Massive transfusion: what can go wrong?

Dr. Paula Bolton-Maggs and
Julie Ball
Serious Hazards of
Transfusion Scheme
UK

Serious Hazards of Transfusion

- UK national reporting scheme
- Started 1996, 20 years cumulative data
- 100% UK national health service hospitals participate
- Changes in practice to enhance transfusion safety
- 78% reports are related to error
- Continuous evolution as new threats emerge

Background

- The UK national patient safety agency (NPSA) was set up in 2001 to identify trends and patterns in patient safety problems through a national reporting and learning system (NRLS)

- Between 2005 and 2010
  - 11 deaths reported
  - 83 incidents in which patients were harmed as a result of delayed provision of blood in an emergency

NPSA ‘Rapid Response Report’ October 2010

NHS
National Patient Safety Agency

Rapid Response Report

NPSA/2010/RRR017

From reporting to learning

21 October 2010

The transfusion of blood and blood components in an emergency

Issue

The urgent provision of blood for life threatening haemorrhages requires a rapid, focused approach as excessive blood loss can jeopardise the survival of patients. Early recognition of major blood loss and immediate effective interventions are vital to avoid hypovolaemic shock and its consequences. One such action is the rapid provision of blood and blood components, for which effective communication between all personnel involved in the provision and transportation of blood is key.

For IMMEDIATE ACTION by the NHS and independent (acute) sector. Actions should be led by an executive director nominated by the Chief Executive, working with the Chair of the Hospital Transfusion Committee. Deadline for ACTION COMPLETE is 26 April 2011.

Actions required 1

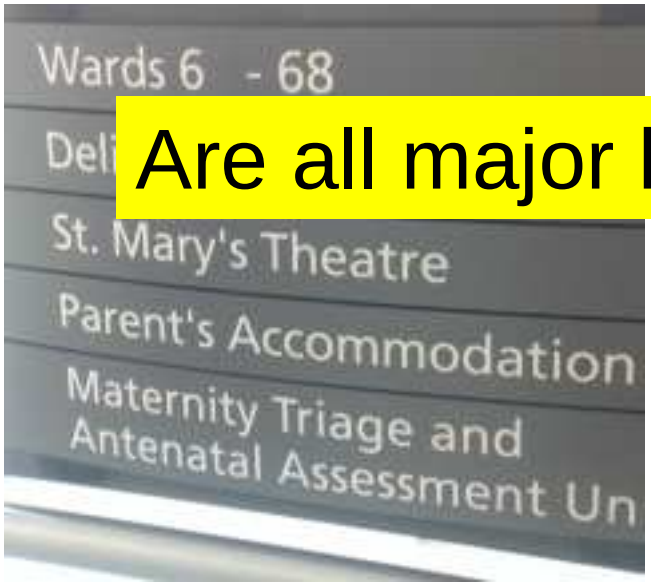
- Hospital transfusion committees to review local practice for requesting and obtaining blood in an emergency
- Local protocols to enable release blood and components without authorisation by a haematologist
- Know where to find the major haemorrhage protocol (MHP) and have practice drills
- Transfusion laboratory to be informed

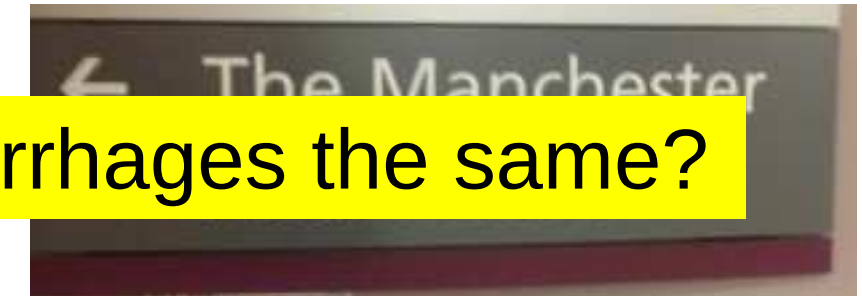
Actions required 2

- Clinical teams to appoint a co-ordinator
- Trigger phrase for start and all subsequent communications
- All instances of delay to be reported to SHOT and investigated locally
- Review all incidents where the MHP has been activated

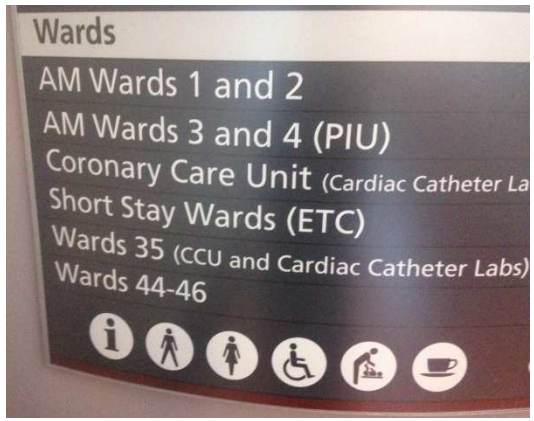
Risks

- Failure to identify the patient correctly
- Delay in transfusion





Are all major haemorrhages the same?



Team: grades of people activating MHP in Manchester audit

Train the whole team
Designate a team leader

Junior nurses /midwives	Senior nurses	Senior midwives	Middle grade docs	Consultants	Docs grade unknown
29%	**14%**	**9%**	**14%**	**10%**	**24%**

FBC
Coag including fibrinogen
Biochemistry
Transfusion
Blood gases

Testing

get those pretransfusion samples urgently to the laboratory

Transfusion

Traceability is the law

Incompatible transfusion in a person with multiple trauma transferred several times

- A 27 year old male with major trauma was grouped at the first emergency hospital as **O D-positive**, was transferred to a larger hospital where he was grouped as **A D-positive** – the sample was from another patient.
- He received multiple transfusions (4 units of O D-negative and 24 units of A D-positive red cells, 5 units of group A platelets in addition to AB FFP).
- He subsequently received care in 3 further hospitals. At the first of these he was noted to have a transfusion reaction with evidence of haemolysis which complicated the management of his major trauma, but he made a full recovery without needing renal dialysis

Wrong blood in tube

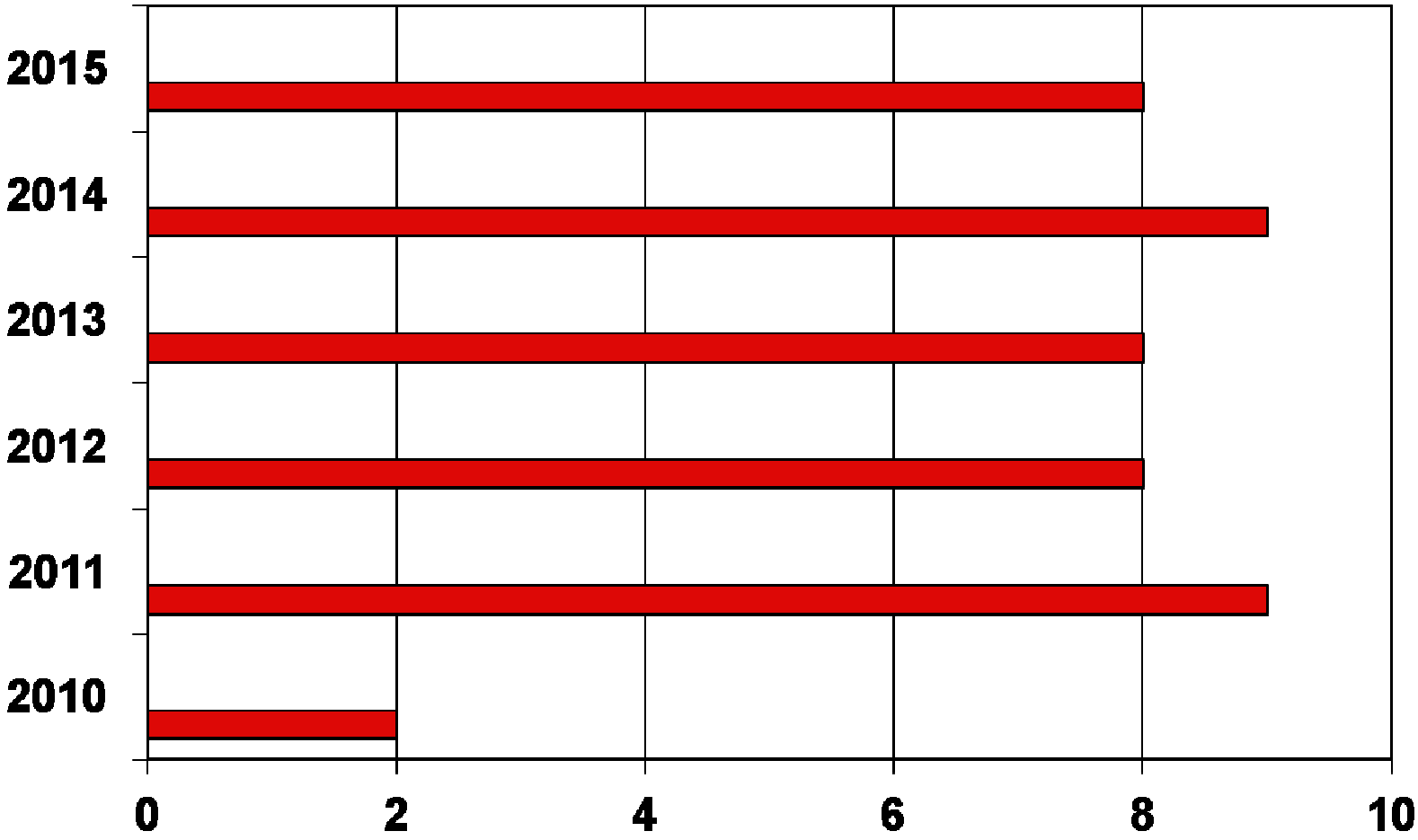
Red cells administered by doctors in theatre without checking

- A 69 year old man was in theatre undergoing emergency repair of an abdominal aortic aneurysm
- A junior doctor collected an incorrect unit of group A D-positive blood from the theatre fridge
- The identity of the unconscious patient, who was group O D-positive, was not checked against the unit of blood and it was administered by an anaesthetist.
- The patient developed renal failure post operatively which resolved, and which may in part have been due to the incompatible transfusion

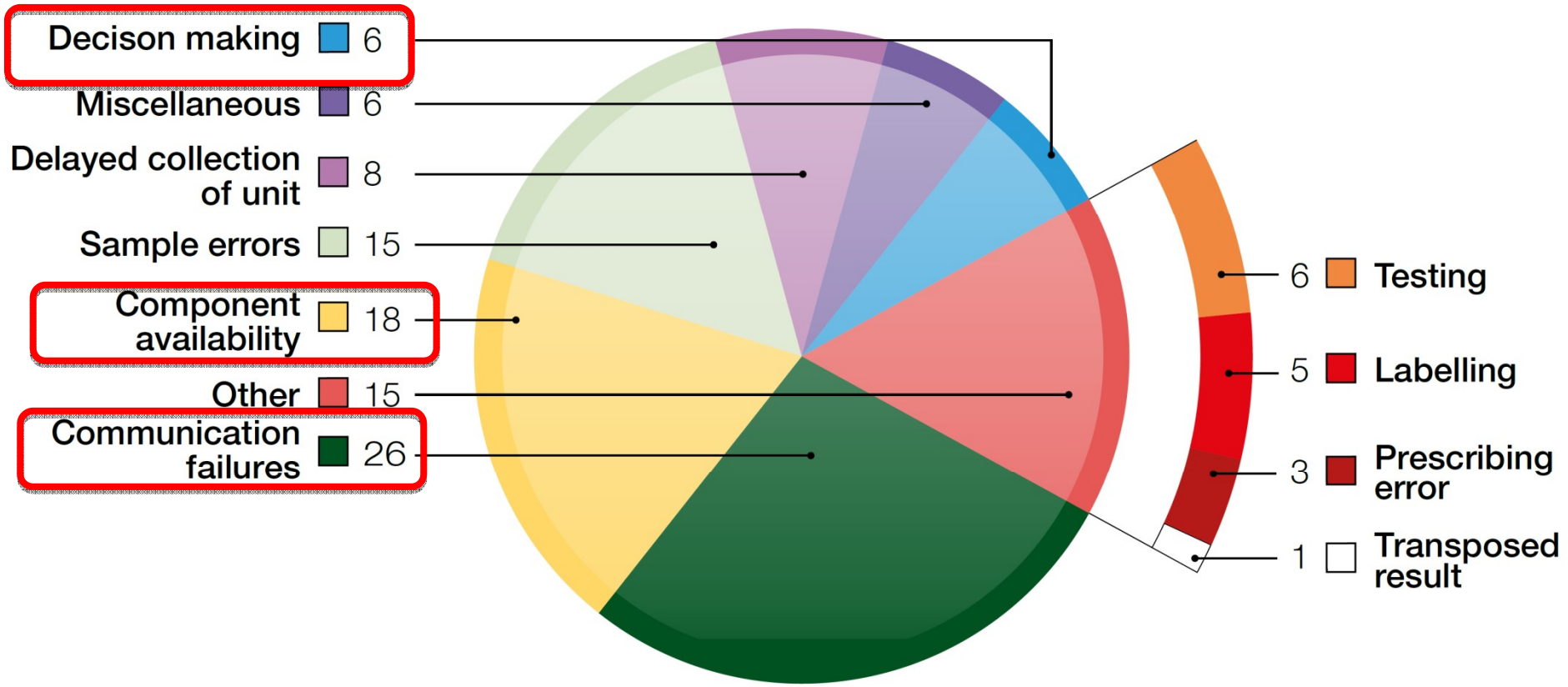
Delayed transfusion headlines 2010-2015

- 213 reports of delayed transfusion
- 16 deaths where delayed transfusion was causal or contributory
- 19 instances of major morbidity – defined by SHOT as life threatening episode requiring immediate intervention
- 44/213 associated with massive haemorrhage protocols
- 2/213 reports of delay due to problems obtaining a ‘group check’ sample

Delayed transfusions involving massive haemorrhage by year 2010-2015 n=44



Reasons for delay 2015 (n=94)



Death from obstetric haemorrhage 2011

- A 34 yr old woman had an unexpected severe post-delivery bleed (vaginal)
- MHP activated, 6 units arrived within 5 minutes
- Transferred from labour ward to OR, bleeding from cervical tear controlled within 30 minutes
- MHP stood down, 2 units transfused
- 2 hours later developed shock and could not be resuscitated despite 12 units of blood and 3 FFP
- *Causes: 2 locations, shift change, two teams*

Cascade the correct information

- 31 year old male was admitted to the ED with acute blood loss
- Massive haemorrhage alert initiated
- An incorrect trigger phrase confused hospital switchboard who then did not cascade the alert
- The porters were not informed of the alert (as policy) so did not attend event as expected
- Delay in delivery of emergency components to the clinical area
- The patient received 2 units of O D negative blood due to the delay

The fire alarm

Obstetric major haemorrhage with delay in transfusion caused by a fire alarm

- A 40 year old woman was undergoing elective caesarean section and started to bleed excessively. At the same time, the fire alarm sounded
- The obstetrician and theatre staff were aware of the alarm, but continued with management of the bleeding
- Outpatient areas were evacuated and staff in delivery and theatre were kept updated on the incident
- Urgent bloods were sent to haematology by the tube system and the laboratory was telephoned to alert them to the need for urgent analysis and a need for blood components

Haemorrhage and fire alarm

- However, there was no answer so an assumption made that the laboratory had been evacuated – the transfusion department was left unattended (against hospital policy)
- The general manager (outside the building with evacuated staff) was contacted and located haematology staff who were cleared to return to the laboratory
- Blood samples were analysed and major haemorrhage pack was requested
- Once samples had been received in the laboratory there was a delay in sending blood products to theatre

Root causes

- Lack of communication between fire co-ordinators and pathology services
- No understanding of consequences of evacuating the laboratory
- Senior lab staff not told what was happening and not able to get update
- Maternity staff failed to use bleep despite knowing lab had been evacuated
- Medical staff ignorance about MH pack (what it contains and how to get it)

What did they do?

- Meeting between fire service and blood transfusion manager – agreed transfusion is an essential service and should not be evacuated unless absolutely necessary
- New policy in transfusion when asked to evacuate the laboratory
- All transfusion staff to be informed about new procedures
- Maternity staff to have training about major haemorrhage

Fire alarm during massive haemorrhage (Case 2)

- 08:30 The transfusion laboratory was informed that a unit of emergency O D-negative blood had been transfused
- 08:40 a second unit of emergency blood had been used for the same patient. Within the next 5 minutes the laboratory issued and replaced the O D-negative units that had been used
- 09:30, the patient's Hb was now 30g/L (result from blood gas analyser) and further units were requested urgently. 09:40 the pre-transfusion sample testing was incomplete so 6 emergency uncrossmatched red cell units were issued

Hitches....

- However, the compatibility label printer ran out of labels (these are essential), so 3/6 not yet labelled
- The fire alarm went at the same moment
- 09:43 The BMS were instructed to leave the department so decided to take all 6 units to the clinical area and informed clinical staff that they could be given
- The TP remained in the lab but was forced to leave the building by managers who would not say if this was a drill or not
- 09:53 After the drill the coagulation tests were finalised, fibrinogen <1g/L so fibrinogen concentrate was issued

Conflicting polices: Fire policy to evacuate immediately
Against transfusion policy to have no compatibility labels and in breach of BSQR

What to do?

- Trust fire policy: for non patient areas: that all staff and visitors must leave the building, which includes the lab
- A formal risk-assessed fire drill procedure was developed which includes the provision of continuous transfusion services by relocating emergency supplies to a remote refrigerator
- This TP was put in contact with the other reporter to learn from their event

Does your hospital fire policy include transfusion as an essential service?

When safe blood is not safe

(O D-neg red cell units are incompatible with anti-c)

Where there are safety concerns, but clinical harm to patients from withholding blood altogether outweighs these, then alternative emergency blood is essential and should be offered
(e.g. O D-, O D+, group specific, or ABO full Rh & K matched, depending on the scenario)

Emergency O D-negative blood used when unsafe because the patient has irregular red cell antibodies (1)

- A 53 year old woman was known to have a complicated antibody history (anti-E, anti-K, anti-Jk^a, and a positive direct antiglobulin test)
- The BMS in the hospital transfusion laboratory advised the ward staff that a repeat sample would need to be taken if the patient required transfusion
- No repeat sample was sent then, nor before an elective surgical procedure, angioplasty of her foot, which began in the radiology department 2 days later
- The patient began bleeding during surgery and was transferred from the radiology intervention room to theatre for vascular surgery

Emergency O D-negative blood used when unsafe because the patient has irregular red cell antibodies (2)

- Blood was requested, a sample sent, but this **sample was clotted** and the **request form was also incorrect** so that the laboratory staff required a repeat sample
- The surgical staff told the laboratory the urgency of the situation. The anaesthetist determined from near patient testing that the Hb was 31g/L, and transfused emergency O D-negative units
- The BMS realised that emergency O D-negative units had been removed from the satellite refrigerator (computer flag) and alerted the doctor that the patient had many antibodies. However the patient was now stable. The patient died unrelated to the transfusion a few hours later

Emergency O D-negative blood used when unsafe because the patient has irregular red cell antibodies (2)

- Blood was requested, a sample sent, but this **sample was clotted** and the **request form was also incorr** so that the laboratory staff required a repe
- The surgical staff tol he situati ent testing used emergency O D-ne
- The BM alised that emergency O D-negative units had been removed from the satellite refrigerator (computer flag) and alerted the doctor that the patient had many antibodies. However the patient was now stable. The patient died unrelated to the transfusion a few hours later

Radiology staff were ignorant of MHPs and there is no provision for transfusion training in their curriculum

A combination of several factors contributes to delayed transfusion

- A patient was admitted with a two day history of melaena, with symptomatic anaemia with haemoglobin of 54g/L
- Four units of blood were requested. The BMS looked up the patient history and found a previous record of anti-c, anti-E and anti-S
- The BMS knew that appropriately crossmatched, antigen-negative blood would have to be provided from the Blood Service. He phoned the ward to ask for additional samples for dispatch to the Blood Service

- The BMS telephoned the Blood Service to inform them that samples were being sent
- The staff at the reference laboratory asked the BMS to screen the sample and let them know the result. The BMS's recollection of this conversation left him with the impression that the staff at the reference laboratory were 'leaving it with him'. He proceeded to screen the blood for antibodies

Misunderstanding: communication failure

I need it now!

- The doctor then phoned the BMS; the patient's blood pressure was falling - 'what is the backup scenario?' The BMS informed him that he could crossmatch the blood and issue the most compatible if that was required
- The BMS completed the antibody screen and crossmatched the blood. As there were no reactions he issued the four units of red cells
- The reference laboratory staff then called the BMS to check the results of the screening test as they had not heard back from him
- They advised that the issued units should be recalled and that they would send 4 units of appropriately antigen-negative blood. The BMS phoned the ward but did not recall the units.

I need it now!

- The doctor then phoned the BMS; the patient's blood pressure was falling - 'what is the backup scenario?' The BMS informed him that he could crossmatch the blood and issue the most compatible if th
- The BMS completed the antibody screen and crossmatched the blood. As there were no reactions he issued the four units of red cells
- The reference laboratory staff then called the BMS to check the results of the screening test as they had not heard back from him
- They advised that the issued units should be recalled and that they would s negative blood. T recall the units.

Wrong answer

Because they were not antigen-negative and could lead to DHTR

It always pours....

- He started to crossmatch the antigen-negative blood received from the blood service but ran in to problems with the analyser
- He telephoned a colleague at another hospital and was advised not to attempt to fix the analyser but to revert to manual crossmatching

Definitely swimming out of his depth

- The BMS was not familiar with this process (his discipline being biochemistry). He found the SOP and proceeded with the crossmatch, but the pipette was not working and there was a reagent problem
- He therefore reverted to trying to fix the analyser and reported being increasingly worried and tired and probably increasingly unable to think clearly
- When the day shift took over the units were immediately recalled but 2 units had been transfused. No reaction was reported

On call staff from other disciplines must be adequately trained and have back up

Life-threatening bleeding

Make sure you know your Major Haemorrhage Protocol

Delay in transfusion: emergency repair of Abdominal Aortic Aneurysm

- An elderly man was undergoing repair of AAA. There was delay in delivery/transport of crossmatched blood from the laboratory to theatres
- Uncrossmatched group O blood was available but not used by clinicians despite BMS advice to do so
- Transfusion was delayed for 2 hours 20 minutes after laboratory received the sample
- The patient sustained a cardiac arrest during the procedure; at this stage he had been transfused with 3 units of red cells

- The major haemorrhage protocol was activated only when the estimated blood loss was 3 litres
- Other components of major haemorrhage pack were not issued for an additional hour because of conflicting messages regarding the request received in the lab

Known high risk procedure for blood loss
MHP drills
Clear lines of communication with a co-ordinator

More haste less speed

- A 66 yr old man was transferred from hospital A to B (vascular unit) for repair of ruptured aortic aneurysm
- Delayed provision of MHP because the ambulance staff gave the wrong date of birth to hospital B
- Blood samples were delayed reaching lab and not marked as urgent
- *Cause: in emergencies people may hurry and panic resulting in time-consuming errors*

Death follows unrecognised post-operative bleeding

- A 66 yr old man had uneventful spinal surgery on a Thursday. High risk (previous IHD, on warfarin for recurrent VTE)
- Transferred from HDU to ward on Friday, heparin infusion, warfarin restarted
- Saturday high heparin level and inadequate monitoring. No clinical notes made on Sunday
- Midnight Sunday to Monday morning he was hypotensive and had a short loss of consciousness

Death from occult post-operative bleeding

- Throughout Monday, raised pulse, low BP and poor urine output
- Failure to recognise likelihood of concealed haemorrhage
- Retroperitoneal bleed diagnosed at 17:00h
- Resuscitation was slow, 2 units of blood given and the patient died later that night
- *Cause: delayed recognition by junior doctor of shock, slow response and poor leadership*

Cardiac arrest follows delayed admission to the Emergency Department

- An elderly woman collapsed at home but the ambulance was ‘stacked up’ waiting outside the emergency department for 3h
- A further delay of 2h occurred before assessment when her Hb was found to be 38g/L and she was noted to have melaena
- She suffered cardiac arrest
- The MHP was activated and she received O D-negative blood while further units were crossmatched. She made a full recovery

Failure in correct patient identification contributes to fatal delay in transfusion

- An elderly woman for elective aortic aneurysm repair. The aneurysm had been identified when she attended the emergency department (ED) with gastroenteritis
- Transferred to another hospital – inpatient for several days. On admission for surgery a week later, blood samples were taken and 6 units crossmatched
- When the blood was required in theatre a discrepancy in the spelling of the patient's name was discovered. The units were returned to the transfusion laboratory according to the hospital protocol
- There was subsequently a delay in transfusion which contributed to her deterioration with development of coagulopathy and death later that night

How did this happen?

- The name was entered incorrectly into the patient information system. This was discovered prior to her admission when checking against her general practitioner records, the electronic patient record was then updated, but not the hard copy case records
- On admission the wristband was correct. However this was not accessible at surgery (under drapes) so the blood bags were checked against the hardcopy notes which still had the wrong spelling. Two new blood samples were sent to the laboratory who advised a delay of 45-50 minutes to provide crossmatched units
- However, surgical complications followed requiring urgent transfusion but emergency group O D-negative units were not stored in the theatre refrigerator as it had inadequate temperature control so that there was a delay in arrival in theatre.

The root cause analysis (RCA) identified several issues:

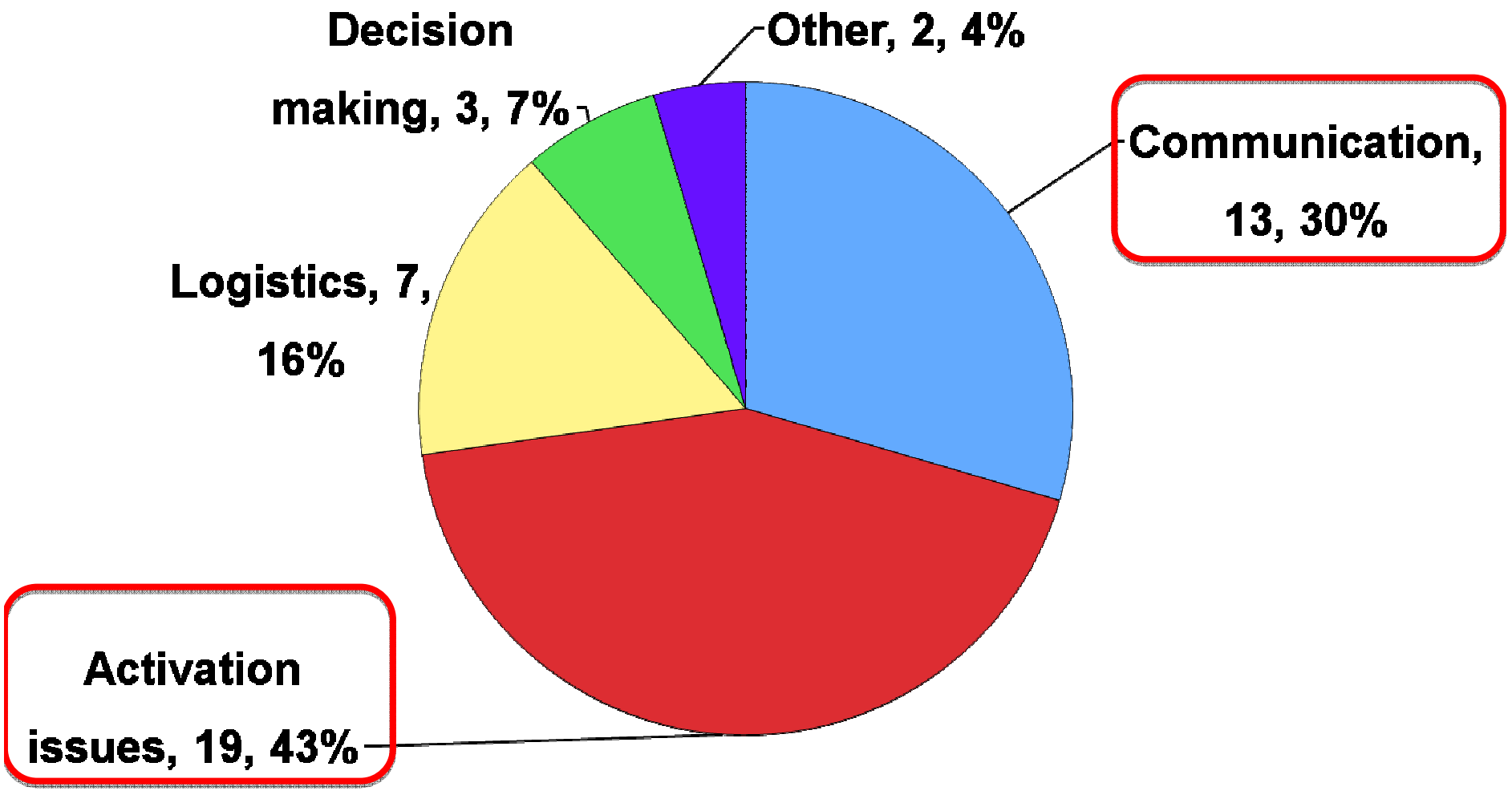
- Failure to initiate a major haemorrhage call
- Poor communication between surgeon and anaesthetist
- Incorrect patient identification labels in the patient records
- No contingency plan for storage of emergency O D-negative blood
- Blood gas machines not functioning
- Several documentation issues

What about provision of components?

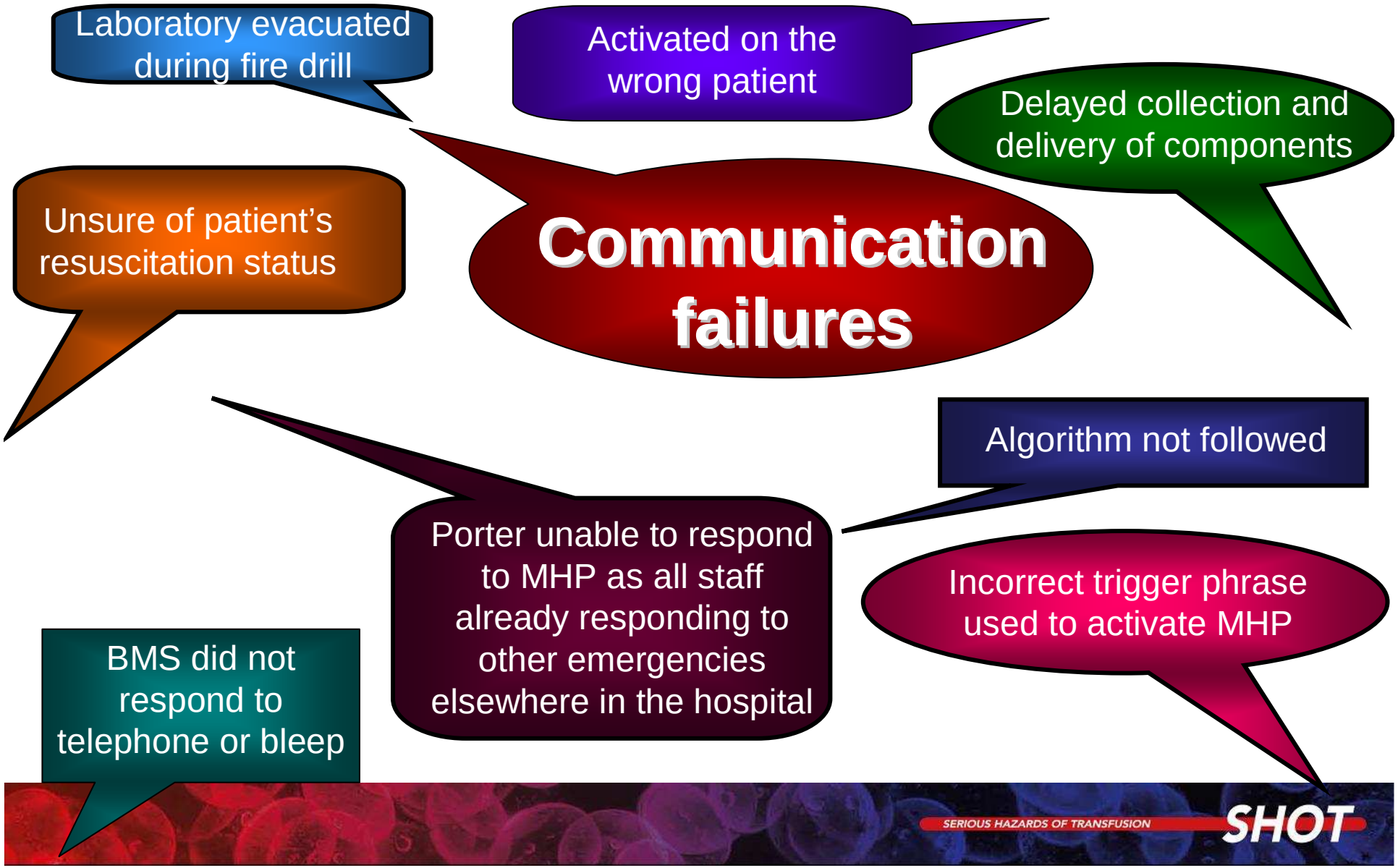
- Observational study of major haemorrhage management in trauma – 22 UK hospitals
- 442 patients, median age 38 yrs and 74% male
- There were delays in administration of blood. Platelets and cryoprecipitate were either not given, or transfused well after initial resuscitation
- Patients who received a cumulative ratio of FFP to red cells of at least 1:2 had lower rates of death than those who received a lower ratio

Stanworth et al. Br J Surg 2016

Reasons for transfusion delays in MHP



Massive haemorrhage reports n=44



Key Learning Points

- Good patient ID at all stages
- Appropriate assessment and prescription
- Communication with laboratory
- Early release of components by laboratory
- Clear instructions / easy to follow protocol
- Continue to sample, monitor and observe during a transfusion


Trigger phrase
Inform
Transfusion boss
Discuss
Clinical assessment
Policy
Review
Practice
Team leader
Runners
Debrief
Contact
Transport
Porters
Stand down
Communication lead
Drill
Protocol
Communication
Alert
Telephone

Other general points

- Management of major haemorrhage is a multidisciplinary process; adapt for different clinical areas
- Every hospital should have a major haemorrhage protocol and practice drills
- Good communication between clinical and laboratory areas is essential – team leader and runner
- Transfusion steps must be completed safely particularly patient identification
- A blood sample must be sent for grouping before starting transfusion of emergency O D-negative units
- Where patients are transferred between departments and hospitals handover must be careful and complete

Inform the laboratory

Acknowledgements

- Julie Ball, SHOT incident specialist
- Debbi Poles, SHOT data analyst
- Hospital reporters