Human Factors and Transfusion Errors

Serious Hazards of Transfusion
The UK haemovigilance scheme

Paula Bolton-Maggs
Medical Director, SHOT
Data from 1st SHOT Report (1997)

- **TTI**: Transfusion-transmitted infections (7 survived, 1 death)
- **PTP**: Post-transfusion purpura (10 survived, 1 death)
- **TRALI**: Transfusion-related acute lung injury (9 survived, 2 deaths)
- **GvHD**: Graft vs host disease (4 survived)
- **DHTR**: Delayed haemolytic transfusion reaction (27 survived, 2 deaths)
- **ATR**: Acute (allergic type) reaction (26 survived, 1 death)
- **IBCT**: Incorrect blood component transfused (80 survived, 1 death)
The greatest risk from transfusion is that somebody will make a mistake.
SHOT Cumulative data: 18 years  n=14822

- UCT: Unclassifiable complications of transfusion
- PTP: Post-transfusion purpura
- TTI: Transfusion-transmitted infection
- TAD: Transfusion-associated dyspnoea
- CS: Cell salvage
- ATR: Acute transfusion reaction
- TAGvHD: Transfusion-associated graft vs host disease
- TRALI: Transfusion-related acute lung injury
- Allo: Alloimmunisation
- TACO: Transfusion-associated circulatory overload
- HTR: Haemolytic transfusion reaction
- ADU: Avoidable, delayed or undertransfusion
- HSE: Handling and storage errors
- Anti-D: Anti-D immunoglobulin errors
- IBCT: Incorrect blood component transfused

**Transfusion reactions which may not be preventable**

**Possibly or probably preventable by improved practice and monitoring**

**Adverse incidents due to mistakes**
In 2013 & 2014 SHOT found 78%...?

78% of Higher Ed CIOs said their departments have little or no ability to stop students from using information technology to cheat.

78% SHOT reports result from human error.

78% Dutch do not know the traffic rules.
“Learn from the mistakes of others. You can’t live long enough to make them all yourself.”

Eleanor Roosevelt
United Airlines Flight 173

- 28 December 1978, UA173 flight crash-landed due to lack of fuel, while circling to resolve a problem with the landing gear.
- Captain’s perception of elapsed-time failed while trying to fix the landing gear problem.
- Flight Engineer tried to intervene, but failed, partly due to issues of flight deck hierarchy.
- Investigation led to introduction of airline Crew Resource Management from 1981.
Transfusion safety – 3 critical factors in patient safety

- Identification
- Documentation
- Communication

But these apply in all areas of medical practice
Not just in transfusion practice:

‘Official figures show that at least 8000 patients a year are killed or severely harmed needlessly by drug errors’ - a report by Jane Reid

‘We should design errors out of the system by making them much harder or impossible to commit’ - Leading article
Boy's leukaemia was missed 35 times

Tom Whipple

A toddler died of leukaemia after medical staff repeatedly failed to diagnose the condition over 35 separate visits to doctors and hospitals.

A coroner has said that he will be writing to the Wolverhampton GP practice of Ryan Bhogal to ask how the his condition went undiagnosed for so long, despite numerous “red flags” indicating the disease.

Ryan died at Birmingham children’s hospital on September 11 last year, days after being admitted. He was 20 months old. Between December 2014 and September last year he had 12 trips to his GP, six to New Cross hospital in Wolverhampton and 17 to walk-in centres. The inquest heard that on all those occasions doctors failed to link key symptoms, such as bruising, a rash, bleeding gums, a lump on his head and a tendency to fall over.

Zafar Siddique, the coroner, said he was particularly concerned that the hospital did not have access to Ryan’s GP records, possibly prolonging the time taken to link the symptoms to leukaemia and order a blood test that could have saved his life.

Dr Indira Wariyar, from the Raynor Road medical centre, saw the boy four times and said that a lack of medical continuity could be to blame for the missed opportunities to help him.

Dr Prashant Hiwarkar, from Birmingham children’s hospital, said a blood test in August, when he presented at New Cross hospital, would have detected leukaemia.

“If Ryan’s gums were bleeding on August 9 and still red and bleeding on August 18 this would be a red flag for me,” he said. “I would have asked for a blood test. I believe you would have seen signs of an abnormal blood count.”

Although Ryan suffered from an aggressive form of leukaemia, those who have it diagnosed early still have about a 50 per cent chance of survival.

Recording a death from natural causes, Mr Siddique said: “I will write to the GP practice to discuss the care of Ryan and, in particular continuity, as he was seen by a number of different doctors. I will also write to New Cross hospital.

“I have concerns about lack of access to GP medical records for patients, which was certainly so in Ryan’s case. I want improvements to be made.”

Gurpal Bhogal, the boy’s aunt, said in a statement after the inquest: “Raynor Road medical centre and New Cross hospital failed Ryan time and time again. There was also a failure in that medical records at New Cross hospital were not available. A simple blood test should have been carried out and there were many missed opportunities to do this. But this was never done. Lessons have to be learnt from this.

“However, we would like to thank the doctors and nurses at Birmingham children’s hospital for the care Ryan received during his two days there.”

Speaking during the inquest his father, Kulvinder Bhogal, described watching his son die. “Seeing him lying there attached to a machine was heart-breaking. I walked away from the ward with tears in my eyes. He was my world.”
1,000 deaths blamed on errors by A&E staff

More than 1,000 hospital patients have died after mistakes by overstretched A&E staff in the past five years. A further 2,539 suffered “serious harm” from poor care. People have been told to stay away from A&E unless “absolutely necessary”. The NHS National Patient Safety Agency found that 1,089 patients have died after errors linked to poor care since 2010. Last year there were 247 deaths, up from 218 the year before. In 2012-13 there were 201, compared with 206 in 2011-12 and 217 in 2010-11. Critics said that the loss of dozens of A&E departments had increased the strain on the remaining 164 units.

Death from septicaemia
Lethal intrathecal vincristine 2001

- 18 yr old in CR from ALL died 4 weeks after the event
- 14 separate factors
- Swiss cheese model
- Communication and hierarchy
- Assumptions and ‘newcomer syndrome’
- Physician and pharmacy error in 69% of 55 cases 1968-2006

Drugs sent together
An unexpected death

29 March 2005, Elaine Bromiley, a 37-year-old mother of two had routine minor surgery.

Anaesthetist’s perception of elapsed-time failed while trying to intubate.

Nurse tried to intervene, but failed, partly due to issues of theatre hierarchy.

This contributed to the introduction of the WHO Surgical Safety Checklist, 2009

(28 years after air industry’s Crew Resource Management in 1981)
Quotation from Independent Report into death of Elaine Bromiley

“So that others may learn, and even more may may live.”

Martin Bromiley, husband of Elaine, airline pilot and founder of Clinical Human Factors Group (CHFG)
To err is human (Pope)

• ‘Human Factors is using what we know about people to design safe, effective and efficient systems.’ Beverley Norris, Human Factors Lead, NPSA

• ‘Every system, process, machine, tool or act that a human devises, uses or does is prone to error and failure. The study of and the learning from this simple truth is the basis of Human Factors.’ Chris Seal, Airline and Military Pilot and Human Factors Consultant
Human factors

The science of optimising human performance through better understanding of human behaviour and interactions

Clinical Human Factors Group (www.chfg.org)

The Human Factors Concordat - National Quality Board, NHS England

‘Sign up to safety’ – NHS campaign
Learning from what goes wrong

• Concept of a ‘just culture’
• Incident reporting more likely if non-punitive – trust is critical
  – Avoid ‘omerta’ the code of silence
• Accountability
  – Looking backwards for a scapegoat to blame
  – Looking forwards to see what can be learned and changed to avoid recurrence

Just culture: Sidney Dekker 2nd ed. Ashgate 2012
Local newspaper
Front page headline:

What message does this give to hospital staff?

Two workers dismissed for putting patient's life at risk
Sign up to Safety

Harnessing the commitment of staff across the NHS in England to make care safer

Sign up to Safety is harnessing the commitment of staff across the NHS in England to make care safer. A patient safety campaign, it is one of a set of national initiatives to help the NHS improve the safety of patient care. Collectively and cumulatively these initiatives aim to reduce avoidable harm by 50% and support the ambition to save 6,000.
The five Sign up to Safety pledges

**Putting safety first.** Commit to reduce avoidable harm in the NHS by half and make public our locally developed goals and plans.

**Continually learn.** Make our organisation more resilient to risks, by acting on the feedback from patients and staff and by constantly measuring and monitoring how safe our services are.

**Being honest.** Be transparent with people about our progress to tackle patient safety issues and support staff to be candid with patients and their families if something goes wrong.

**Collaborating.** Take a lead role in supporting local collaborative learning, so that improvements are made across all of the local services that patients use.

**Being supportive.** Help people understand why things go wrong and how to put them right. Give staff the time and support to improve and celebrate progress.
Human factors

Sample taken from wrong patient

Death of patient
More near misses → fewer actual incidents of patient harm

- Giving a patient the wrong blood is the most dangerous transfusion error
Outcome of ABO incompatible red cell transfusions

66% have no adverse effect

15 deaths to 2005

4 deaths 2006-2014

BSQR

NPSA SPN 14

Competency assessments
SHOT Near Misses

- Data collected since 1999 on near miss errors
- Fully analysed since 2010 when electronic SHOT database began

Oops! I nearly hit him when overtaking.
Detection of incorrect transfusions and other error categories

Near miss vs actual cases
by SHOT category
2010-2013

Total errors analysed n=8282

- Incorrect blood component transfused: 2877
- Anti-D immunoglobulin: 1157
- Handling and storage errors: 1073
- Right blood right patient: 622
- Avoidable delayed or undertransfusion: 565

Number of reports

- Near miss
- Transfused

Category of report
Who was responsible for near miss samples?

- Doctor
- Nurse
- Midwife
- Healthcare assistant
- Phlebotomist
Reasons for wrong samples

- Patient not identified correctly
- Sample not labelled at bedside
- Sample not labelled by person taking blood
- Pre-labelled sample used
Wrong transfusions, where are the mistakes made?

Data for 2014

Near miss – 686 detected

Clinical

Laboratory errors

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Number of Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request</td>
<td>108</td>
</tr>
<tr>
<td>Sample taking</td>
<td>0</td>
</tr>
<tr>
<td>Sample receipt</td>
<td>76</td>
</tr>
<tr>
<td>Testing</td>
<td>55</td>
</tr>
<tr>
<td>Component selection</td>
<td>112</td>
</tr>
<tr>
<td>Labelling</td>
<td>11</td>
</tr>
<tr>
<td>Collection</td>
<td>28</td>
</tr>
<tr>
<td>Prescription</td>
<td>140</td>
</tr>
<tr>
<td>Administration</td>
<td>162</td>
</tr>
</tbody>
</table>
Near miss 2015

- 1240 reports (about a third of the total)
- Wrong component transfusions 887 (71.5%)
- Wrong blood in tube 780
- ABO-incompatible transfusions would have resulted in 289 (37.1%) cases
  - Actual ABO-incompatible red cell transfusions 7 (one death)

These are serious incidents but the solution is not to dismiss 289 staff, it is to understand why and change the process
Near miss incidents, where errors are caught by a barrier before harm is done, can be described as “free lessons” (James Reason, 2008)

Multiple errors are common – incorrect blood components transfused 2013 and 2014

- 69% failure to provide irradiated components
- 485 reports
- 1239 errors
Mortality from over-transfusion 2000-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Error</th>
<th>Outcome</th>
<th>Underlying diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/1</td>
<td>2</td>
<td>Unsuitable sample</td>
<td>Cardiac arrest</td>
<td>IHD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>GI Bleed</td>
</tr>
<tr>
<td>2001/2</td>
<td>2</td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>GI Bleed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>GI Bleed</td>
</tr>
<tr>
<td>2004</td>
<td>1</td>
<td>WBIT</td>
<td>TACO</td>
<td>Unknown</td>
</tr>
<tr>
<td>2005</td>
<td>1</td>
<td>Misdiagnosis haemorrhage</td>
<td>TACO</td>
<td>Acute abdomen</td>
</tr>
<tr>
<td>2006</td>
<td>2</td>
<td>Paediatric prescription</td>
<td>Cardiac arrest</td>
<td>Premature infant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>Fractured femur</td>
</tr>
<tr>
<td>2008</td>
<td>1</td>
<td>XS red cells</td>
<td>Polycythaemia</td>
<td>GI bleed</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
<td>WBIT</td>
<td>TACO</td>
<td>Carcinoma Fractured femur</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>Fractured femur</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>XS red cells</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
<td>XS red cells</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Total deaths by category 5 years - 2010-2014
n=67
Imputability 1-3

Delayed transfusions

ADU  ATR  HTR  IBCT  PTP  TAD  TACO  TAGVHD  TRALI  UCT
A different approach

- **Safety-I** Situations where nothing goes wrong and responses are **reactive** – responding to adverse events when they happen: fire-fighting

- **Safety-II** Working environment where things go right. It is **proactive** – adjustments to performance so that risky situations do not occur
Resilience

- The intrinsic ability of a system to adjust its functioning before, during or after changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.

- Requires the abilities to anticipate, to monitor and respond, and to learn.
‘Pull out! Pull out, you’ve hit an artery!’
Reality

- Standard operating procedures (SOPs) and protocols may work well in the lab and for the bedside check.

- They do not work so well in the busy complex clinical environment:
  - Multitasking is common
  - Distraction is everywhere
  - Assumptions…
Resilience
Managing the unexpected

Hudson river plane crash, 2009. Pilot Chesley Sullenberger saved all 155 lives
Red Devils parachutists collided at 1,800ft

- Both ended up hanging from a single canopy
- Too low to deploy an emergency parachute
- Crash-landed in a nearby marina

‘Remarkably, both men, who have completed more than 2800 jumps between them, were unhurt and within 10 minutes were enjoying a pie and a pint together’

Sunday Times, 21 June, 2015
Situational awareness - Noticing

- Sherlock Holmes - The curious incident of the dog in the night time
  ... it didn’t bark

- Noticing when things do not go as anticipated

- Learning from what works
Situational awareness - Noticing

• Level 1 of situational awareness is perception, or ‘noticing’

• Error reports from calendar year 2014 (n=2346) were searched for use of the words ‘noticed/noticing’

• Did ‘noticed/noticing’ link with prevention of patient harm, or were failures to notice the error associated with inappropriate patient management?
A unit of irradiated platelets was taken to the ward. A nurse noticed the irradiation sticker on the component was still red and the word **NOT** was still visible.

Although the component had been signed and dated as having been irradiated, the nurse contacted the laboratory to double-check.

The nurse was advised to return the unit as it had not been irradiated and thus prevented the patient receiving an incorrect unit.
‘Noticing’ is more likely in Near Miss cases

Analysis of SHOT reports in 2014 n=284/2346

<table>
<thead>
<tr>
<th>Category of SHOT error report</th>
<th>Near miss incidents</th>
<th>Actual incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect treatment prevented</td>
<td>105</td>
<td>27</td>
</tr>
<tr>
<td>Incorrect treatment occurred</td>
<td>61</td>
<td>91</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of reports mentioning ‘noticed/noticing’</th>
<th>Failure to notice</th>
<th>Positive noticing</th>
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Graph showing the distribution of reports mentioning 'noticed/noticing' in near miss and actual incidents, with categories 'failure to notice' and 'positive noticing'.
Are we looking from the wrong end?

- Most of the time, it goes right
- 2.7 million blood components issued in the UK in 2014
  - Risk of major morbidity - 1 in 16,000 (n=169 in 2014)
- Risk of transfusion death - 1 in 180,000 (n=15 in 2014)
  - Death from error (human factors) - 1 in a million
  - Death from TACO - 1 in 450,000 (Transfusion-associated circulatory overload)
- Comparison non-transfusion risks
  - Risk of death in a road traffic accident (UK) in any one year – 1 in 20,000 (on a population basis)
  - Medical complications in next year - 1 in 100,000
SHOT Symposium 2016
The Lowry Centre, Salford, Manchester,
Thursday 7th July 2016
Keynote speaker: Erik Hollnagel
Resilience in Healthcare

Registration deadline: Wednesday 29th June 2016
Abstract deadline: Friday 29th April 2016
Acknowledgements

- SHOT Team in Manchester
- SHOT Working and Writing Expert Group
- SHOT Steering Group
- UK healthcare organisations for reporting
Additional Information

Documents available on website: [www.shotuk.org](http://www.shotuk.org)

- SHOT reporting definitions
- Clinical Lessons
- Laboratory Lessons
- SHOT Bites

Also available:
- Annual SHOT reports
- Annual SHOT summaries
- Supplemental data