the World

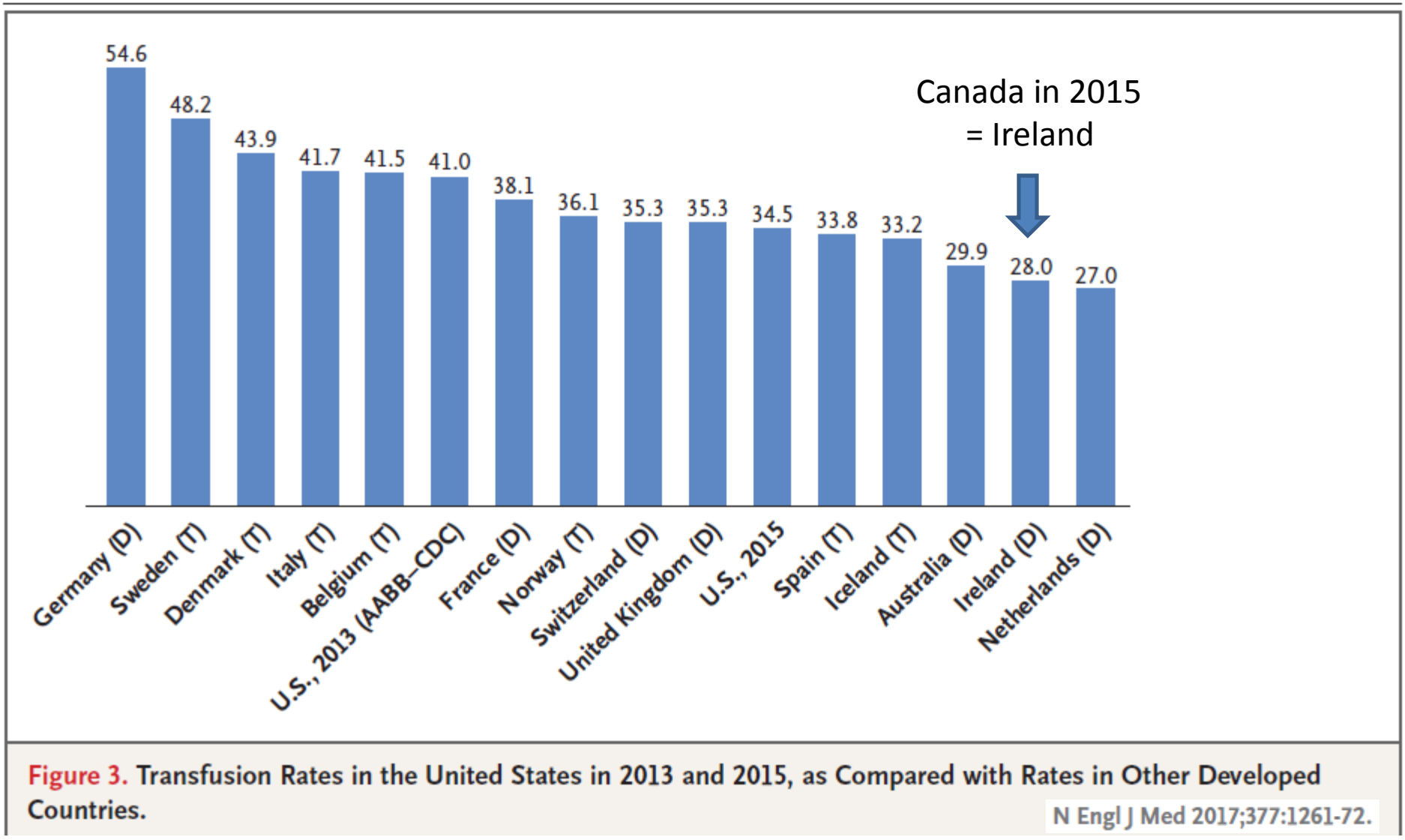
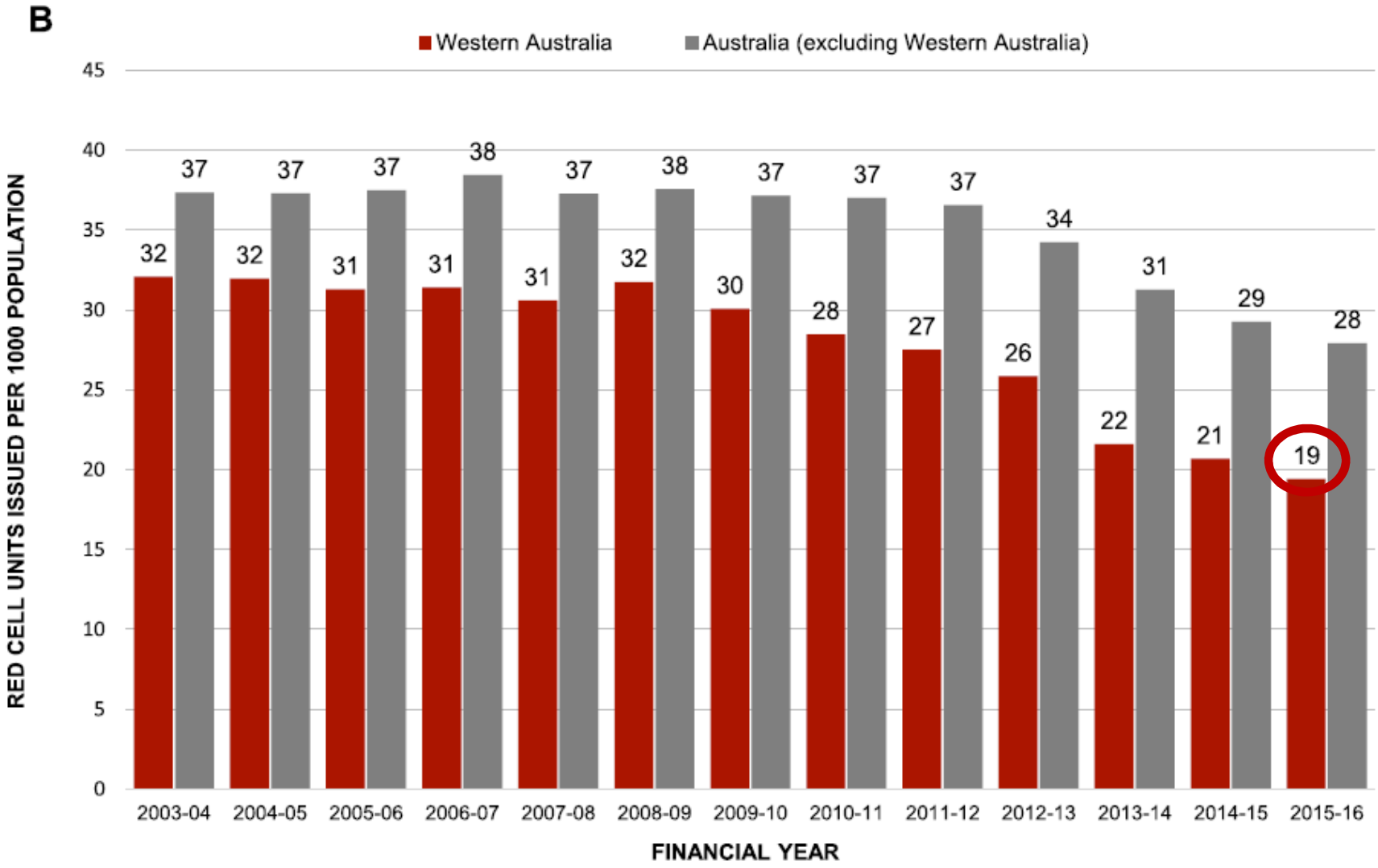


Figure 3. Transfusion Rates in the United States in 2013 and 2015, as Compared with Rates in Other Developed Countries.

N Engl J Med 2017;377:1261-72.

What patient blood management adds to restrictive transfusion thresholds

Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.



Can we afford to be so lax with our use of Red Blood Cells (and plasma, etc.)?

292,000 RBCs

338 million dollars per year

(CBS and hospital costs = $1158/unit)

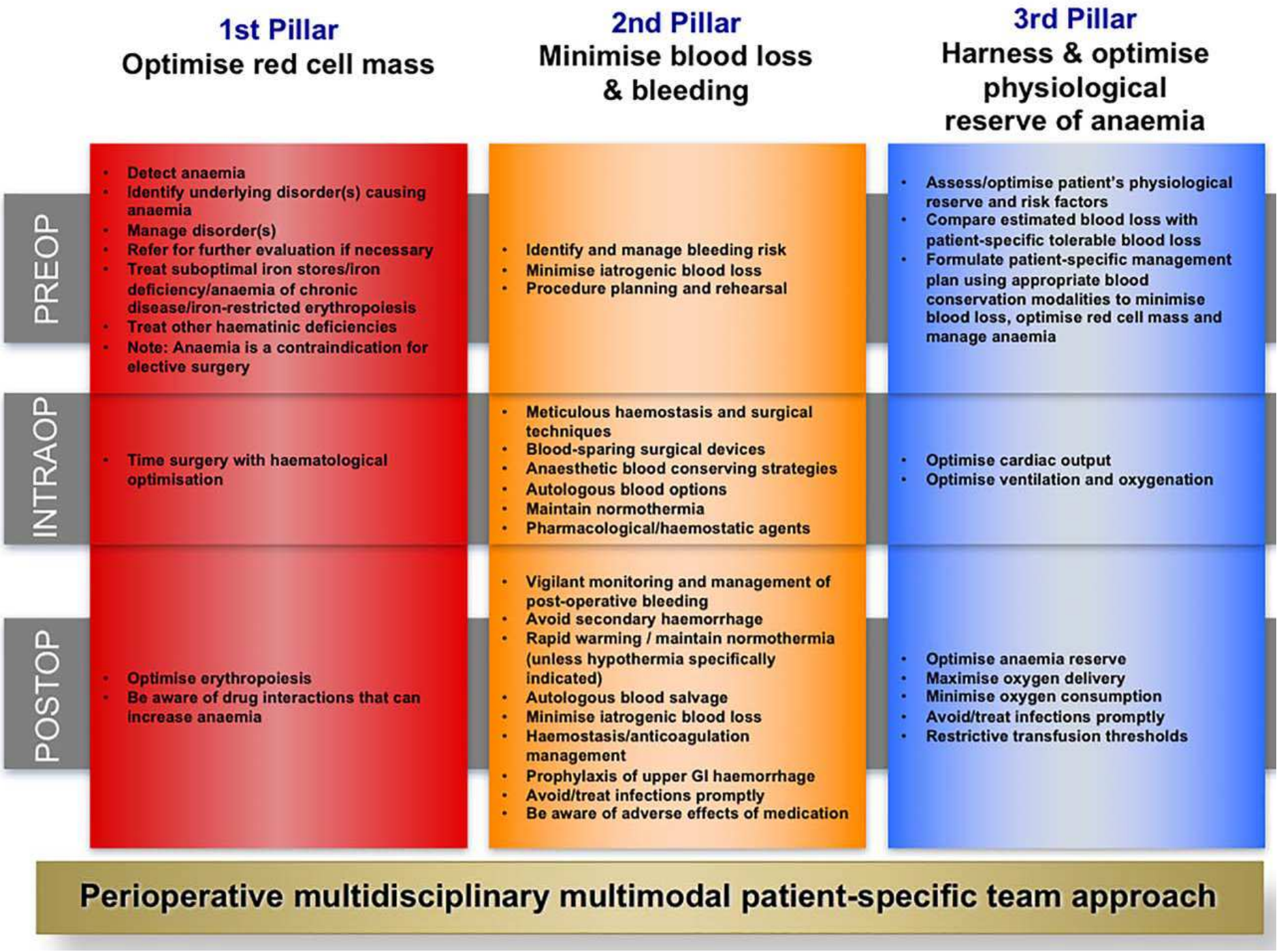
Aryeh Shander et al. Blood 2008; 112:3045

Methods

- The program incorporated principles of the Kotter model for successful change management, including:
  - Motivation for change
  - Executive and clinical leadership
  - Multidisciplinary team engagement
  - Clinical strategies
  - Education
  - Communication (clinicians & patients)
  - Feedback on change
  - All changes in policies and procedures

Professor John Kotter
Harvard Business School

Michael Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.


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

Program Foundations

- Pillar 1. Optimize RBC mass
  - Systems were re-engineered to facilitate timely preintervention patient assessment and optimization of hemoglobin and iron stores, and the use of intravenous iron and other hematinics for postoperative and in-hospital anemia as well as anemia and iron deficiency in pregnancy and primary care

Michael Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.

Program Foundations

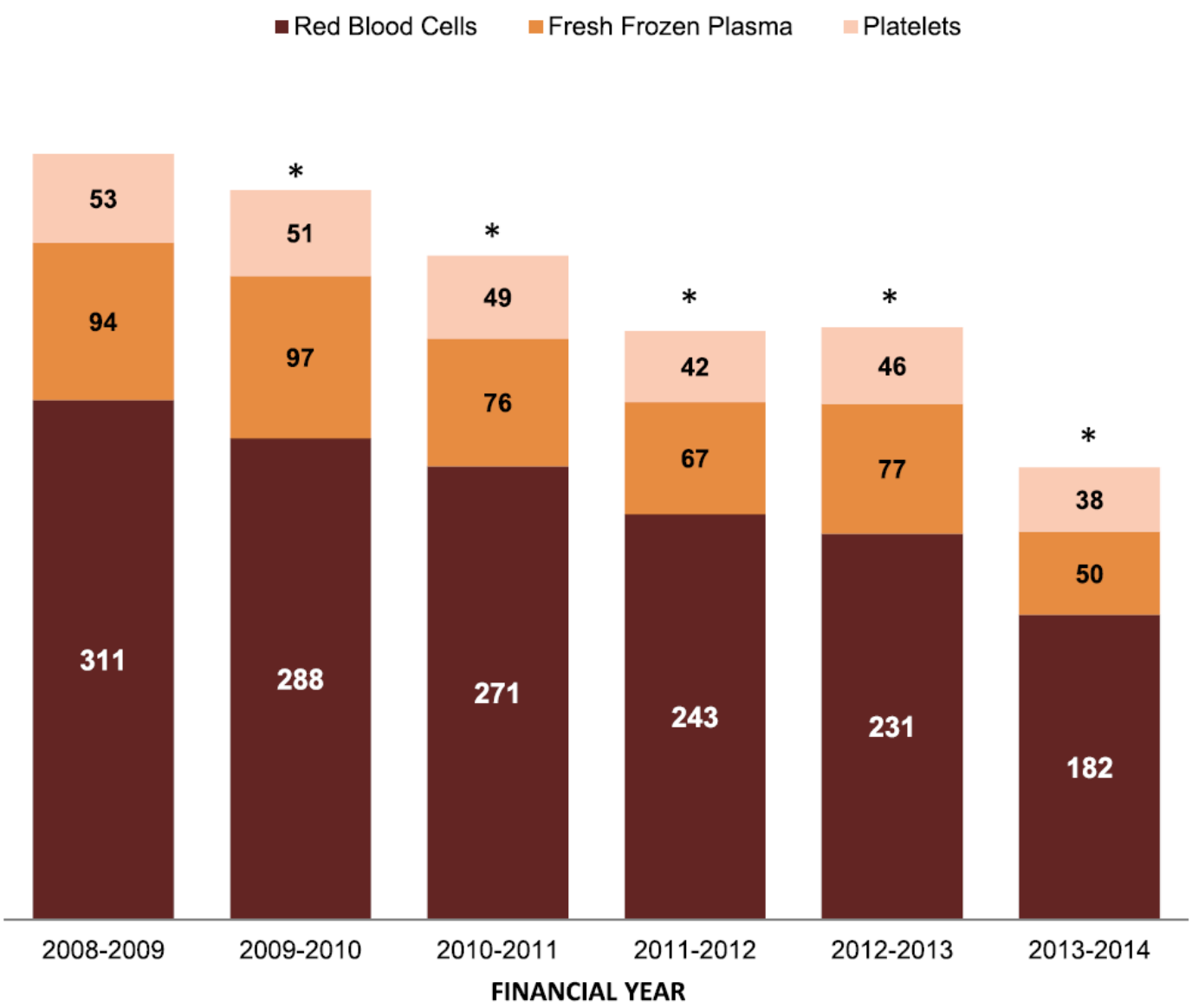
- Pillar 2. Minimize blood loss
  - Educational and clinical initiatives were undertaken to reduce blood loss, including preintervention bleeding risk assessment and management, surgical hemostasis workshops and symposia, use of blood-preserving anesthetic techniques, hemostatic agents, autologous blood salvage, viscoelastic coagulation testing with targeted therapy in critical bleeding and coagulopathy, and minimize laboratory blood sampling volumes

Michael Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.

Program Foundations

- Pillar 3. Optimize the patient-specific tolerance of anemia
  - No specific transfusion threshold values were established for the program. Transfusion decisions were encouraged to take into account patient-specific clinical and physiological factors and accept evidence-based, more restrictive but individualized thresholds
  - Single unit transfusions

Michael Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.



** p-value < 0.05, indicating the mean units transfused per 1000 discharges decreased significantly when compared to the reference year (2008-2009).*

Fig. 3. Mean units of blood transfused per 1000 discharges.

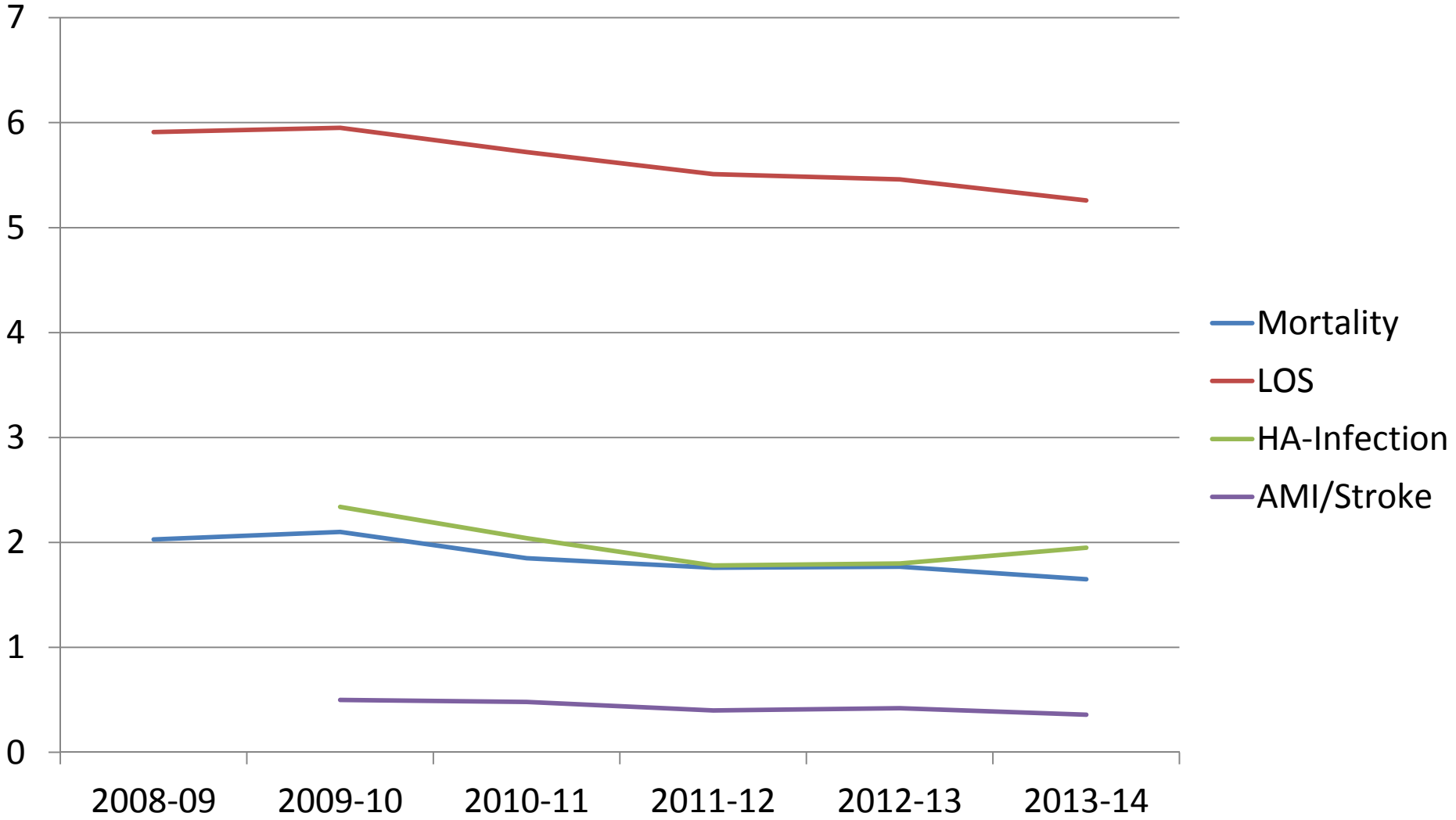
Results

- Pre-transfusion hemoglobin decreased from 79 to 73 g/L ($p<0.001$)
- The proportion of single unit increase from 33 to 64% ($p<0.001$)
- The proportion of elective surgery patients admitted with anemia decreased from 21 to 14% ($p=0.001$)

Michael Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.

Outcomes

Adjusted 28% deaths, 15% LOS, 31% AMI/stroke



Michael Leahy et al . Transfusion 2017 Jun;57(6):1347-1358.

Objectives

1) What is patient blood management?
2) Is blood really that bad for you?
3) Does PBM save money?
4) Does PBM improve outcomes?
5) **Is this an expectation of your hospital?**

Is it an expectation that your hospital implements a comprehensive PBM program?

YES

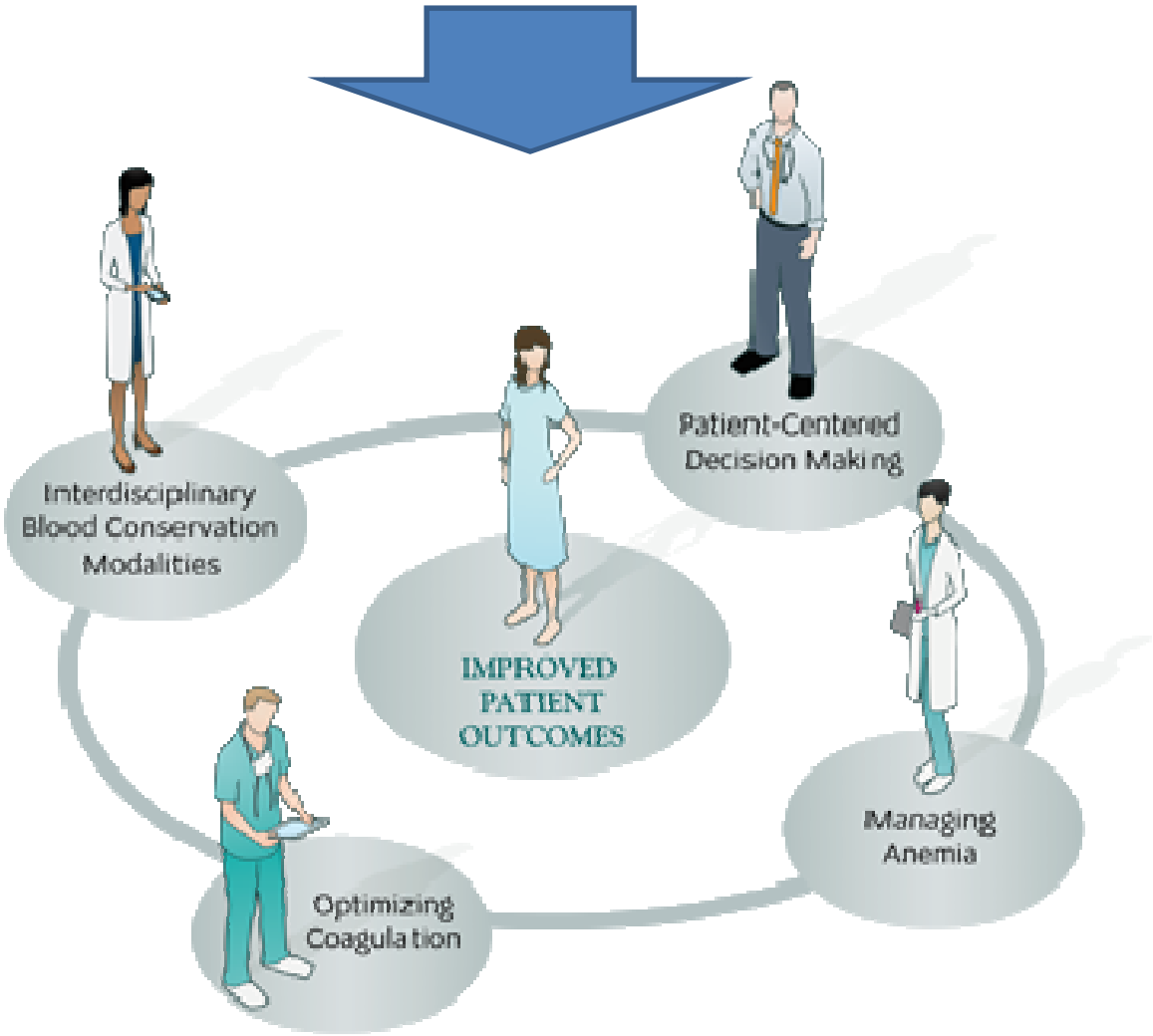
The Reasons

- People will die if your don't implement a multifaceted blood conservation program
- Patients will have complications that are preventable if you don't make sure they get better care
- Health care spending on blood and complications from preventable transfusions can be re-deployed to other areas of health care
- Blood donors can cut back on their frequency of donation and replete their iron stores (maybe we can also be more picky about who can donate)

Message

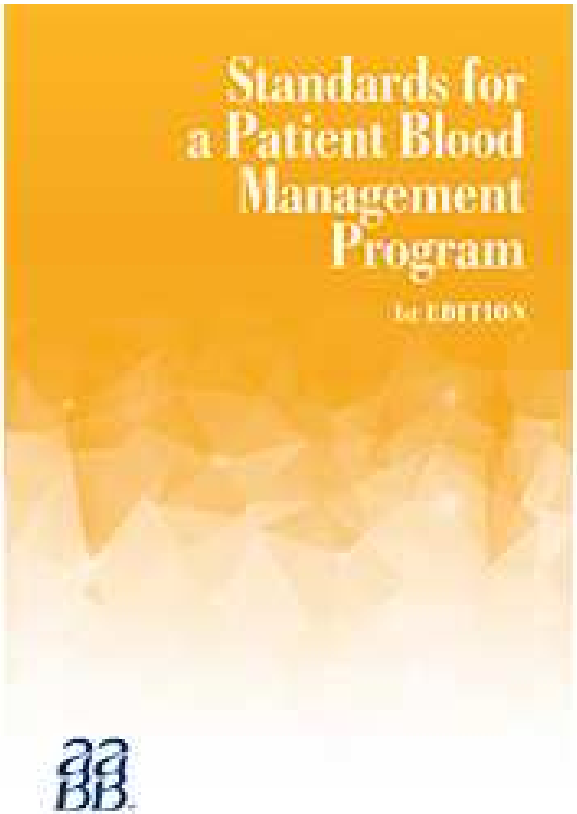
- On the PBM front we have a long way to go:
  - Intravenous iron and ESAs for surgery
  - Anemia prevention for HMB and pregnancy
  - Access to therapies for HMB
  - Cell salvage
  - Tranexamic acid
  - Pre-op/delivery assessment for bleeding risk
  - POCT testing for bleeding patients
  - Post-op iv iron
  - Minimize lab testing
  - Low vacuum sample tubes

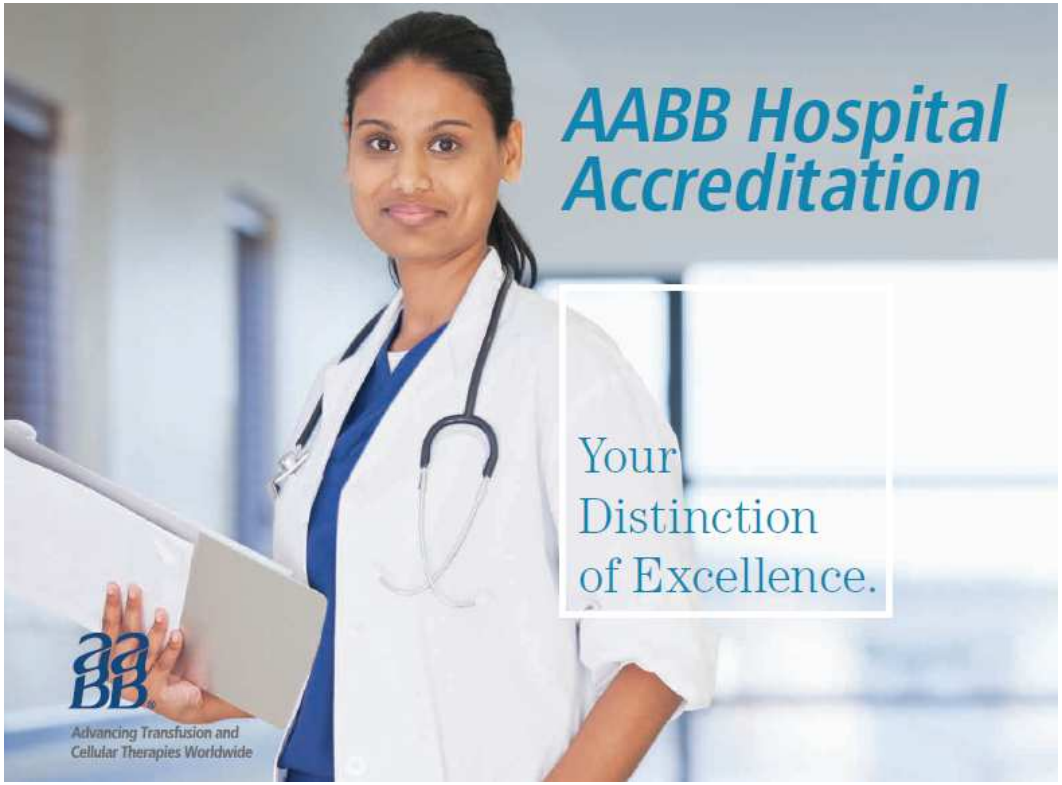
We are all turning a blind eye to patient blood management = hard



Pressure is mounting

AABB Standards & Accreditation for Patient Blood Management





Get going

- Go back and do a self-assessment of your current starting point
- Determine where you are falling short on multifaceted PBM
- Develop an implementation strategy for your next intervention/QI project
- Test and re-measure in repeated quality cycles

Thank you for your attention

Questions (and criticisms) welcome