LESSONS LEARNT FROM HAEMOVIGILANCE IN GREAT BRITAIN AND EUROPE

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Haemovigilance schemes aim to collect data and analysis untoward effects of blood and blood component administration in order to correct their cause and prevent recurrence.

The objectives include

- To aid improvements in clinical care to reduce risk to patients
- To demonstrate to the public and professionals the safety of the existing systems
- Present risks and benefits in perspective
- Show that problems are recognised and effectively tackled - no "cover-ups"
- Improve public confidence

This was approached in the UK by forming the Serious Hazards of Transfusion scheme (SHOT). SHOT is a confidential, anonymised scheme for the reporting of serious adverse events of blood transfusion. Launched in November 1996 the data is used to inform policy in the transfusion services, improve standards of transfusion practice, aid production of clinical guidelines for the use of blood components and educate users on transfusion hazards and their prevention

Importantly the scheme is independent of the National Blood Services, being organised by representatives of interested Royal Colleges and professional bodies

SHOT invites reports of major adverse events complicating blood transfusion in the UK. It collects data on incorrect transfusions of blood and blood components (IBCT) and major immunological and infectious complications.

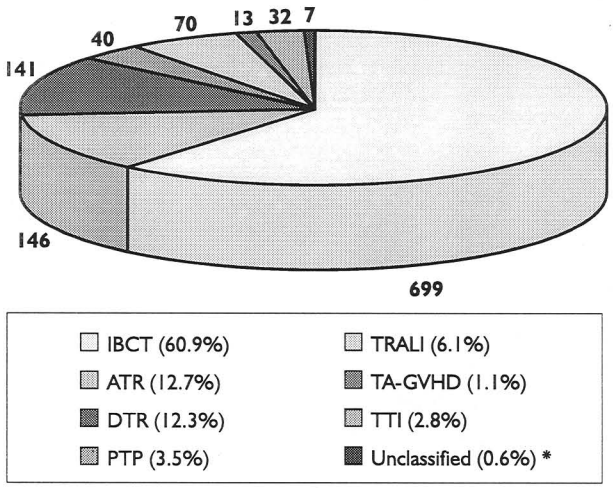
Hospitals report adverse events directly to the SHOT Office with 7 categories of events. These are

- Incorrect blood/component transfused (IBCT)
- Acute transfusion reaction (ATR)
- Delayed transfusion reaction (DHTR)
- Transfusion-associated graft-versus-host-disease (TA-GVHD)
- Transfusion-related acute lung injury (TRALI)
- Post-transfusion purpura (PTP)
- Transfusion transmitted infection, including bacterial contamination (TTI)

In addition a Near Miss events scheme attempts to obtain data for errors in the transfusion process which are detected before any blood or blood component is administered. It is hoped that these incidents will identify both the strong points and deficient areas in procedures.

Whilst the SHOT scheme is voluntary the overall participation is 92%. Of the 413 hospitals eligible to participate, 199 submitted initial reports and 180 indicated that they had seen no incidents.

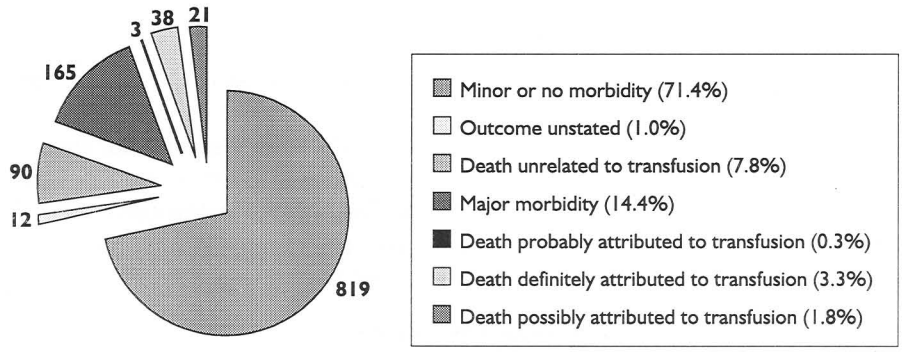
The breakdown of reports from 1996 - 2001 are shown below (Total = 1148)



Mortality and morbidity data for all events were requested, with morbidity being defined as the presence of one or more of

- Intensive care admission and / or ventilation
- Dialysis and / or renal dysfunction
- Major haemorrhage from transfusion induced coagulopathy
- Intravascular haemolysis
- Potential RhD sensitisation in a female of child-bearing age
- Persistent viral infection
- Acute symptomatic confirmed infection (viral, bacterial or protozoal)

Overall mortality/morbidity from 1996 - 2001 (Total = 1148)



Incorrect blood component transfused (IBCT) incidents are defined as "all reported episodes where a patient was transfused with a blood component or plasma product which did not meet the appropriate requirements or which was intended for another patient".

Cumulative data for the period 1 Oct 1996 - 31 Sept 2001, from the 1148 fully analysed questionnaires, has shown that 699 (60.9%) were IBCT incidents, comprising the largest single category. 161 were ABO incompatible transfusions leading to 9 deaths, with another 73 instances of RhD incompatibility. Other errors included failure to meet special requirements e.g. for irradiated components.

Categories of IBCT reported 1996 – 2001 (Total 699)

Category	No. of cases
Major ABO incompatibility	161
RhD incompatibility	73
ABO/RhD compatible	195
Other red cell incompatibility	37
Inappropriate transfusion	61
Special requirements not met	122
Anti-D	37
Other	1
Blood group not stated	**12**

Multiple procedural failures were identified in 49% of cases, with 112/699 reports having 3 or more errors in the procedures. 2 incidents were identified as having 7 failures in the process leading to the IBCT.

55% of errors arose at the point of collection from hospital storage site or at the time of administration, 28% in the hospital blood bank and 13% at the point of prescription, sampling or request.

Approximately 36% of hazards were immune complications (ATR, DTR, PTP, TRALI, TA-GVHD) The outcome in 70 fully analysed cases of TRALI included 18 deaths and 49 cases of major morbidity, making this the 2nd most common cause of transfusion-related morbidity/mortality after ABO incompatibility.

Immunological reactions - mortality and morbidity 1996 - 2001 (Total =410)

		ATR	DTR	PTP	TA-GVHD	TRALI
Deaths - imputibility	Definitely related	2	4	1	13	6
	Probably related	0	0	0	0	2
	Possibly related	4	1	1	0	10
	Unrelated	13	14	3	0	3
Major Morbidity		3	18	11	0	49
Minor or No Morbidity		121	103	24	0	0
Outcome unknown		3	1	0	0	0
TOTAL		**146**	**141**	**40**	**13**	**70**

In the first 3 years of reporting 12 cases of TA-GVD were identified but since the introduction of universal leucodepletion in the UK only 1 further case has been reported. The significance of this is not yet clear. The underlying diagnosis in these 13 patients was B cell malignancy (6), cardiac surgery (3), congenital immunodeficiency (2), autoimmunity (1), and no risk factors identified (1).

Transfusion transmitted infections 1995 - 2001

	Donations	Recipients
HAV	1	1
HBV	8	9
HCV	2	2
HIV	1	3
Bacteria	25	25
Malaria	1	1
HTLV	1	1
TOTAL	**39**	**41**

Infectious complications comprised 2.8% of cases (32/1148) of which 21 were due to bacterial contamination resulting in 6 deaths, 5 in recipients of platelets. In 8/25 bacterial infections the donor's skin was confirmed as the source of the infection.

Bacterial contamination was therefore the predominant cause of post transfusion infection.

Neonatal and Paediatric concerns

Neonatal and paediatric clinical practices involved in blood transfusion are very different from adult practices. The need to give small, usually measured, volumes of blood components necessitates modified procedures for administration, whilst because of concerns about the immaturity of immune systems at a very young age and the potential for future long life, additional special requirements are recommended for this unique group of patients.

Established haemovigilance schemes do not differentiate age related incidents and consequently a full evaluation of specific problems in neonatal and paediatric patients reported to haemovigilance schemes is not possible. However soma data has been extracted from the UK SHOT reports and this is presented below.

Neonatal and Paediatric incidents reported to SHOT 1996 to 2001

In the 5 years of SHOT reporting the scheme has received a total of 88 cases involving children up to the age of 18. For this group the percentage of incidents reported by type was similar to that seen over all age groups with 79% Incorrect (or inappropriate) Blood Component Transfused (IBCT), 11% Acute Transfusion Reactions (ATR), 8% Transfusion-related Acute Lung Injury (TRALI), and 2% Transfusion-associated Graft-Versus-Host-Disease (TA-GVHD).

Table 1
Age, No. of cases, Incident type

Age	No. of cases	Incident type			
		IBCT	ATR	TRALI	TA-GVHD
0 to 1 day	6	6	0	0	0
>1 day to 1 week	10	9	1	0	0
>1 week to 1 month	9	6	2	0	1
>1 month to 1 year	10	9	1	0	0
>1 year to 5 years	15	11	1	3	0
>5 years to 10 years	10	9	0	1	0
>10 yeras to 18 years	28	19	5	3	1
TOTAL	**88**	**69**	**10**	**7**	**2**

Immunological complications

Acute Transfusion Reactions (n = 10)

Age range 2 days to 17 years

Reactions were to platelets in 2 cases and red cells in 8 cases. In 7 cases the cause of the reaction was unclear or not known. The 3 reactions whose cause was identified were:

i Reaction to unspecified plasma protein.

ii Anti IgA detected. Patient IgA deficient.

iii Patient increased his own drip rate as he was anxious to attend a social event that evening.

All patients survived with no ill effects.

Transfusion Related Acute Lung Injury (n = 7)

Age range 2 years to 17 years

4 patients made a full recovery.

3 patients died – unsure if related to the transfusion.

Transfusion associated Graft versus Host Disease (n = 2)

2 cases were seen.

The first was a 13 day old male baby. An anaemic premature neonate, he was 32 weeks at birth and 34 weeks at transfusion.

The 2nd was a 14 year old girl with acute lymphocytic leukaemia.

Both patients died from TA-GVHD.

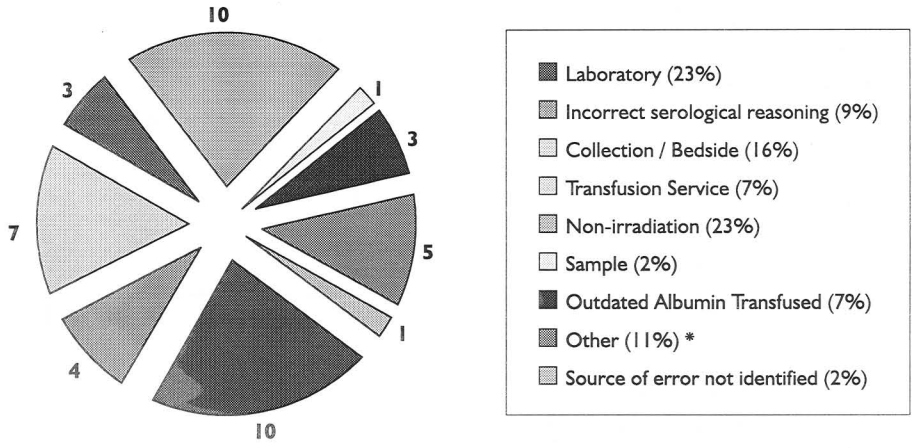
Incorrect (or inappropriate) Blood Component Transfused (N = 69)

Total statistics are given for the 69 patients in the age range < 1 day to 18 years, but only those patients under 6 years old have been analysed in any depth. In one case in particular the patient, whilst being under 18 years of age, was being treated for a post-partum haemorrhage and would not have been on a paediatric ward.

Of the 69 patients who received an incorrect or inappropriate transfusion, 39 were female and 30 male. 53 suffered no ill effects as a result of their transfusions, 10 recovered after suffering some morbidity or potential morbidity including 2 with intra-vascular haemolysis, 5 died of their underlying condition and in 1 case the outcome was not given.

44 cases involved children under the age of 6

Figure 1
Types of incidents reported (n=44)



***Other category incidents reported**

Case 1 - correct product transfused despite incorrect name on unit.
Case 2 - red cells used were too old for an exchange transfusion
Case 3 - misinterpreted prescription for RBCs 50 mL to be given over 4 hours as 50 mL per hour for 4 hours.
Case 4 - 8 paediatric red cell packs transfused instead of 1 adult unit.
Case 5 – red cells given after false low Hb result from a diluted sample.

Morbidity

7 cases resulted in morbidity for the patient or a potential development of anti D in female children.

Table 2
7 cases with morbidity

Case no.	Product	Group of product	Group of patient	Error	Outcome
1.	RBC	ORhD pos	ORhD neg	Laboratory group error	Possible sensitisation
2.	RBC + Platelets	O RhD pos	A RhD neg	Laboratory group error	Possible sensitisation
3.	RBC	O RhD pos	A RhD pos	Laboratory group error	Heamoglobinuria
4.	RBC	A RhD pos	B RhD neg	Laboratory group error	Fever, rigors, loin pain
5.	RBC	O RhD pos	O RhD neg	Selection error	Possible sensitisation
6.	RBC	---	---	Cells too old for exchange transfusion	Cardiac problems and electrolyte imbalance
7.	Platelets	O---	B---	Transfusion Service sent grp O platelets for a group B patient without checking for high titre ABO antibodies. The unit was very high titre anti-B.	Acute reaction, fever, rigors. Hb fell from 9.8 to 4.0

Two categories of error (laboratory errors and failure to irradiate) accounted for the highest percentage of errors at 23% each. These are shown below.

Figure 2
Laboratory errors (n=10)

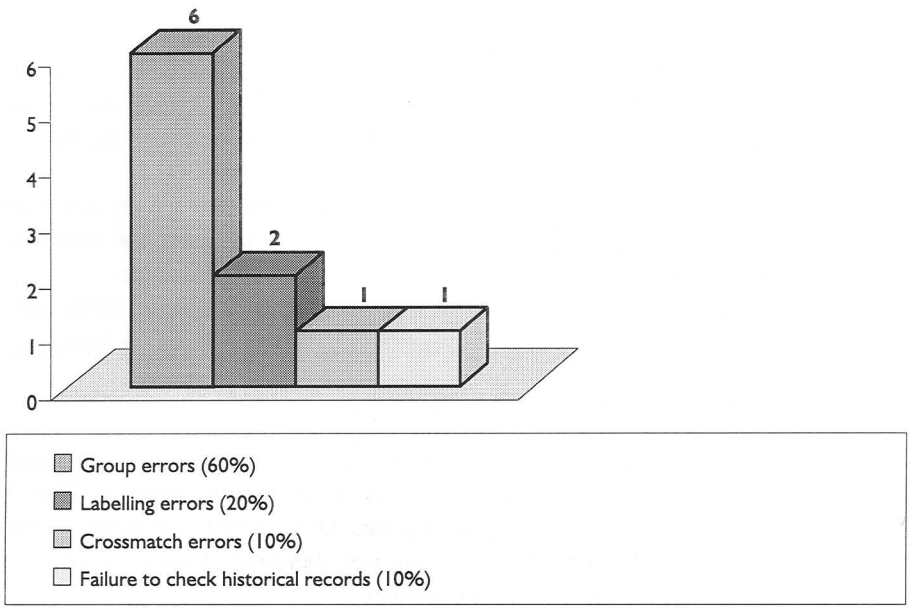
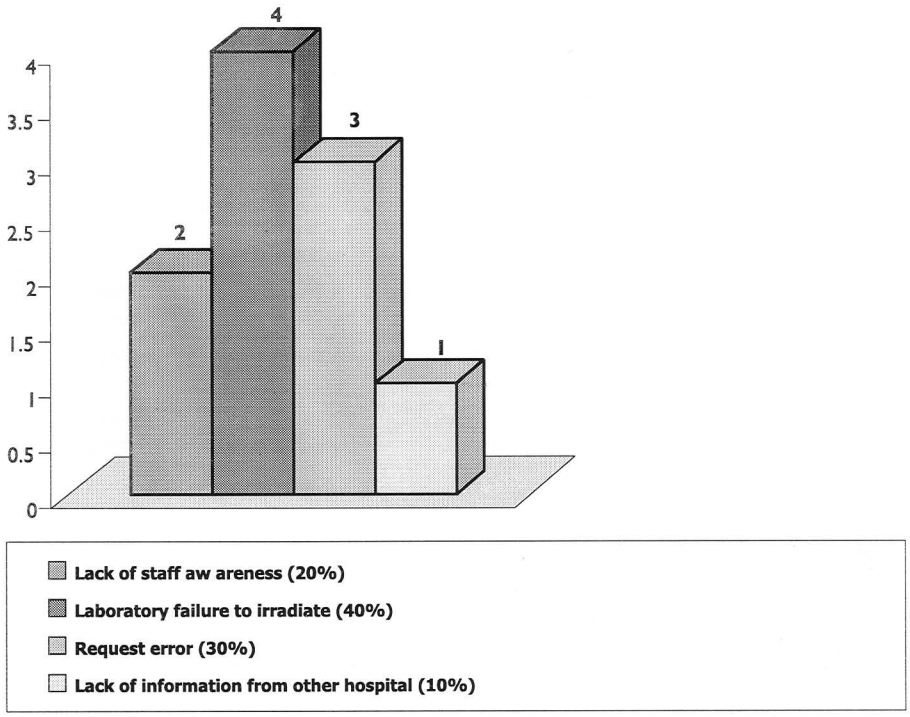


Figure 3
Failure to irradiate (n=10)



There were 8 cases in which a worrying lack of knowledge resulted in inappropriate transfusions including the 3 cases of failure to irradiate shown in figure 3 above.

Case 1 - A consultant anaesthetist selected O RhD pos FFP for a group B RhD pos patient.

Case 2 - A physician took a non-irradiated unit of red cells from an emergency fridge without reference to the laboratory. The patient was a premature baby with hydrops secondary to interuterine parvovirus infection.

Case 3 - Wrong serological reasoning by laboratory staff led to a unit of adult O RhD neg FFP being issued to a group A RhD pos neonate. Local policy stated that all neonates should have been issued with AB RhD neg FFP.

Case 4 - Incorrect serological reasoning by laboratory staff led to the transfusion of group O RhD pos FFP to a group A RhD pos patient.

Case 5 - In this case the error (incorrect blood issued) would have been prevented if the historical record had been checked. However the reason the record was not checked was that the laboratory staff believed that maternal antibodies do not persist long after delivery.

Case 6 - Laboratory staff issued non-irradiated red blood cells for a baby who had been given an intrauterine transfusion (IUT). The technical staff involved were unaware of the need to irradiate in these circumstances.

Case 7 - Laboratory staff issued blood which was too old for an exchange transfusion.

Case 8 - Medical staff were not aware of the need to irradiate products following IUT.

The original causative error in IBCT incidents identified from paediatric / neonatal patients differ from the overall frequency in the SHOT scheme as shown in Table 3 below. It is possible that the relatively small number of cases (69) compared to the overall SHOT data (699) makes this difference not statistically relevant or it may highlight a need for more education in laboratories.

Table 3
Comparison of initial source of error in IBCT

	Laboratory	Collection & administration
Total SHOT	28%	55%
Paediatric	41%	25%

Miscellaneous aspects

The administration of measured small volume transfusions requires the use of syringe or burette administration, and therefore different procedures are necessary than when transfusing adult patients. Significantly, local variations often develop and may introduce unrecognised (or unrealised) hazards. The use of in-line filters is recommended for the administration of all blood / blood components, but because of the system variations introduced, these may be eliminated. Anecdotal reports indicate that some transfusion complications have been resolved by reintroduction of in-line filters into the administration system.

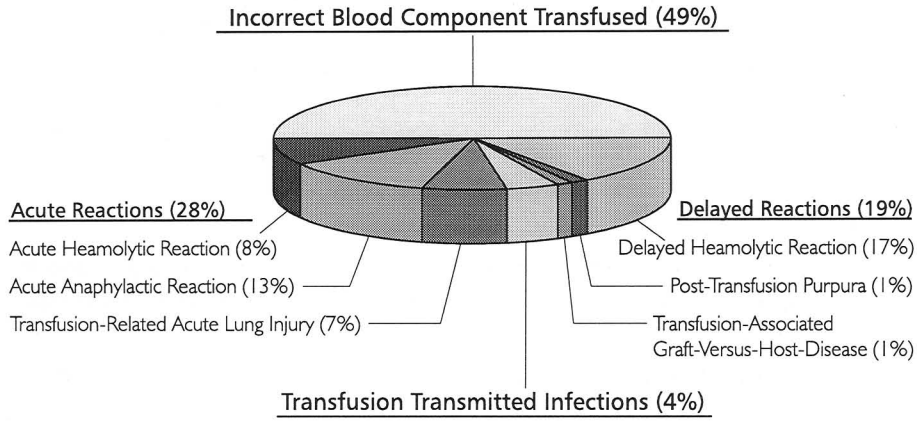
Children are naturally mischievous! At least one incident has been reported where, following checking of bloods prior to transfusion, brothers changed beds and incorrect transfusions were commenced. The problem was not realised until a 3rd. brother informed staff. A small amount of ABO incompatible blood had been given to one of the brothers, fortunately without incident.

How does SHOT compare with other European haemovigilance schemes?

Unfortunately precise comparisons are difficult for several reasons. There is a lack of common definitions for types of incidents, the range and type of data collected varies, and different National requirements and approaches are necessary.

Comprehensive data evaluation from schemes operating in Denmark, Ireland and France are shown below.

Denmark (DART) 1999 - 2002 (Total 72 reports)



72 reports were analysed and it was calculated that the risk of IBCT was 1 in 40,000 units transfused and the risk of death 1 in 450,000.

The reports highlight ABO incompatibility and bacterial contamination of platelets for remedial action

Ireland 2002 (Total 144 reports)

• Incorrect Blood Component Transfused	(69)	48%
• Severe Acute Anaphylactoid or Anaphylactic Reaction	(35)	24.5%
• Transfusion Associated Circulatory Overload	(16)	11%
• Acute Haemolytic or other Severe Acute Transfusion Reaction	(12)	8%
• Unusual	(3)	2%
• Autologous	(3)	2%
• Transfusion Related Acute Lung Injury	(3)	2%
• Transfusion Transmitted Infection	(2)	1.5%
• Delayed Haemolytic Transfusion Reaction	(1)	<1%

From the 144 reports the risk of IBCT is 1 in 2300 units transfused, with ABO incompatibility risk of 1 in 27,000 units transfused.

France 1994 – 1998 (Total 24234 reports)

The scheme is compulsory, but variable rates of reporting are apparent, with 75% of incidents being stated as of minor significance.

Major ABO incompatibility was reported in 85 instances (risk of 1 in 139,000 units transfused) with 6 deaths (a risk of 1 in 800,000 units transfused). Errors without adverse events or ABO compatible errors were not included.

Bacterial contamination resulted in 18 deaths from 185 incidents.

UK SHOT 1996 - 2001 (total 1148 reports)

	Risk/units transfused
Risk of IBCT (all categories)	1 in 25,000
Risk of ABO incompatible	1 in 106,000
Risk of major complications	1 in 103,000
Risk of death (definite/probable)	1 in 415,000
Risk of death (includes possible)	1 in 280,000

Comparisons

Interpretation and comparison of data, both within the country of origin, and for comparison between countries, is difficult because of the lack of common denominator data.

IBCT is shown as the major problem in all available data, with ABO incompatibility remaining a significant problem, although death form such incidents is <10% of all cases.

Bacterial contamination of blood components is of serious consequence, with platelet concentrates >3 days old often being implicated.

The diagnosis of TRALI is difficult, but in the SHOT data, after ABO incompatibility, acute lung injury post transfusion is the second largest cause of transfusion related mortality/morbidity.

A "no blame" culture of adverse incident reporting is essential to increase public confidence in the safety of blood transfusion. Under-reporting may result from the fear of disciplinary action, or lack of recognition of a problem, especially where the event is delayed e.g. Post transfusion viral transmission.

Benefits of system in UK

- Now able to establish relative risks and set transfusion hazards in context
- Produced data to enable priorities for future health care spending
- Provided data for evidence based education and training
- Identified potential roles and benefits of Specialist nurses and medical staff
- Enabled the potential for rapid alert mechanisms for system or equipment problems
- Presentation of accurate data assists with media information – able to emphasise good news, not bad news, and present risks in perspective

In the UK the data acquired by the SHOT scheme and the experience of SHOT members has been used to influence blood safety awareness by

- Production and wide circulation of Annual Reports
- All data is publicised and is widely used to inform and improve better practice
- Annual educational symposium
- Presentations / lectures / materials freely available
- Membership of National committees
- Contribution of data and expert advice in the production of national guidelines
- Contributions to national / local initiatives