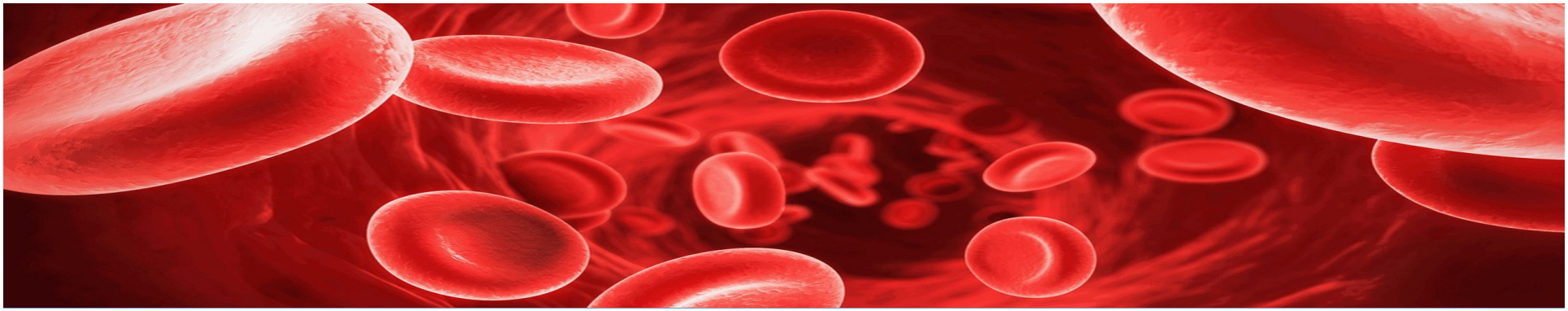
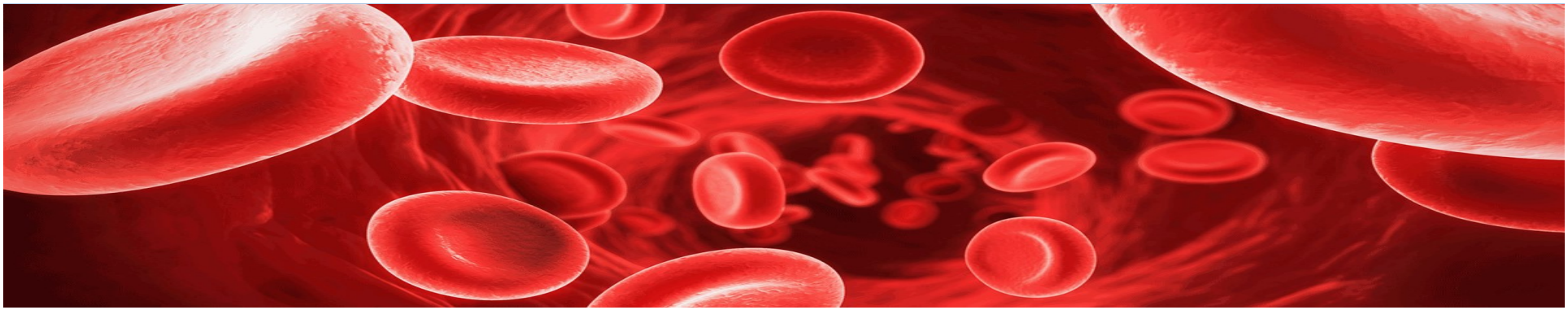


Massive obstetric haemorrhage

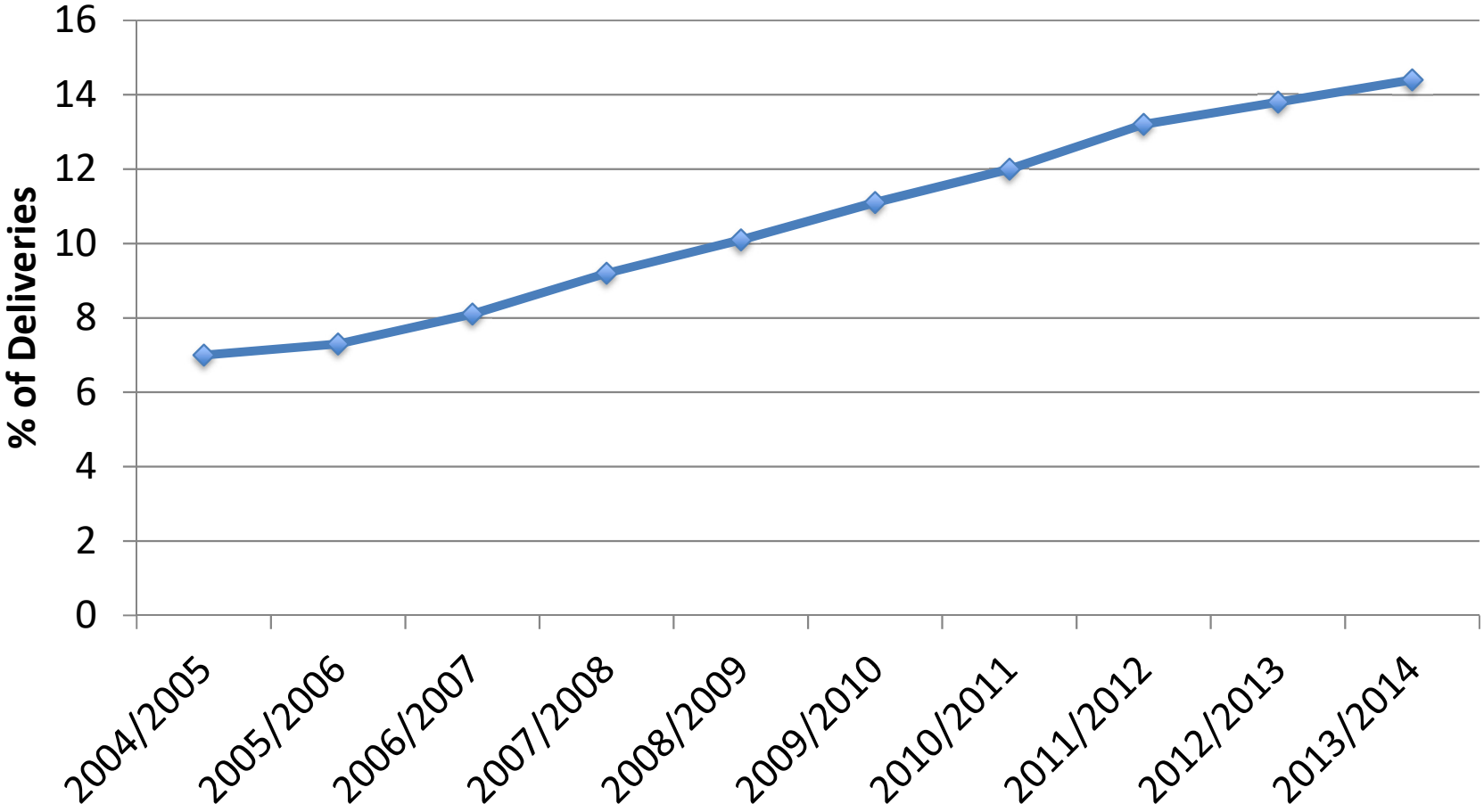
Jim Bamber

Cambridge University Hospitals



INCIDENCE

PPH in England 2004-2014



NHS Maternity Statistics, NHS Digital

PPH in a ‘4000 maternities/yr’ DU

- PPH = 11 per week
- Major obstetric haemorrhage* = 2 per month

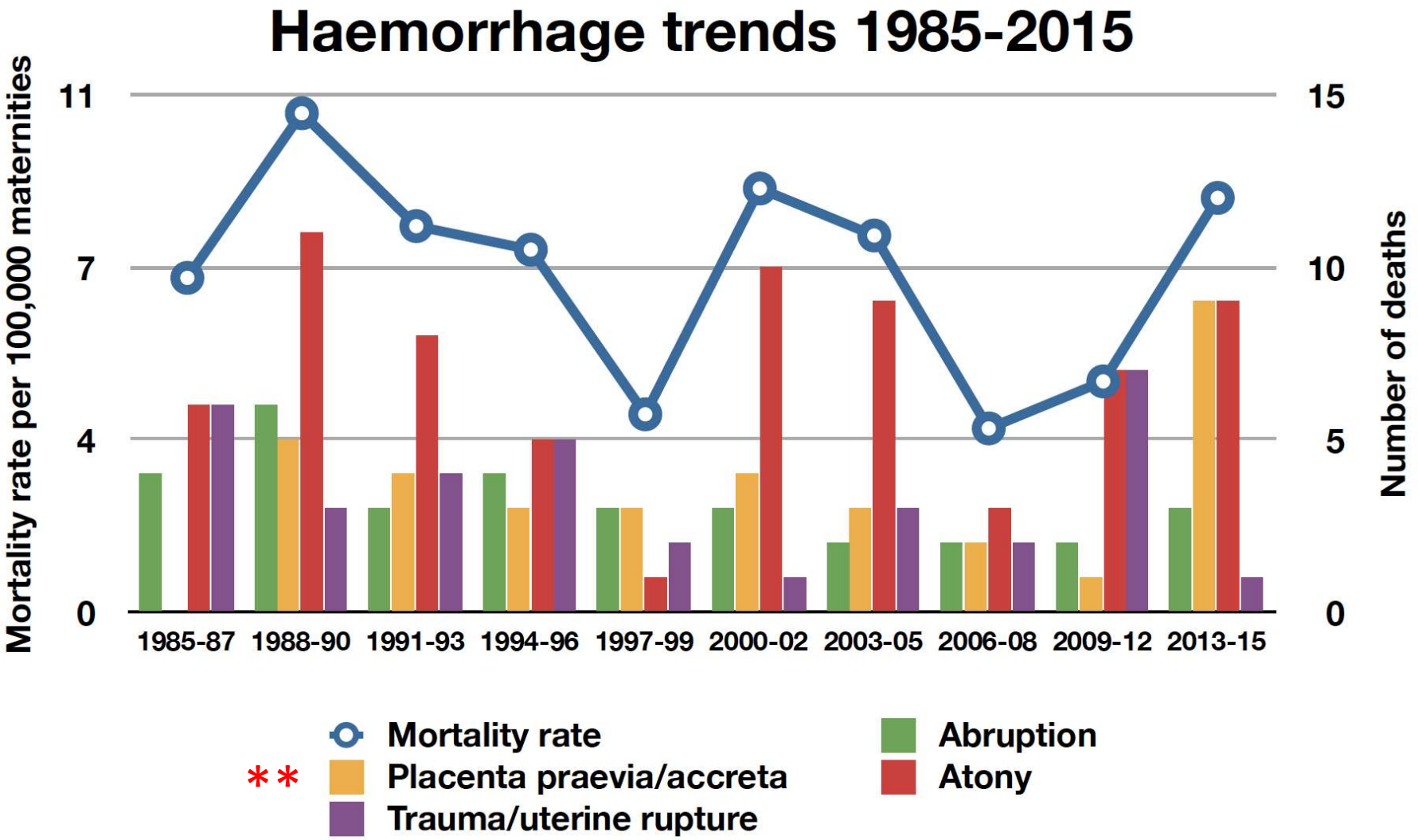
*Blood loss ≥ 2500mls or blood transfusion ≥ 5 units or treatment for coagulopathy

- Massive obstetric haemorrhage* = 1 per year

*Blood transfusion >8 units of blood within 24 hours of delivery

Based on data from:
Maternity Statistics, NHS Digital
Scottish Confidential Audit of Severe Maternal Morbidity
UK Obstetric Surveillance System

DEATHS



"Of particular concern is the rising rate of maternal death in association with placenta accreta".

CEMD Haemorrhage lessons for care

- Don't be falsely reassured by a single (POC) Hb result
- Consider concealed bleeding if clinical signs of hypovolaemia present
- Recurrent APH, pain or agitation are 'red flags' in women with accreta
- Expedite management of retained placenta
- Call and activate "MOH" protocol promptly
- Use misoprostol cautiously
- Concerns about training/competence in hysterectomy and staffing workload balance on a DU

Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2013–15

DEFINITION

Definitions of MOH

- **By volumes**
  WHO (2012): Severe PPH = ≥ 1000 ml within 24 hours
  *RCOG (2016)***:** Major Severe PPH = > 2000 ml
  NHS England Maternity Dashboard Metrics (2017): ≥ 1500 ml
  Scottish CASMM: ≥ 2500mls
- **By transfusion**
  Scottish CASMM: ≥ 5 units or treatment for coagulopathy
  UKOSS: >8 units of blood within 24 hours of delivery
- **By rate**
  BCSH (2006): Blood loss ≥ 150ml per minute
  : Loss of 50% Blood Volume in 3 hrs
  : Loss of 100% Blood Volume in 24hr

EBL impact and maternal size

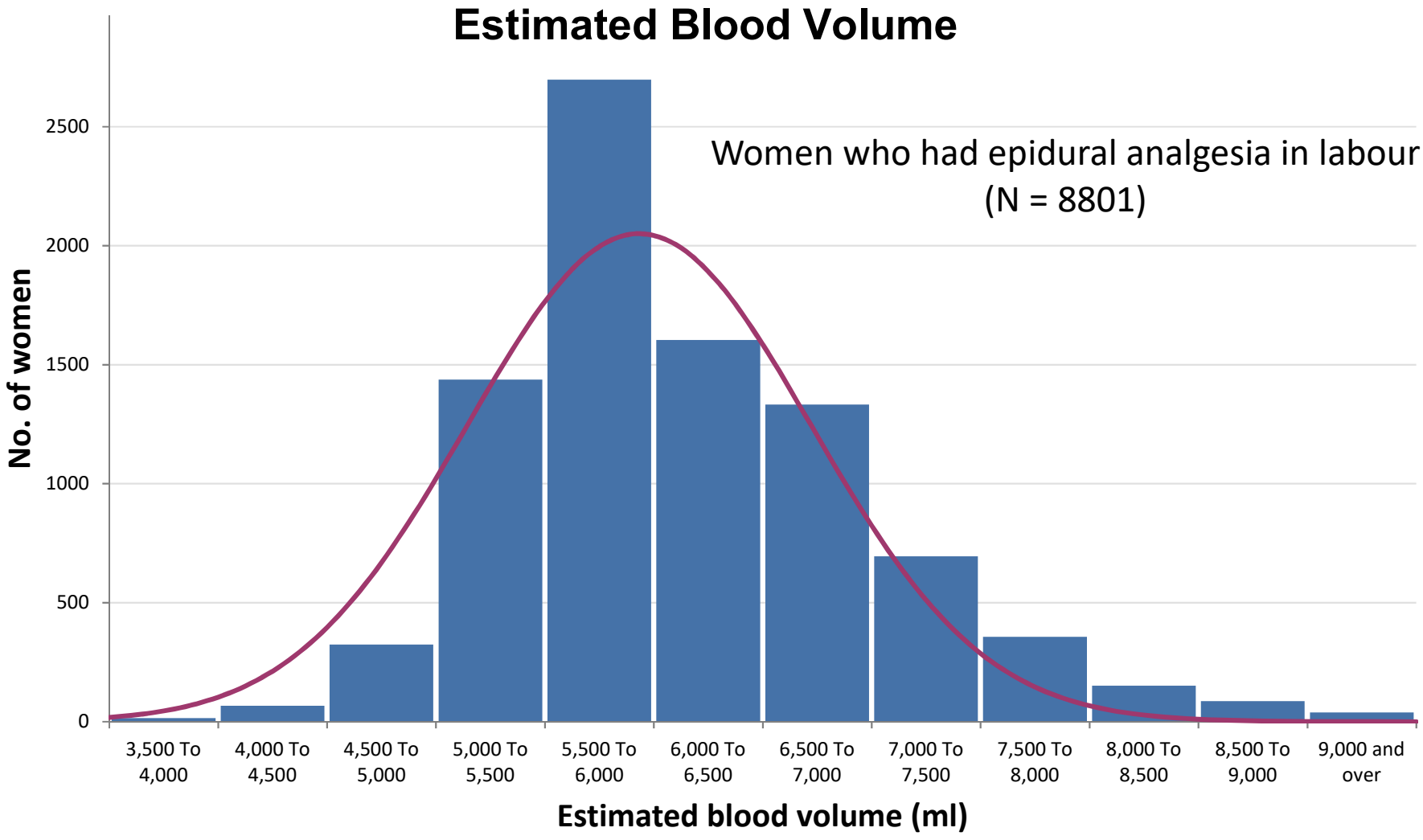
Small women have small blood volumes

Weight (kg)	Total blood volume (mls)*	15% loss (mls)	30% loss	40% loss
50	5000	750	1500	2000
55	5500	825	1650	2200
60	6000	900	1800	2400
65	6500	975	1950	2600
70	7000	1050	2100	2800

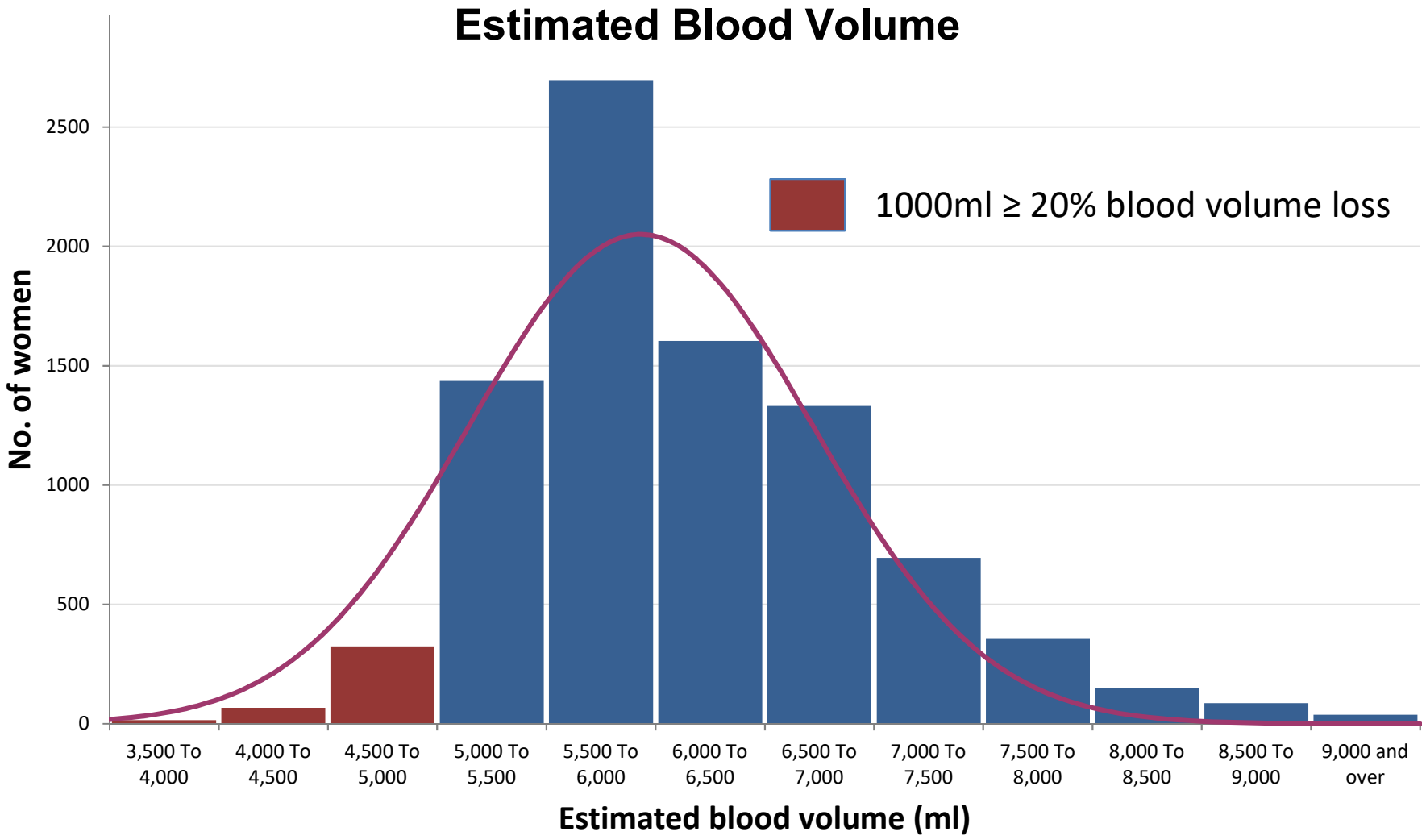
*Based on 100mls/kg blood volume in pregnancy (RCOG 2011) but may overestimate blood volume in obese women

Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Con dential Enquiries into Maternal Deaths and Morbidity 2009–12

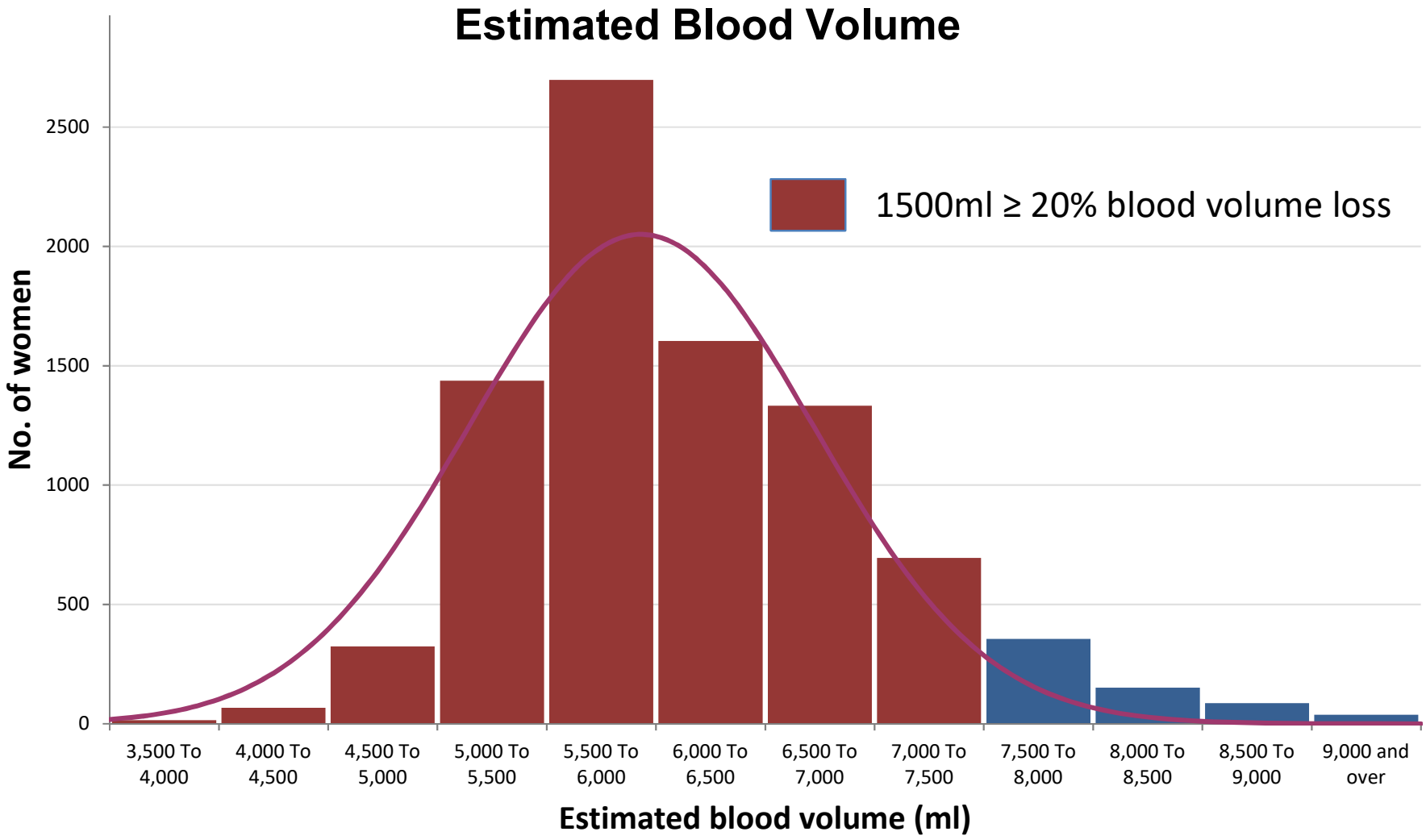
Blood volume varies with size



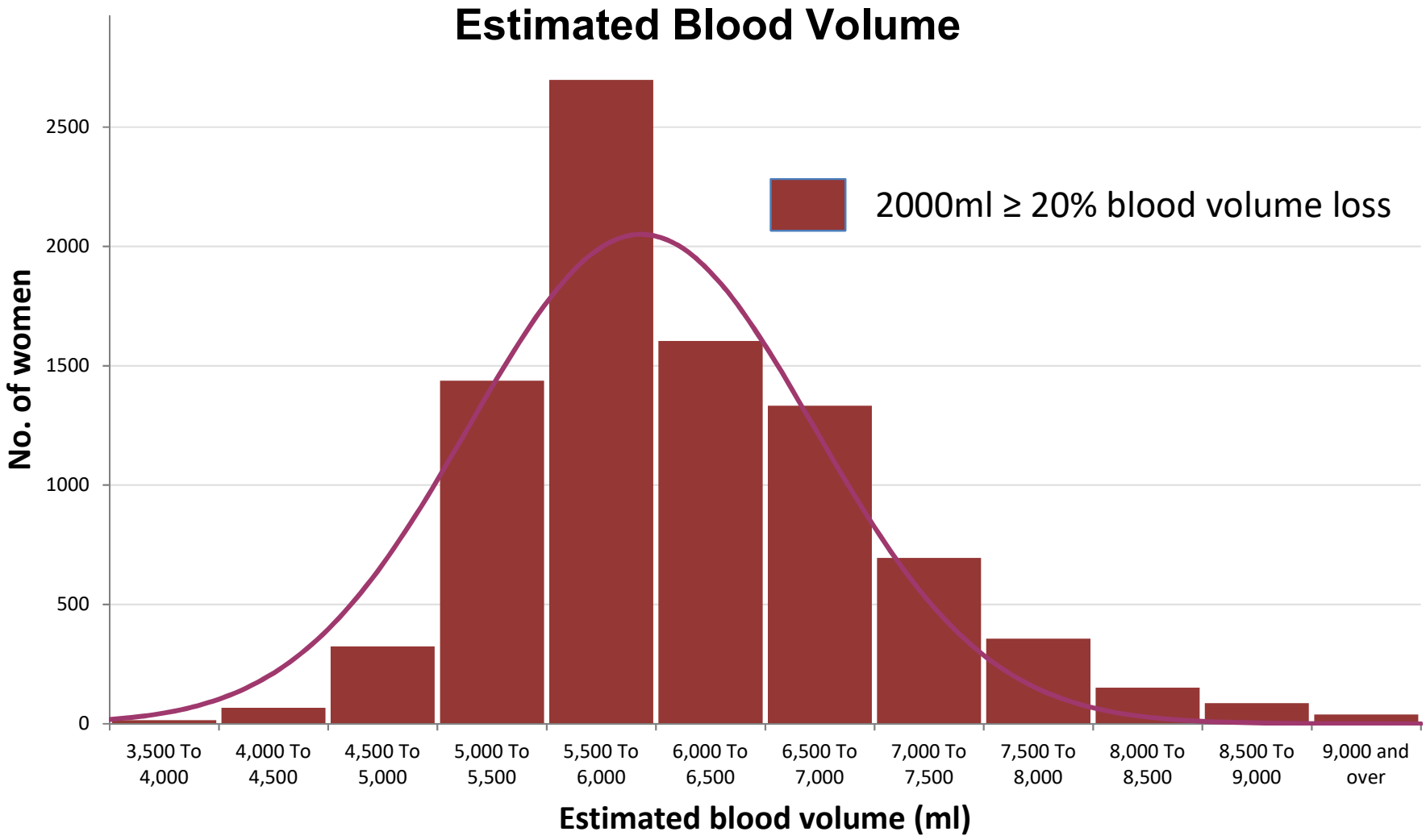
Blood loss effect will vary with size



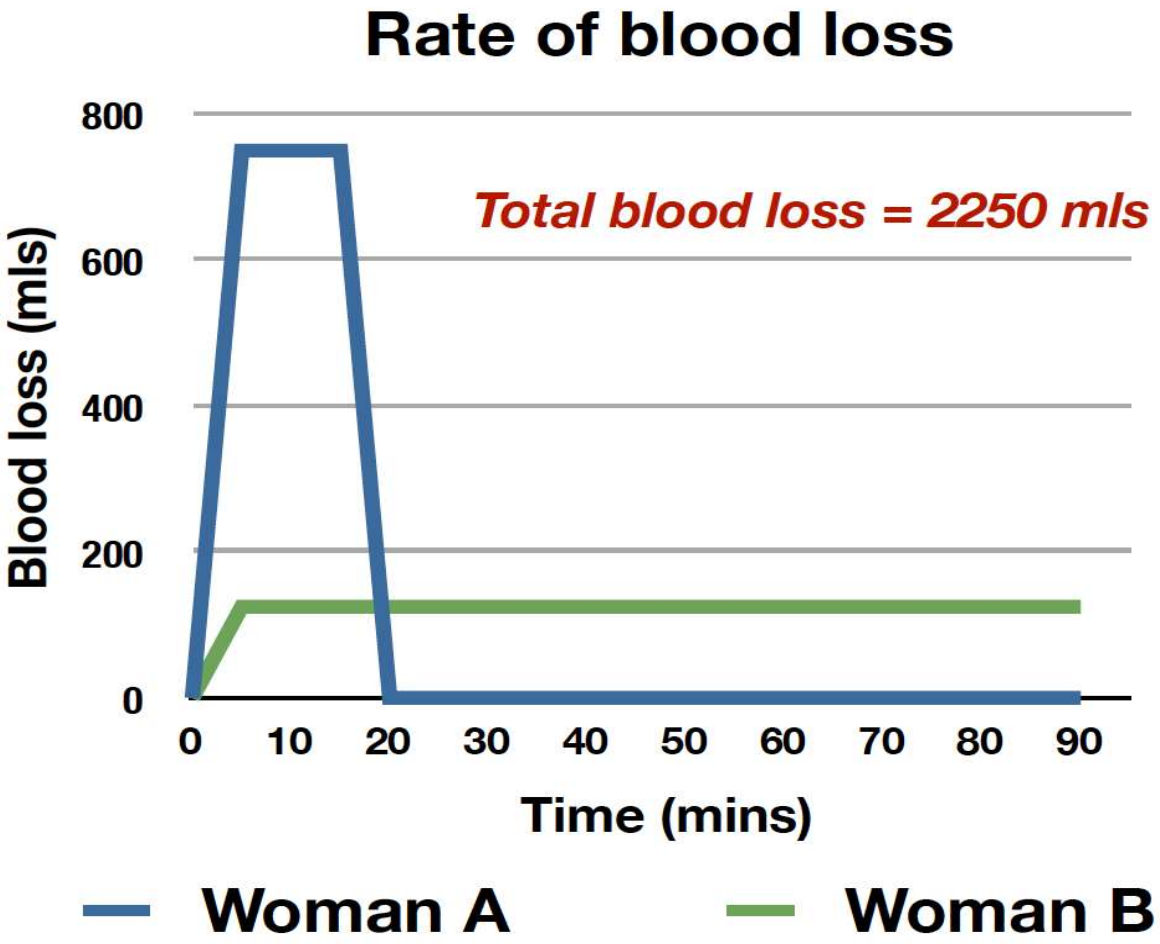
1500ml loss is significant for most



2000ml loss is significant for all



Rates of Massive PPH



How to Recognise Massive PPH

- Measuring blood loss
- Clinical signs
- Blood tests

“Seeing is not believing” for blood loss

- Not all haemorrhage is visible
- Visual estimation consistently underestimates large EBL volumes by 30-50%
- Training can improve visual EBL skill but skill deteriorates within 9 months of training
- Quantification of blood loss (QBL) significantly more accurate than EBL
- QBL reduces risk of underestimation and treatment delay

How to QBL

- Measure fluid/blood loss by using calibrated under-buttock drapes and/or suction cannister and/or weighing blood soaked material and clots
- Measure before and after placenta delivery.
  Before *placenta delivery most fluid = amniotic/urine/faeces*
  After *placenta delivery most fluid =* ***blood***
- Have a laminated dry weight card attached to all scales with dry weights of common items
- One gram weight = One ml of blood

“Rule of 30”

30% loss in blood volume = moderate shock

- Systolic BP fall by 30mmHg
- Heart rate rise by 30 beats/min
- Respiratory rate rise by 30 breaths/min
- Urine output <30ml/hr
- *Haemoglobin (hematocrit) drop by 30%*

A Systematic Review of the Relationship between Blood Loss and Clinical Signs

Rodolfo Carvalho Pacagnella[1]*, João Paulo Souza[2], Jill Durocher[3], Pablo Perel[4], Jennifer Blum[3], Beverly Winikoff[3], Ahmet Metin Gülmezoglu[2]

Citation: Pacagnella RC, Souza JP, Durocher J, Perel P, Blum J, et al. (2013) A Systematic Review of the Relationship between Blood Loss and Clinical Signs. PLoS ONE 8(3): e57594. doi:10.1371/journal.pone.0057594

Citation: ONE 8(3):

Introduction: This systematic review examines the relationship between blood loss and clinical signs and explores its use to trigger clinical interventions in the management of obstetric haemorrhage.

Conclusion: We found a substantial variability in the relationship between blood loss and clinical signs, making it difficult to establish specific cut-off points for clinical signs that could be used as triggers for clinical interventions.

However, the **shock index** can be an accurate indicator of compensatory changes in the cardiovascular system due to blood loss.

Shock Index = HR / SBP

Blood tests

- Arterial/venous blood gas
- Correct sample use
  - *Use blood gas syringe (heparinised) Keep rotating it*
- Lactate – *Increases if tissues not perfused*
- Base deficit- *Increases if tissues not perfused*
- Haemoglobin (haematocrit) – *May not reflect blood loss if woman not fluid resuscitated*

Understanding the blood gas

- Cells and tissues need oxygen for energy
- Oxygen is carried by red blood cells in plasma
- Cells and tissues don't get enough oxygen if:
  - not enough plasma to carry the red cells to cells/tissues (***hypoperfusion***)

    and/or
  - not enough red cells available to carry oxygen (***anaemia***)
- If not enough oxygen available then cells produce acid (including lactate acid) to make some energy.
  (***High lactic acid levels in blood indicate severe tissue hypoperfusion***)
- The acid produced by cells and tissues is removed from the blood by breathing out acid as CO_2 (***increased RR***) or neutralising acid with bicarbonate
  (***the base deficit measures the reduction of bicarbonate as it gets used up***)

	Class 1	Class 2	Class 3	Class 4
ATLS				
Blood loss (%)	<15	15-30	30-40	>40
HR (bpm)	<100	>100	>120	>140
SBP (mmHg)	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal or increased	Decreased	Decreased	Decreased
RR (bpm)	14-20	20-30	30-40	>35
Mental state	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic
Shock Index				
Shock index	<0.6	≥0.6 to <1.0	≥1.0 to <1.4	≥1.4
Base Deficit				
Base Deficit (mmol/L)	≤2.0	>2.0 to 6.0	>6.0 to 10.0	> 10

	Class 1	Class 2	Class 3	Class 4
		ATLS		
Blood loss (%)	<15	15-30	30-40	>40
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		Shock Index		
Shock index	<0.6	≥0.6 to <1.0	≥1.0 to <1.4	≥1.4
		Base Deficit		
Base Deficit (mmol/L)	≤2.0	>2.0 to 6.0	>6.0 to 10.0	> 10

A woman with a retained placenta

- SVD at 05:00
- Booked for MROP at 07:15
- Not bleeding at 07:18
- Bleeding spurts (e.g. 400+100+100+700…)
- EBL prior to transfer to theatre 1500-2000mls
- Arrives in theatre at 08:30
- Observations on arrival **P.167 bpm, BP 125/90** (SI = 1.3)
- GA for MROP. Atony.
- 5000ml Hartmanns +5 units of blood +4 units FFP
- Total EBL 2800mls
- Transferred to ICU for 24 hour stay

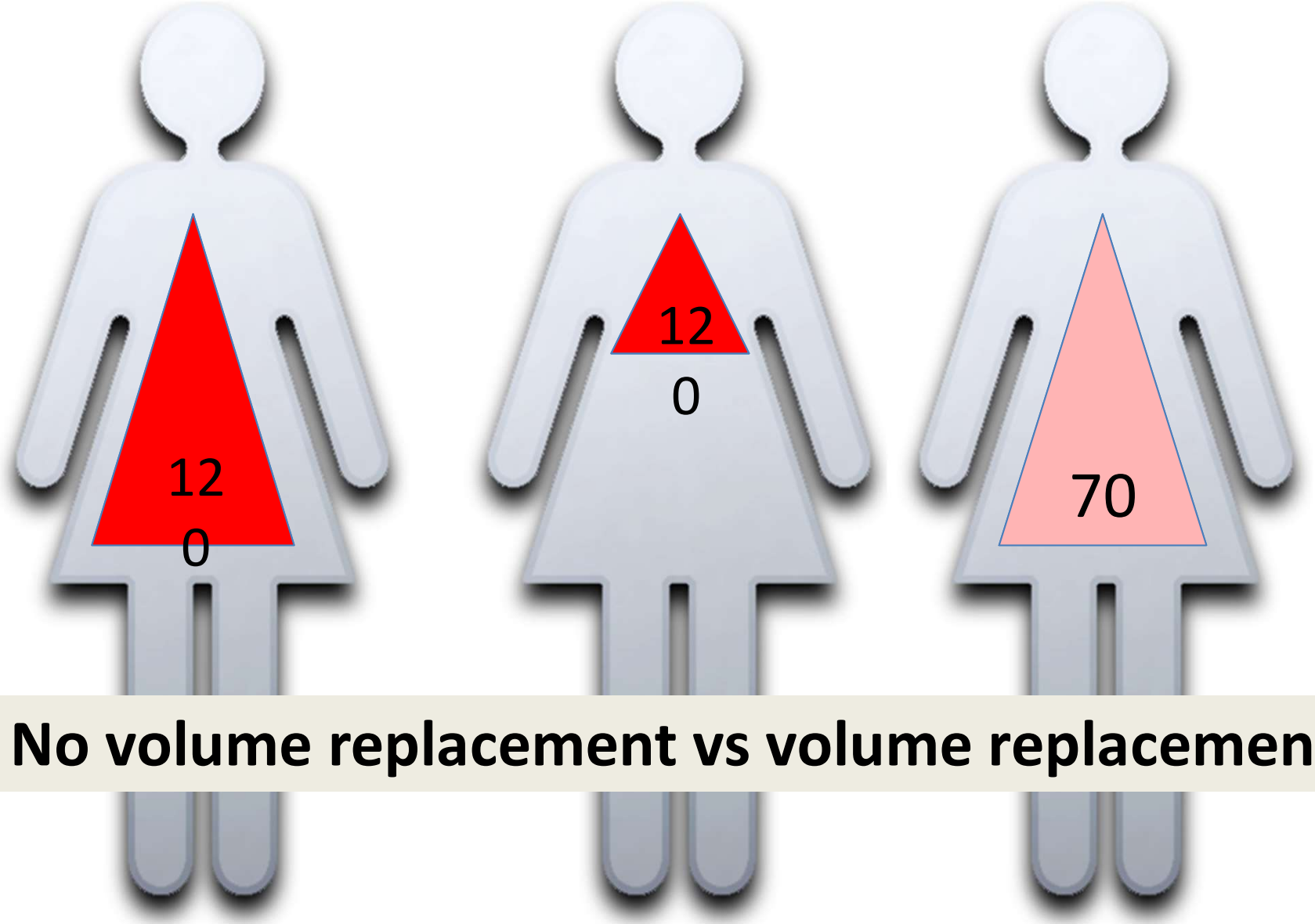
Intra-GA

Pre-GA

	08:30	09:30	
pH	7.49	7.20	[7.350 -7.450]
H^+	41.7	62.6	
PCO_2	3.3	5.0	[4.67 – 6.00]
PO_2	43.5	38.7	[10.67 – 13.33]
$cHCO_3$	20.1	14.5	
BE	-1.2	-12.5	
Na^+	131.7	131	[135- 148.0]
K^+	3.83	4.85	[3.50 – 4.50]
Ca^{2+}	1.25	1.18	[1.120 -1.320]
Glu	6.15	6.43	[3.33 – 6.10]
Lac	6.9	8.1	[0.44 – 2.22]
Hct	28.6	23.9	[35.0 – 50.0]
tHb	95.4	79.6	[120.0 – 150.0]
HR	167		
BP	125/90		

Near patient testing pitfalls

Haemoglobin count and 40% blood volume loss

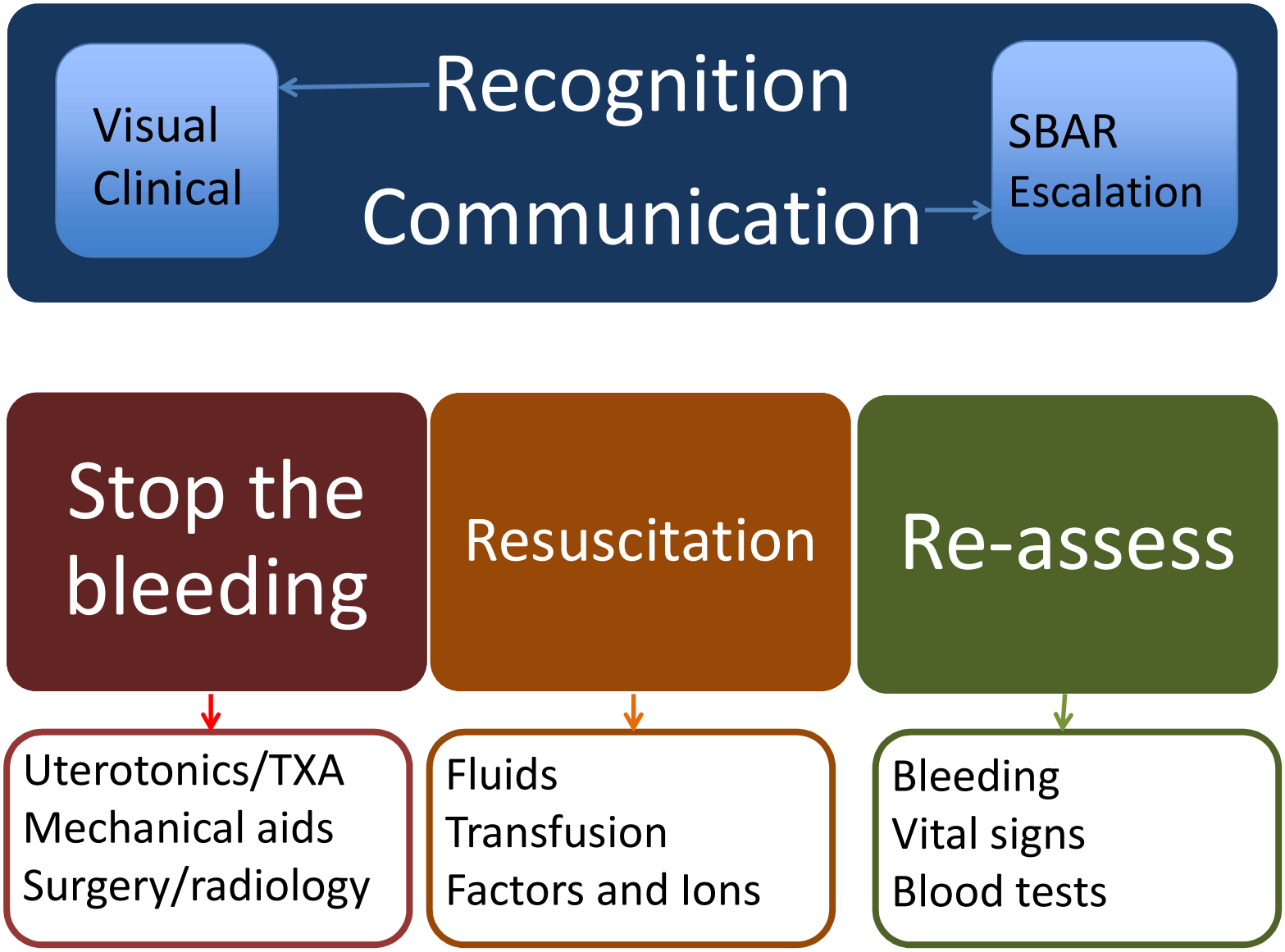


No volume replacement vs volume replacement

Recognising massive PPH

- Rule of 30:
  HR and RR ↑ 30 % , SBP ↓ 30%, OU<30mls/h
- Shock Index (HR/SBP) > 1.0 *(= HR > SBP)*
- Base deficit > 6 (mmol/L)
- *Haemoglobin (hematocrit) drop by 30% **after** fluid resuscitation*

MANAGEMENT


Recognition
Visual
Clinical
Communication
SBAR
Escalation
Stop the bleeding
Resuscitation
Re-assess
Uterotonics/TXA
Mechanical aids
Surgery/radiology
Fluids
Transfusion
Factors and Ions
Bleeding
Vital signs
Blood tests

Communication

- Get Help
- Remember patient and partner
- Senior midwife, obstetrician and anaesthetist
- Blood transfusion and duty haematologist
- Theatre Team
- Portering services
- Delegate record keeping

Cambridge University Hospitals NHS
NHS Foundation Trust

Massive Blood Loss in Adults

4 litres in 24 hours 2 litres in 3 hours > 150ml/min

Get help

Contact senior member of clinical team. Contact senior ward nurses
Contact portering services

Contact Transfusion ext 58405

Contact Transfusion ext 58405

Ask Transfusion to 'initiate major blood loss protocol'

Assess ABC

IV access

2 large cannula

Send blood samples, cross-match, FBC, coagulation, biochemistry
Consider arterial blood gas measurement

Send FBC and coagulation samples after every 5 units of blood given

Resuscitate

IV warm fluids – crystalloid or colloid

Give Oxygen

Give blood

Blood loss >40% blood volume is immediately life-threatening

Give 4 units via fluid warmer. Aim for Hb>8g/dl

Give Group O Rh D negative if immediate need
and/or blood group unknown

Blood Transfusion lab will provide group specific/cross-matched red cells as required

Before Tranfusion
- Check Patient ID
- Use wristbands
- PBARS

Blood loss >40% Blood volume
- 1500–2000mls loss
- Pulse > 120, RR > 30
- Hypotensive
- Urine < 20mls/h

Prevent coagulopathy

Anticipate need for platelets and FFP after 4 units blood replacement and continuing bleeding

Give Primary Major Haemorrhage (MH) Pack

Order Secondary Major Haemorrhage (MH) Pack

Correct hypothermia

Correct hypocalcaemia (keep ionised Ca > 1.13mmol/L)

Contact Haematologist

Primary MH Pack
- Blood 5 units
- FFP 4 units

Secondary MH Pack
- Blood 5 units
- FFP 4 units
- Platelets
- Cryoprecipitate

Reassess and document

Get help to stop bleeding

Contact surgeons, gastroenterologists, obstetricians as appropriate

v1 02/10

Resuscitation

- ABC
- Oxygen
- Major Haemorrhage Trolley
- IV access and blood samples
- Near-patient testing
- IV fluids
- O Neg Blood

What has been lost in PPH

- *Plasma volume*: Required for perfusion
  Replace after 1L loss (fluid replacement)

- *Red cells*: Required to carry 0_2 to cells
  Replace after 2L loss (e.g. O neg blood)

- *Coagulation factors/Platelets*: For clots
  Replace after 5L loss (FFP, cryo, platelets)

Making Blood Clot

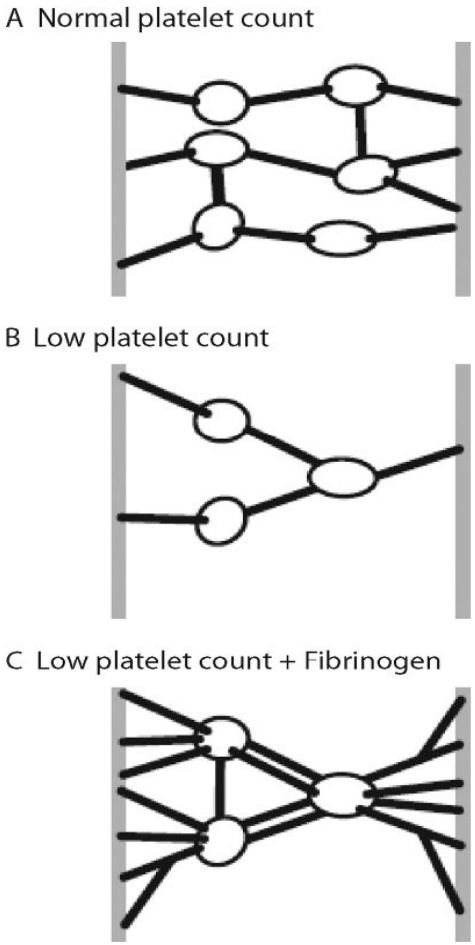
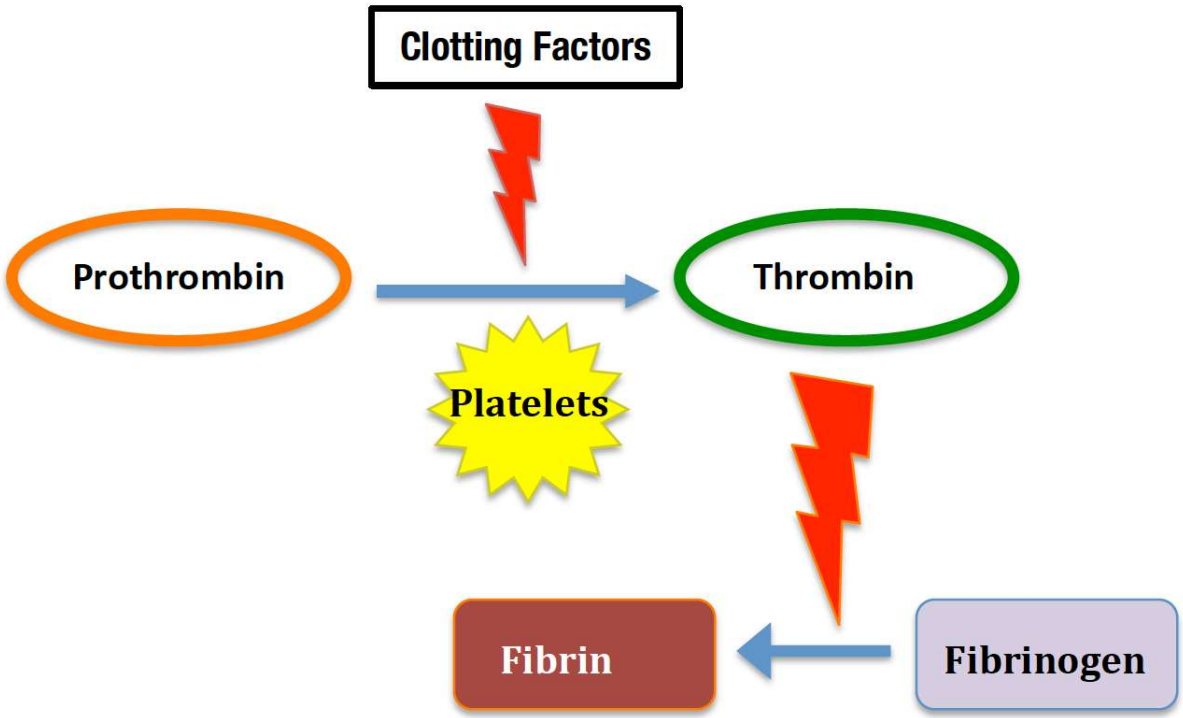


Figure 5. The relationship between platelets and fibrinogen during blood clotting. Panel A, normal clot firmness is generated by normal levels of platelet (open circles) and fibrin(ogen) (black lines); Panel B, reduced clot firmness is observed when platelet and fibrin(ogen) levels are reduced; Panel C, clot firmness is restored by increased fibrin interaction in the presence of fewer platelets.



A clot = Fibrin and Platelets

Aim to keep fibrinogen >2g/L

The 50 rule

- > 50% blood volume loss without fluid replacement will be fatal
- Hb < 50g/L despite fluid replacement may cause organ failure/death

Fluid replacement

How much blood can you afford to lose?

- Blood is vital for oxygen delivery to organ cells
- Organ cell damage occurs with 50% blood volume loss if **NO** fluid replacement
- Organ cell damage does not occur until 100% blood volume loss if given equivalent fluid replacement

GIVING JUST FLUID CAN SAVE A LIFE

Average blood volume in 3rd trimester = 6L

Haemoglobin = 115 g/L

Blood loss = 50% of blood volume
No fluid replacement

Haemoglobin = 115 g/L

Blood loss = 50% of blood volume

But with fluid replacement

Haemoglobin = 56 g/L

How much fluid?

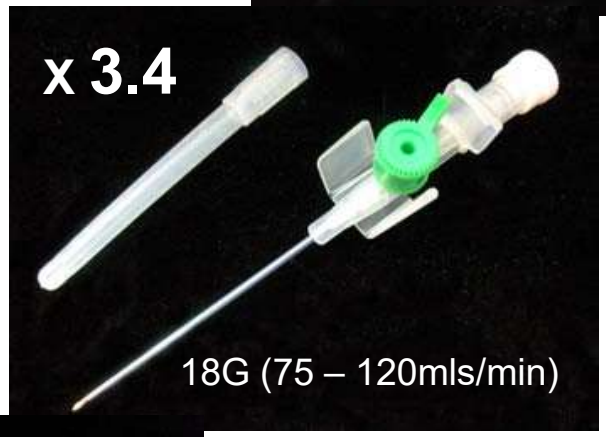
3 Fluid
to
1 Blood

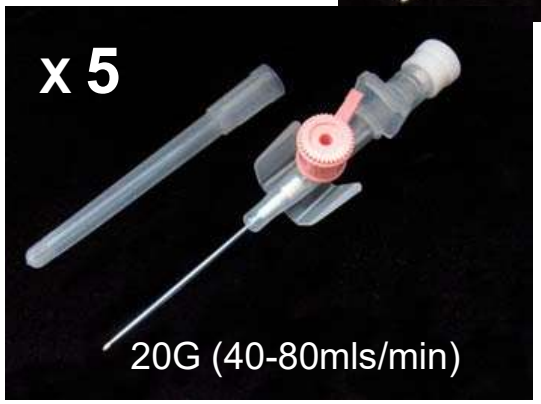
Warm Fluids Please

Ready available warm fluids

Rapid Infuser on standby

=





Relative flow rates

Uterine Blood Flow = 600mls/min

Cannula size matters!

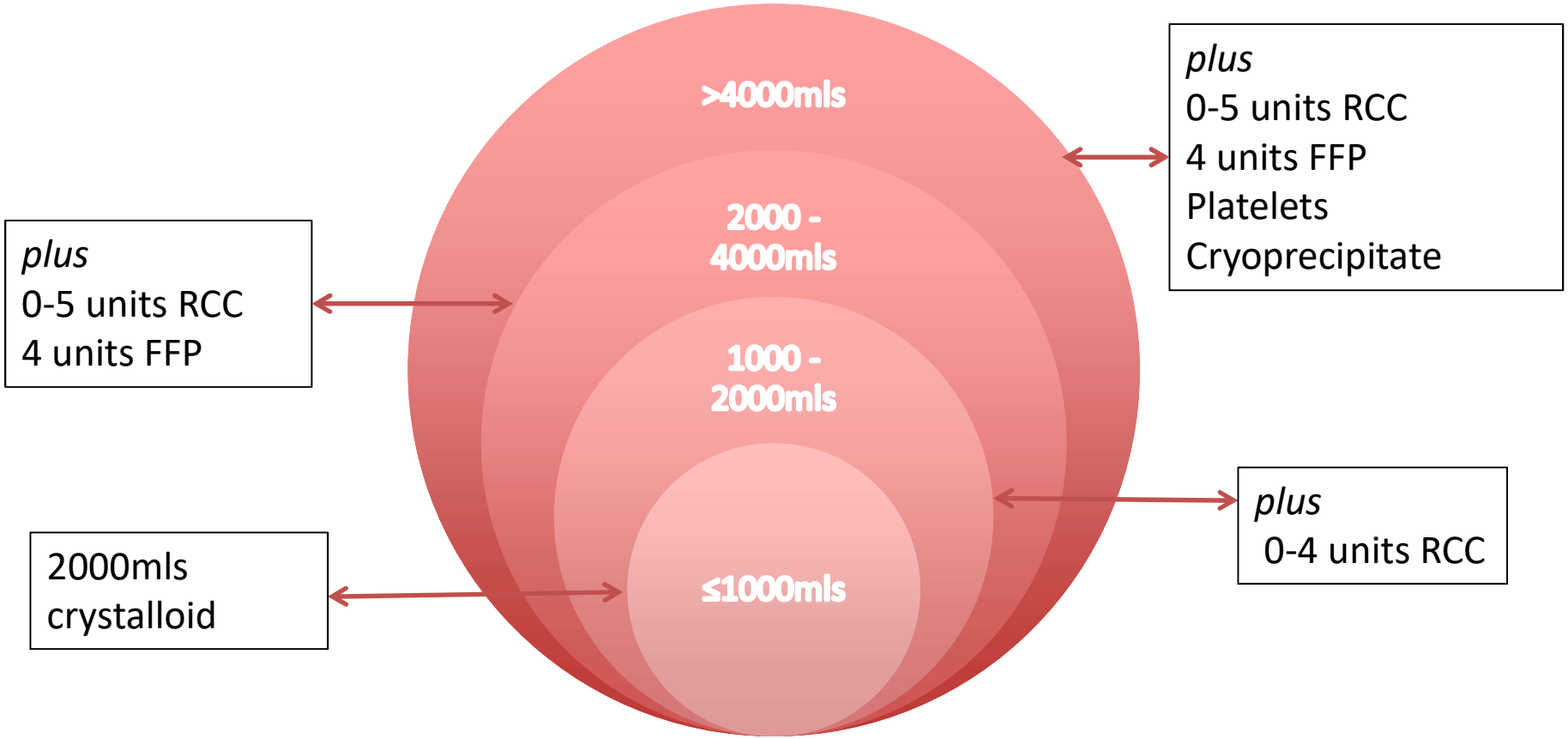
Putting it all back together again

Whole Blood Composition Compared with Component Therapy

	Whole Blood (1000 mL)	Component Therapy (1000 mL) [2 units PRBC + 1 unit platelets + 1 unit FFP]
Haematocrit	38-50%	28%
Platelets (K/µL)	150-400	90
Plasma Coagulation Factors	100%	70%
Fibrinogen (g/L)	3-6	5

Blood sampling after every 5 units RCC

Check FBC, fibrinogen, PT/aPTT, blood gases including lactate, Ca and K



How quickly can I get blood?

- O negative - should be immediate (local fridge)
- Group specific blood – 15 minutes ***after*** G&S sample received by lab
- Cross matched blood – 45 minutes ***after*** G&S sample received by lab

Remember to factor in portering time

Monitor the resuscitation

- Assess for shock and effectiveness of resuscitation : regular and **repeated** obs
- Respiratory rate and capillary refill useful signs
- Don’t rely on systolic BP as main sign
- Measure and record urine output
- Document resuscitation and treatment

Resuscitation Targets

Measurement	Target	Why
Heart rate	< 100	Adequacy of fluid resuscitation and DO_2
Blood pressure (systolic)	80-100mmHg	Adequacy of fluid resuscitation
Hb (HCT)	10 (30)	Optimal for DO_2 and clotting
Platelets	≥ 75	Clotting
Fibrinogen	≥ 2g	Clotting
PT/APTT	< 1.5 x control	Clotting
Lactate	≤ 2.5mmol/L	Adequacy of fluid resuscitation and DO_2
Base deficit	≤ -2.0 mEq/L	Adequacy of fluid resuscitation and DO_2
Calcium	>1.1 mmol/L	Clotting
Temperature	$>35^0C$	Clotting

STOPPING THE BLEEDING: TREAT THE CAUSE

Treat the Cause

There may be more than one!

Tone
70%

Tissue
9%

Trauma
20%

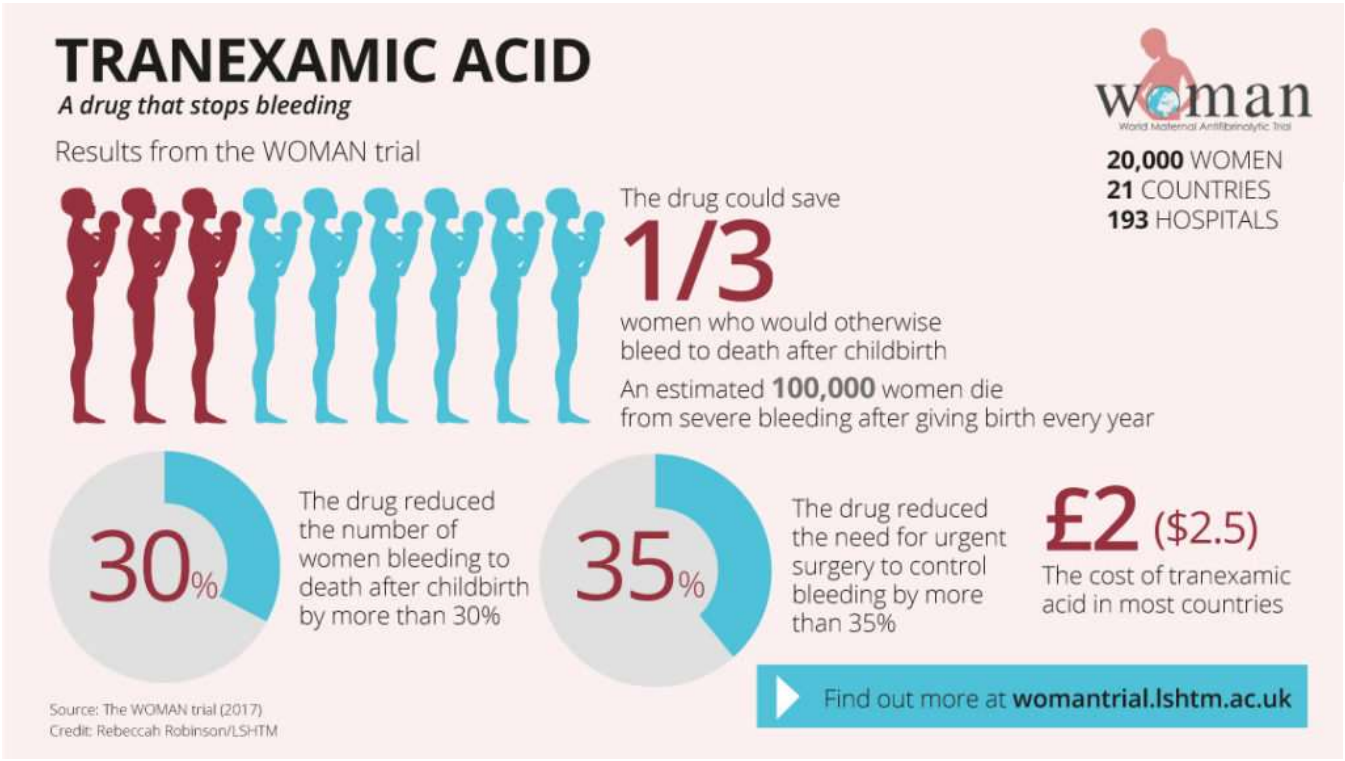
Thrombin
1%

Uterotonic management

- Rub up the uterine fundus
- Empty bladder
- Oxytocin 5 iu, slow IV (repeat if necessary)
- Ergometrine 0.5 mg, slow IV or IM
- Oxytocin infusion (40 iu in 500 ml)
- Carboprost 0.25 mg IM every 15 minutes up to 8 times
- 0.5 mg Misoprostol 800 micrograms sublingually

RCOG GTG No. 52 (2016)

Tranexamic Acid



- Give 1g IV over 10 minutes
- Repeat dose 1 g at 30 minutes if bleeding persists

Other measures. Seeking other causes

- Transfer to theatre for EUA and resuscitation
- Intrauterine balloon: Tamponade Test (for atony only)
- Laparotomy: Brace suture, artery ligation, hysterectomy
- Interventional radiology: uterine artery embolisation

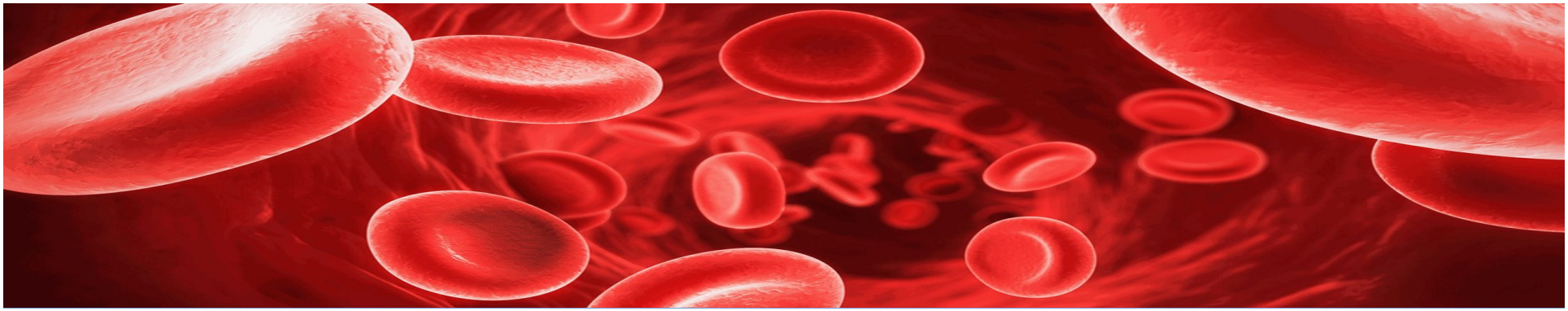
Success rate 87-91%

Tamponade Test

Positive: If PPH controlled by balloon inflation then laparotomy not needed
Negative: If continued PPH despite balloon inflation then needs laparotomy

Summary

- Be prepared
- Recognise
- Communicate
- Team work
- Resuscitate
- Treat and stop the bleed



https://youtu.be/3aKse0HbAac