10. INCORRECT BLOOD COMPONENT TRANSFUSED

Definition
This section describes 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.

As in all previous years this category represents the highest number of reports received. For the 12 month period, Oct. 2001-Sep. 2002, 258 new initial reports were received, and a total of 343 to the end of the new reporting year (December 2002). This is a 21.1% increase over the equivalent 12 month reporting period 2000-2001 and IBCT reports comprise 71.7% of all reports received. There is therefore a continuing steep rise in the number of IBCT reports being received, indicating a significant degree of underreporting in the past and increasing awareness and confidence in the SHOT scheme. This chapter analyses 346 completed questionnaires, including 27 which were outstanding from the preceding year. Completed questionnaires are outstanding on 25 initial reports and will be analysed next year. In addition, 15 reports were withdrawn as not meeting the criteria for IBCT and 10 have been "written off" due to failure to submit a completed questionnaire within an appropriate timescale.

Analysis of reported errors

The questionnaires sought further information about the circumstances and factors which may have contributed to errors and adverse outcomes. The findings are presented in some detail with the use of case studies where appropriate. The aim is to illustrate weak points in the transfusion process in order to help those responsible for training staff, or for the review and implementation of transfusion procedures, to identify areas for improvement and so ensure that the right blood is given to the right patient at the right time.

The data from 346 completed questionnaires are presented.

The following 3 tables give information on the gender, age of recipients and the blood components implicated in the incident.

Table 15
Sex of IBCT patients

Female	=	189
Male	=	154
Unknown	=	3
Total	=	**346**

Table 16
Age of IBCT patients

Age of recipients	
Age range	0 to 98 years
Median Age	51 years

Table 17
Components implicated in IBCT (356 components in 346 cases)

Components implicated	Number of cases
Red cells	252
Platelets	36
Fresh Frozen Plasma	19
Cryoprecipitate	2
Anti-D immunoglobulin[1]	44
Other [2]	3

[1] Adverse events to this plasma product are usually reported through the MHRA yellow card system but these incidents are reported here because they fall into the category of either blood derivative to the wrong patient or unnecessary administration of a blood derivative due to an error earlier in the chain.

[2] 1 x granulocytes, 1 x expired albumin, 1 x Human Factor VIII

It is clear that errors occur in the transfusion of patients of all ages and in the administration of all types of components.

The outcome of 346 fully analysed incidents is shown in table 18

Table 18
Outcome of 346 fully analysed incidents

OUTCOME	NO. OF INCIDENTS
Death definitely related to transfusion	0
Death probably related to transfusion	1
Death possibly related to transfusion	3
Death unrelated to transfusion	18
Major morbidity*	9
Minor or no morbidity	310
Outcome unstated by reporter	5

* Major morbidity was classified as the presence of one or more of the following:

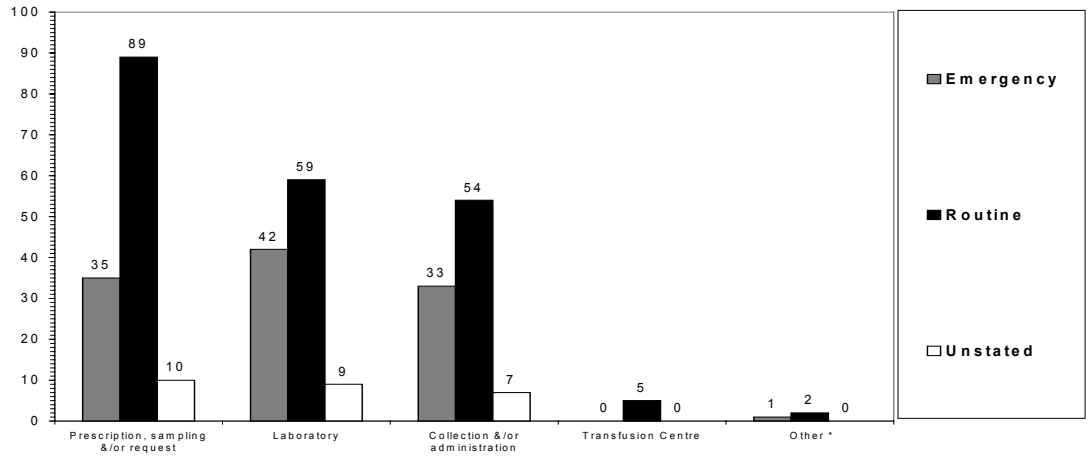
- Intensive care admission and/or ventilation
- Dialysis and/or renal impairment
- Major haemorrhage from transfusion-induced coagulopathy
- Intravascular haemolysis
- Potential risk of RhD sensitisation in a female of child-bearing potential

As in previous years, the small numbers of deaths belies the potential for a disastrous outcome in many of the incidents reported and major morbidity was reported in only 2.6% of cases.

Emergency and elective transfusions

Of the 346 completed questionnaires, 209 (60%) related to elective and 111 (32%) to emergency transfusions. These proportions are similar to those noted in previous years but we lack denominator data to determine whether or not emergency transfusions pose a greater risk of error than elective transfusions. It is perhaps surprising that 60% of errors occur in an elective setting. Twenty-six questionnaires did not state whether the transfusion was elective or emergency. Figure 19 shows the distribution of errors relating to emergency and elective transfusions.

Figure 19
Incidence of errors at the various stages of the process of emergency and elective transfusion (n=346)



*

Other = 3 x blood bank refrigerator failure

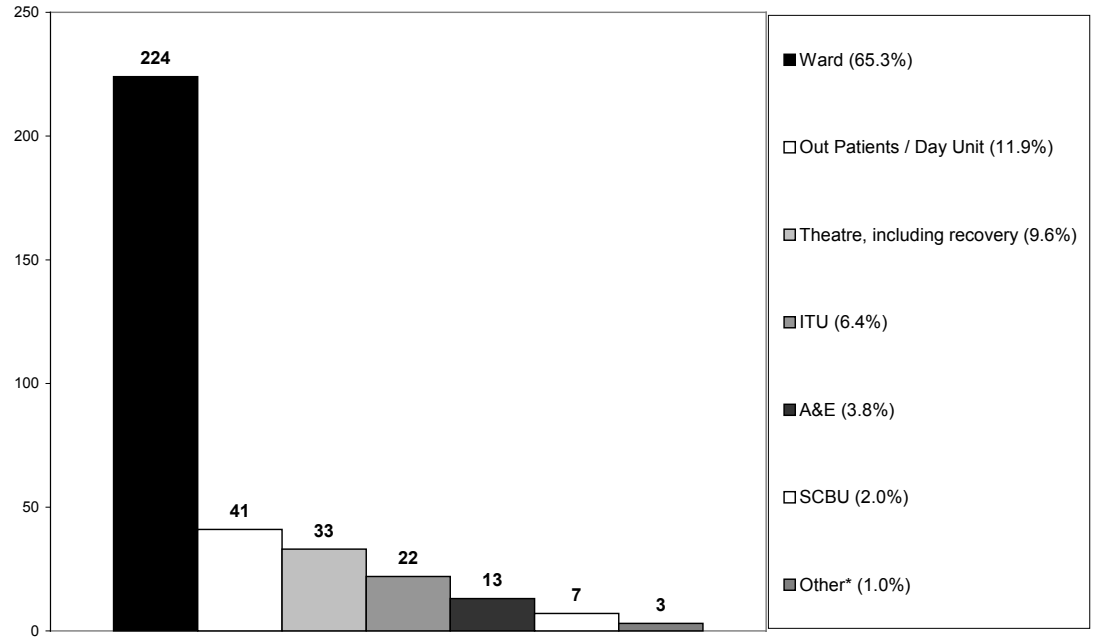
Respondents were also asked whether or not the transfusions took place during normal working hours or outside normal working hours. While we currently lack denominator data on this aspect of transfusion the responses are still of interest. Modifications to all questionnaires are now in progress in order to collect more detailed information on the potential impact of "out-of-hours" working on laboratory and clinical transfusion practices.

- 165 transfusions took place in normal working hours (47.7%)
- 156 were outside normal working hours (45%)
- 6 reporters stated both normal and outside normal working hours (1.7%)
- 4 reporters stated that they did not know the answer to this question (1.2%)
- 15 reporters did not respond (4.3%)

Site of transfusion

The questionnaire asked for information about where the transfusion took place. Three hundred and forty-three reports gave information on the site of the transfusion (figure 20). Again, this information is of limited value, as no denominator data are available. However, it is notable that 11.9% of incidents took place in out-patient or day case settings where use of name-bands is less common than in in-patient areas, yet there is often a rapid throughput of patients with very disparate diagnoses. In addition, 6.4% of errors have occurred in the ICU setting where there will be one-to-one nursing in most instances.

Figure 20
Site of transfusion (n=343)

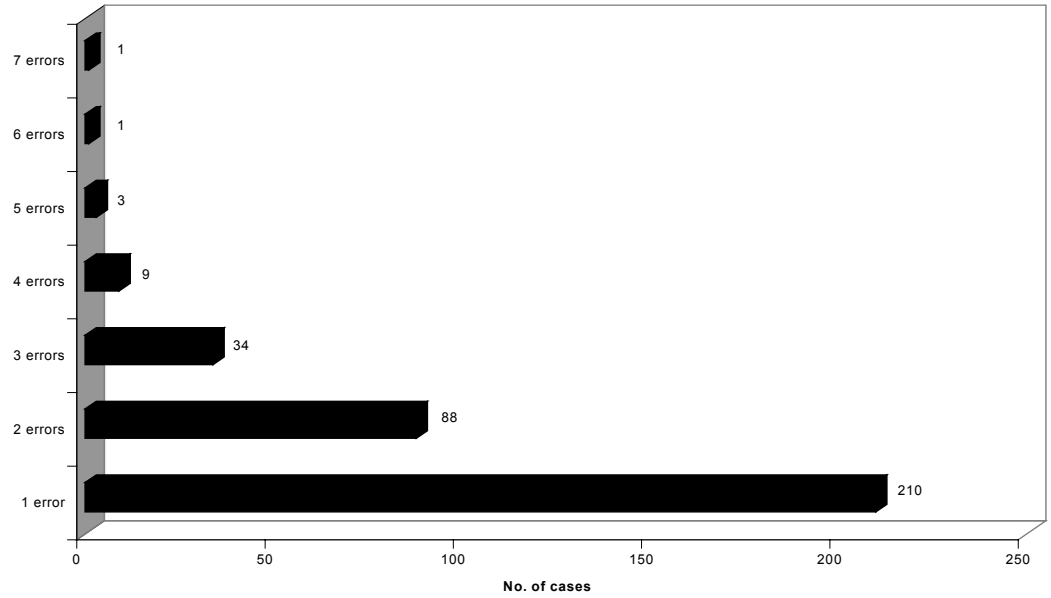


*** Other = 1 x Endoscopy Unit, 1 x Ambulance, 1 x Transfer between hospitals**

Multiple errors continue to contribute to many "wrong blood" transfusions

The SHOT scheme has consistently demonstrated that multiple errors have been implicated in many "wrong blood" incidents. In this 15 month reporting period multiple errors were noted in 137 (40%) of cases, with a total of 552 errors in the 346 fully analysed cases. In 14 cases there were four or more errors in the transfusion process. In the cases of multiple errors, most have included a failure of bedside checking which could have revealed a mistake arising earlier in the process. Of 103 bedside check failures, there were 39 instances where the wrong component had been collected and 46 instances where it was considered that another mistake earlier in the chain should have been noticed by the bedside check but this opportunity was missed.

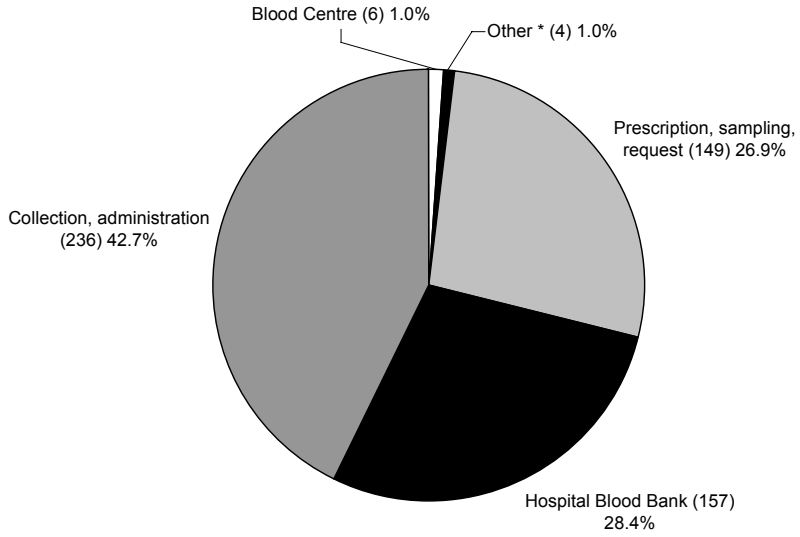
Figure 21
Total number of errors per case (total cases = 346; total errors = 552



Distribution of errors

The following pie chart (figure 22) shows the distribution, according to the main reporting categories, of a total of 552 errors from the analysis of 346 completed reports. A more detailed analysis of the distribution of total errors can be seen in table 19.

Figure 22
Distribution of total errors according to the main reporting categories (n=552)



***Other** = 1 x Incorrect Hb result – unable to determine cause
3 x Failure of Blood Bank refrigerator

Table 19
Distribution of procedural failures in terms of total errors (n=552 errors, 346 cases)

	Number of errors
Prescription, sampling and request	
Sample taken from wrong patient	6
Details on request form incorrect	14
Details on sample incorrect	13
Prescription of inappropriate and / or incompatible component(s)	19
Inappropriate Request	83
Other	13
Unknown	1
Total	**149**
Hospital Blood Bank	
Transcription error	3
Failure to consult / heed historical record	23
Grouping error	30
Missed Antibody(ies): Screen error	5
Missed Antibody(ies) Identification error	2
Missed Incompatibility	2
Selection / Issue of inappropriate component	24
Labelling error	8
Failure to irradiate	9
Crossmatch error	2
Crossmatch wrong sample	5
Failure to follow protocol	11
Incorrect serological reasoning	3
Clerical error	7
Technical Error	7
Failure to clear satellite refrigerator	5
Failure to detect error by Blood Centre	1
Other	10
Total	**157**
Collection and Administration	
Collection of wrong component	39
Failure to detect error earlier in the chain	46
Failure of bedside checking procedure	103
Wristband missing or incorrect	4
Inappropriate component selected by clinician	6
General administration Error	2
Failure to follow protocol	24
Other	12
Total	**236**
Supplying blood centre	
Inappropriate component supplied	1
Incorrect serology results supplied	2
Other	3
Total	**6**
Other	
Failure of Blood Bank refrigerator and / or alarm system	3
Wrong Hb result – unknown reason	1
Total	**4**

Analysis of total errors shows that there has been a marked increase in the proportion of errors occurring at the time of prescription, sampling and request (27% c.f. around 15% previously) with a proportionate reduction in errors occurring at collection and administration (43% - c.f around 50-55% in previous years). This may be due to the introduction of formal procedures for checking against patient identity at the time of collection of blood from storage sites combined with education. Possible alternative explanations are more complete reporting of errors occurring earlier in the transfusion process or a deterioration of practice at the request and sampling stage. The bulk of the increase in errors at the request stage has been in the number of inappropriate requests and it is notable that 60/83 inappropriate requests were failure to request irradiated components.

Multiple errors – how and when do they occur?

The following analysis of 552 errors occurring in 346 cases illustrates how some mistakes occur and the potential for multiple errors within a complex system requiring multiple human interventions. In many cases an error early in the chain should have been picked up but was not.

Errors in prescription, requesting of blood components and patient sampling

This year 26.9% of errors (149/552) in 39% of case reports (134/346) originated at the prescription, request, sampling stage.

Case 1

Labelling errors leading to failure to locate previous records

A 37 year old female patient required transfusion for anaemia due to end-stage renal failure. The dates of birth on the sample and request form were both incorrect. Two units of O RhD positive, Cytomegalovirus (CMV)-positive blood were issued but during transfusion of the second unit the patient noticed the discrepancy on the pack label and the transfusion was stopped. Provision of the correct details revealed that the patient had a previously identified anti-e (not found on the recent sample) and also that she required CMV-negative units. Both transfused units were found to be e-positive.

A number of similar cases were reported in which the correct patient received the intended unit but it was noted that staff had not picked up (or possibly had accepted) a discrepancy in the patient's identification details. While these are examples of "right blood in right patient" and caused no adverse event, the potential for serious reactions is evident from Case 1, above. Staff must not proceed with transfusion if any discrepancy in identification is noted. If these cases represent failure of the bedside check in that the discrepancy was not picked up then, clearly, there is the possibility that the wrong unit of blood may be given to a patient with similar details. These cases also represent failure of the blood transfusion laboratory 'look-up' system, which should enable previously known patients to be found even if there are discrepancies in identification details.

Case 2

Errors at all stages of the transfusion process

A 38 year old woman underwent removal of retained products of conception after spontaneous miscarriage. A pretransfusion sample was labelled with the wrong date of birth and this error was repeated on the request form. No hospital number was given. The blood group was O RhD positive and an antibody screen performed by IAT and enzyme techniques was wrongly interpreted as negative. Two units of blood were crossmatched – the low ionic-strength saline (LISS)-IAT match was also interpreted as negative. The hospital policy was to give women of childbearing age K-negative blood but this was not followed in this case. Two nurses checked the blood in theatre and administered the first unit without noting the date of birth discrepancy. Nursing staff on the ward noted the date of birth discrepancy when they came to hang the second unit and contacted the laboratory. A fresh sample was sent and was shown to contain anti-K. Repeat testing showed this was also present in the first sample. The first unit which had been transfused was then shown to be K-positive. The patient experienced no morbidity from this series of errors.

Failure to request the appropriate component (83 cases)

In 83 cases there was failure to meet the special requirements of the patient for irradiated blood, CMV-negative blood, special phenotype selection or provision of blood suitable for neonatal use. The most common error was

failure of medical staff to request irradiated components for patients at risk as defined in BCSH guidelines[7] (60 cases). In addition, two patients who required CMV-negative components received untested or CMV-positive blood. Eighteen patients were reported to have received fludarabine although actual numbers of fludarabine recipients may be higher as suggested by the underlying diagnosis in 10 cases (Non-Hodgkin's lymphoma (NHL), Acute Myeloid lymphoma (AML) etc).

In 12 cases errors in the provision of irradiated or CMV-negative blood arose at least in part because of failure of the haematology or transplant unit to communicate the patient's special needs to the laboratory in the hospital sharing the patient's care or to other departments in the hospital to which the patient had been temporarily transferred (e.g. ICU, renal). None of these incidents led to serious morbidity or mortality but there was potential for the development of fatal GVHD or CMV infection.

Case 3

Communication failures relating to autologous units

A 30 year old bone marrow donor had predonated 2 units of autologous blood to cover his bone marrow harvest. These had been received in the hospital transfusion laboratory before the harvest. The request form for blood for the donor did not state that he had autologous blood available, and unirradiated, allogeneic units were transfused during the bone marrow harvest, with the potential risk of inducing graft-versus-host disease in the transplant recipient. There seems to have been no system in place to allocate the donated units to the donor's hospital transfusion laboratory record before a sample and request form were received from the ward. Communication from the doctor who sent the sample and made the request was inadequate, as was the blood transfusion laboratory record keeping facility.

Case 4

Over-reliance on hospital numbers may cause errors

A 65 year old patient with NHL (?given fludarabine) was admitted as an emergency through A&E and transfused with unirradiated blood. The laboratory had not identified that he had a transfusion record which stated that he required irradiated blood, as he was registered in the system under a hospital number from the Cancer Centre rather than the hospital number he was given on admission. There have been several cases reported where patients who already have a transfusion record stating that they had antibodies or special requirements have not been identified because a different hospital number has been used. IT systems should be capable of searching on the basis of name and date of birth, and should highlight matches which only differ in the hospital number. Laboratory staff need to be capable of undertaking adequate patient searches.

Communication Failures in Shared Care

In 20 patients errors arose because of failure of tertiary referral centres to communicate special requirements to other hospitals or units sharing the patients care. These included:-

- failure to advise of planned stem cell harvest or bone marrow harvest, leading to transfusion of unirradiated components in the few days prior to collection. In one case the bone marrow harvest was discarded and in another a child's stem cell collection was abandoned, after a central line had been inserted to allow this to take place.
- failure to advise of donor/recipient ABO group differences leading to administration of incompatible components.
- failure to provide irradiated components to transplant recipients who had been transferred for renal support or who were re-admitted through A&E.
- elective admission for surgery at a private hospital where the past history of autologous stem cell transplant was not elicited.
- failure to irradiate blood for a neonate who had received intrauterine transfusions at a fetal medicine unit. The obstetricians attending the delivery were apparently unaware of this fact and the maternal details on the hospital transfusion laboratory computer could not be linked to the record of an as yet unborn patient.

Hospital Transfusion Laboratory Errors

There were a total of 157 errors in this category occurring in 120 case reports.

This year in 35% of cases (120/346) the first error occurred in the hospital transfusion laboratory. In many cases errors made within the laboratory cannot be detected further down the transfusion chain, although in some cases involving 'special requirements' they should be noticed by the nurse commencing transfusion.
Of the 157 laboratory errors, 88 occurred during routine working hours and involved 84 state registered BMSs, 1 supervised medical laboratory assistant (MLA), 2 locum/agency staff and 1 trainee. The 49 errors made out of hours involved 16 BMSs who worked regularly in the blood bank and 33 who did not. In 16 other cases involving 20 errors the grade of staff was not stated. This information is summarised in figure 23. Table 20 gives more detail about the errors and grades of staff involved.
31.2% of laboratory errors occurred outside normal working hours. As stated in last year's report it is not possible to comment on the significance of this information in the absence of relevant denominator data but it is hoped that some indicative data can be collected over the next year. Staff in hospital laboratories who can readily break down their workload into "normal working hours" and "outside normal working hours" are encouraged to make these data available to the SHOT office when reporting errors or near-miss events. Further work is required to provide relevant denominator data.

Figure 23
Staff involved in laboratory errors (n=157)

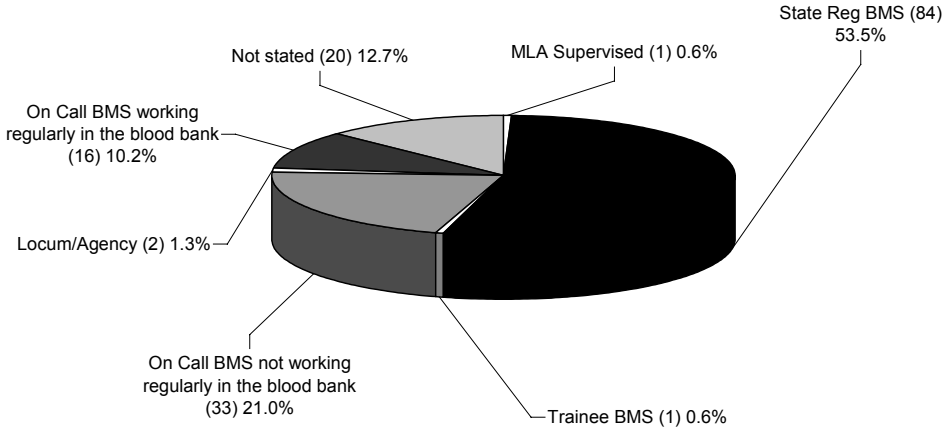


Table 20
Laboratory errors and grade of staff involved (n=157)

Error	Total number of errors	State registered BMS, routine, regularly working in blood bank	State registered BMS, on call, regularly in blood bank	State registered BMS, on call, not regularly in blood bank	Other staff	Unstated
Sample transposition	**5**	1	2	2	0	0
Failure to consult / heed historical record	**23**	14	1	6	1	1
Incorrect group	**30**	13	8	5	0	4
Missed antibody(ies)	**7**	2	1	2	0	2
Missed incompatibility / crossmatch error	**4**	0	0	2	0	2
Incorrect labelling of component	**8**	6	0	2	0	0
Selection / issue of inappropriate component	**24**	12	1	6	2	3
Failure to clear satellite refrigerator	**5**	5	0	0	0	0
Failure to irradiate	**9**	6	0	2	0	1
Clerical error	**10**	8	1	0	0	1
Other procedural error	**22**	11	0	6	0	5
Other	**10**	6	2	0	0	2
Total	**157**	**84**	**16**	**33**	**3**	**21**

The largest single areas of laboratory error are in “failure to consult/heed historical record”, “incorrect group” and “selection and issue of an inappropriate component”. As can be seen from the table above, these errors are, in the main, being made by trained staff working routinely in the blood bank, rather than by on-call staff.

Failure to consult/heed historical record (23)

In 23 cases laboratory staff failed to note or act on a previous record which would have highlighted the previous presence of an alloantibody, for example, or special requirements in component selection. This included 10 cases where the need for irradiated components was already recorded on the hospital transfusion laboratory database yet this was missed or not acted on.

Case 5

Date of birth discrepancy leads to failure to identify recent antibody record

An 81 year old woman required routine transfusion because of gastrointestinal bleeding. A pre-transfusion sample revealed the presence of a weak anti-K and K-negative units were issued. Three days later a further sample was received with a request for 3 units. The date of birth on this sample differed from the earlier one by one day. The historical record was therefore not identified and as no antibody was detected in the sample, the units were not K-typed, however they appeared compatible. The error was revealed following a further request 12 hours later. Fortunately the transfused units were subsequently shown to be K-negative and no adverse event occurred. The date of birth on the second sample was, in fact, correct. It is not known if the patient’s hospital number was used to search the database nor whether the IT system would have restricted the “view” of patient details, after registration, only to that which was an identical match, or if “near misses” (on date of birth, for example) would have been shown on the screen.

Grouping errors (30)

There were 30 errors in blood grouping, including 16 cases in which the wrong RhD group was obtained and 14 errors in ABO grouping. Seven of the RhD group errors resulted in errors in anti-D administration. However in

all cases in which RhD incompatible components were given as a result of a laboratory grouping error, the recipients were male. Four ABO grouping errors led to incompatible transfusions, in which one patient died of unrelated causes whilst the other 3 survived without ill-effects.
17/30 grouping errors (57%) related to rapid group techniques; 12/17 were outside normal working hours and 14/17 were in emergency situations. Sixteen of these errors were detected when retrospective routine grouping was carried out.

Case 6

Illogical "resolution" of anomalous results – failure to spot an obvious error

A 52 year old male with anaemia due to lymphoma required an elective transfusion of four units of blood. Blood grouping was performed using microplate techniques by the state registered blood bank BMS and this was interpreted as being anomalous as there was a reaction with Anti-A, Anti-B, A_1 cells and both anti-Ds. The BMS decided to repeat the group before selecting the red cell units. The wrong sample appears to have been selected and this grouped as O RhD positive. Four units of Group O RhD positive red cells were cross-matched and administered. The sample selection error was revealed the following day when routine grouping showed that the initial reaction pattern had been correct – the patient was Group A_2B RhD positive with anti-A_1. As the transfusion was compatible no adverse reaction occurred.

Selection/issue of inappropriate component (24)

There were 6 cases in which expired blood was given to patients, at least in part because units were issued towards the end of their shelf-life. It is difficult in these cases to know whether this was intentional on the part of the laboratory in anticipation that they would be used within a few hours of issue. Incompatible platelets, FFP and cryoprecipitate were issued in 5 cases, with no morbidity other than serological discrepancies and the possibility of RhD sensitisation in one female baby. Errors in the selection of components for infants were seen in 4 cases, including failure to select pathogen-inactivated FFP.

Labelling of blood components (8)

Labelling errors, in which the details of one patient were applied to a pack intended for another patient, will generally result in 2 mislabelled components with the potential for harm to two patients. In one case (see Case 23, below) this led to significant morbidity.

Errors in the collection and administration of blood components

There were 236 errors in this category occurring in 159 case reports comprising 42.7% of all errors.
As in previous years this remains the most frequent point of error, although it is proportionately smaller than in any previous year.

Collection of incorrect component (39)

Table 21
Collection errors according to grade of staff involved and whether or not a formal check was made at this stage

GRADE OF STAFF	FORMAL ID CHECK		
	Yes	**No**	**Unstated**
Registered Nurse	8	4	1
Unregistered Nurse	3	1	0
Porter	3	7	0
Theatre Staff	0	2	0
Unknown	0	3	4
Other [1]	0	3	0

[1] 1 x clinical support worker, 2 x doctor

In most cases where the grade of staff is known, the individual collecting the blood has been a nurse and a formal identity check has apparently been carried out at the time of collection, yet the wrong unit has been collected. Portering staff appear to be less likely to have carried out an identity check, perhaps reflecting a failure of hospital policy and lack of appropriate training of portering staff.

Failure of bedside checking procedure (103)

Failure of bedside checking occurred in 30% of all IBCT cases. It is disappointing that this is still the commonest site of error, despite emphasis on the need to address this in all previous SHOT reports. In most cases where this has gone wrong there has been no identification of the patient at the time of administration and in 39 cases there has been a failure to pick up previous collection errors. There were only 4 reported cases of missing wristbands although this is a difficult point to determine accurately some time after the event.

Table 22
Outcome of bedside errors (103)

Category	Survived/ no ill effects	Major morbidity	Died unrelated to tx.	Died possibly related to tx.	Died probably related to tx.	Died definitely related to tx.	Unknown	Total
Major ABO incompatibility	10	2 [1]	2	1	0	0	0	**15**
RhD incompatible	2	0	0	0	0	0	0	**2**
ABO / RhD compatible	51	0	2	0	0	0	2	**55**
Other red cell incompatibility	3	0	0	0	0	0	0	**3**
Special requirements not met	6	0	4	0	0	0	1	**11**
Inappropriate transfusion	4	1	0	0	0	0	0	**5**
Anti-D	10	0	0	0	0	0	0	**10**
Other [2]	2	0	0	0	0	0	0	**2**
Total	**88**	**3**	**8**	**1**	**0**	**0**	**3**	**103**

[1] Recovered from intravascular haemolysis
[2] 1 expired unit given, 1 transfused more than 72hrs post cross-match

Table 23
Grades of staff involved in bedside incidents (n=103)

Grade of Staff	Number of cases
Registered nurse & registered nurse	53
Registered nurse and unregistered nurse	3
Registered nurse & doctor	5
Registered nurse & medical student	1
Registered nurse and unknown	3
Registered nurse only	15
Registered nurse & other [1]	2
Doctor & doctor	2
Doctor & other [2]	1
Doctor only	10
Other only [3]	4
Unstated	4

[1] 1 x auxiliary, 1 x student nurse
[2] 1 x Operating department practitioner (ODP)
[3] 1 x ODP, 3 x midwife

Bedside errors led to 15 cases of administration of ABO-incompatible blood, resulting in severe morbidity in 2 cases and one possibly related death, while two further patients died unrelated to the transfusion. The remaining 10 patients survived without any ill-effects.

In 70 cases two individuals were responsible for the bedside check, with one person responsible in 29 cases. Nurses were involved in 82 cases but as the bulk of transfusions are administered by nursing staff no conclusion can be drawn from this other than that the "safe transfusion" message has so far failed to reach both nursing and medical staff. Patients have received the wrong blood even though a bedside check has apparently been carried out. Observational studies (Effective use of Blood Group, Scottish National Blood Transfusion Service, unpublished data) have shown that in many cases the documentation has been checked against the details on the blood pack but staff have failed to check the identity of the patient, either verbally or using the wristband.

Inappropriate component selected by the clinician (6 cases)

These included the selection of the wrong group of FFP or the wrong unit of platelets, in situations where nursing or medical staff were given the responsibility of accessing FFP or platelet stocks out-of hours, and included the inappropriate use for neonates of blood provided for the mother, or emergency "flying squad" blood. These cases illustrated poor communication with the hospital transfusion laboratory over anticipated requirements for babies affected by haemolytic disease of the newborn and also a lack of serological knowledge (which is not particularly unexpected) amongst paediatric or obstetric staff.

Case 7

Lack of understanding of significance of maternal antibody in relation to blood selection

An antenatal patient with known anti-c was admitted for induction of labour shortly after an ultrasound scan which had shown a healthy fetus. The paediatricians had contacted the hospital blood bank the day before delivery and were advised that suitable blood for exchange transfusion would be requested from the blood service. At induction the fetus showed severe distress resulting in an emergency caesarean section. The infant was hydropic with a Hb of 60/L. The paediatrician gave an urgent top-up transfusion (50mL) using "flying squad" blood. Several hours later they requested blood for an exchange transfusion and notified the laboratory that "flying squad" blood had been used. The paediatricians appeared to have been unaware that the blood used would have homozygous expression of the implicated antigen (Group O rr – i.e. c-positive). The infant appeared to have experienced no adverse reaction although any increased haemolysis is likely to have been managed by the subsequent exchange transfusion. The hospital has changed its procedure for management of similar cases, requesting earlier notification of intended delivery and the provision of compatible Group O blood for the mother in order that this can also be used for an immediate top-up in the neonate in an emergency.

Cases 8 and 9

Wrong blood to baby – 2 cases in one unit reveal failure to "close the loop"

A preterm infant required a routine top-up transfusion for anaemia, during normal working hours. Pretransfusion testing and cross-matching was performed and a labelled unit was placed in the blood bank refrigerator. A porter collected one unit of O RhD negative "flying squad" blood from the refrigerator instead of the cross-matched unit, with no identity check and without signing the register. Two qualified nurses apparently "checked" the unit prior to administration, even though the pack label and issue report showed clearly that this was "Emergency O Negative".
Three weeks later the same scenario was repeated with a second baby on the same unit! The staff have identified that although appropriate policies were "in order" there were evident training issues to be addressed.

Inappropriate transfusion episodes

Currently SHOT does not record a category where patients received components which they did not require (other than in cases where a patient received blood intended for someone else). However, these instances are relatively common – either inappropriate administration due to lack of knowledge of the appropriate guidelines or due to spurious laboratory results as described below.

Inappropriate transfusion due to spurious results on FBC or coagulation screen

In 21 cases, patients received red cells (19), platelets (1) or FFP (1) as a result of errors in sampling, testing or communication of haematology results. In the 19 patients who received red cells which were not, in fact, required, the problem seems to have arisen during sampling in 10 cases – for example due to drawing blood from the drip arm or perhaps due to allowing blood to settle in a syringe before filling the sample tubes. In four cases verbal transmission of results to the ward, or between different staff on the ward has led to the wrong Hb being recorded. In 2 cases Hb results from gas analysers were assumed to be accurate and the patient transfused on this basis. One patient who received FFP unnecessarily seems to have had a spurious coagulopathy generated by sampling from the arm which was the infusion site for a red cell transfusion as the group on the coagulation sample differed from the pre-transfusion sample drawn slightly earlier. One patient received platelets when thrombocytopenia was diagnosed on a sample containing clots. The discrepancy between the spurious Hb levels and the patient's actual Hb was up to 70g/L in some patients, yet the results appear to have been accepted as in keeping with the clinical picture by the medical staff prescribing the blood. In two patients (see Cases 16 and 17, below) the inappropriate transfusions are felt to have contributed to the patients' deaths.

Case 10

Iatrogenic polycythaemia

A haematologist was asked to advise on a patient with post-operative polycythaemia. This 85 year old female had been admitted with gastrointestinal bleeding and received a 4 unit red cell transfusion as ward staff had reported the Hb to be 91g/L. In fact the correct result was 145g/L. The cause of the polycythaemia became clear when the laboratory results and transfusion history were compared!

Cases 11 and 12

Don't rely on Hb levels from blood gas analysers

Two patients were transfused on the basis of Hb results of 50g/L from blood gas analysers. A sample from one of the two was later checked in the laboratory and found to have a Hb of 117g/L pre-transfusion. The second patient had an Hb of 157g/L after the transfusion of 5 units of red cells. It is estimated that the pre-transfusion Hb was, in fact, around 100g/L.

Case 13

Unauthorised access to blood bank refrigerator

A junior doctor was observed drawing blood from a pack in the blood bank refrigerator. He advised that he was conducting a "potassium level audit" and that he had been carrying this out for the previous three days. The BMS discovered that nine packs in the refrigerator had been similarly punctured and one sampled unit had already been transfused. The doctor was ignorant of the potential risk of bacterial contamination of the punctured units. This potentially disastrous incident highlights a number of issues including the need for adequate supervision and training of junior medical staff and for restriction of access to blood storage areas.

Errors originating at the supplying blood centre

There were 6 errors in this category occurring in 6 case reports

Case 14

Failure to irradiate granulocytes – particular risks of infrequently used components

A 34 year old male patient with acute lymphoblastic leukaemia received three units of granulocytes from a Blood Service donor. The units were not irradiated and were not CMV-negative. On arrival at the hospital blood bank they were issued by the on-call BMS who was not regularly working in the blood bank and administered to the patient. No adverse consequences were identified. All granulocyte transfusions MUST be irradiated and, because of their high white cell content, carry a significant risk of CMV transmission to susceptible patients. This is an infrequently used component and it is not surprising that an on-call BMS would not be aware of the necessity to irradiate this product.

Errors in anti-D administration

SHOT does not seek to record errors in anti-D administration (either of omission or commission) due to failure to follow guidelines. However errors due to laboratory grouping errors, patient misidentification or wrong serological reasoning are included. There were 43 reports involving anti-D administration – 8 cases in which anti-D was indicated but either not given or given in an inadequate dose. In one of these cases the BMS issued Hepatitis B immunoglobulin, in error. In 35 cases patients received anti-D which they did not require. In 4 cases the patient was known to have immune anti-D present, 4 patients had delivered RhD negative babies, one case involved anti-D cover for administration of platelets which were, in fact, from a RhD negative donor while in all other cases anti-D was administered to patients who were RhD positive. In most instances this was due to midwives administering anti-D to patients before grouping results were available or to patients who had already been shown to be RhD positive. Routine antenatal prophylaxis was given to three RhD positive patients by the same midwife working in a GP's practice – it was not clear if this simply reflected lack of training/understanding of the antenatal prophylaxis programme. In 8 cases anti-D was administered to the wrong patient because of misidentity of the patient at the time of administration or telephone communication of incorrect results by the laboratory.

Case 15

A series of failures leads to repeated unnecessary administration of anti-D

An antenatal patient underwent routine blood grouping by community midwife. The result, A RhD positive, was written on the patient-held records. Inexplicably, the midwife then wrote "information given re Rh Neg" and made an appointment for routine anti-D prophylaxis. The transfusion laboratory issued anti-D without checking their records for the blood group. Anti-D was administered by the midwife, again without checking records. A further appointment was made for 34 weeks gestation and the same scenario was repeated other than that blood group A pos, appeared on the issue form, but was not noted. Anti-D was given by the same midwife. At delivery, the patient enquired about anti-D at which point previous errors were noted. A number of changes have been implemented in order to reduce the risk of recurrence.

Outcomes

Of the 346 fully analysed cases there were 32 cases of major ABO incompatibility, including 2 cases which were also RhD incompatible and 1 case who also failed to receive irradiated components. There were 19 cases of RhD incompatibility (of which 13/19 errors originated in the laboratory), 18 cases where other red cell antigen incompatible transfusions were given, and 106 incidents which resulted in ABO and RhD compatible transfusions.

The remaining cases comprised 83 cases of failure to provide for special requirements (including 69 non-irradiated, 1 neither irradiated nor CMV negative and 2 not CMV negative), 43 cases of errors in anti-D immunoglobulin administration, 31 cases of an inappropriate or wrong component transfused, and 14 "other". (including administration of expired units, transfusion later than 72 hrs post-crossmatch, incorrect storage during transfer of patient, freezing of red cell units due to incorrect packaging).
There were 3 deaths which may have been related to the adverse event.

Mortality due to the adverse events

Case 16

A spurious Hb result which may have contributed to this fatal outcome

This 92 year old woman was admitted with a gastrointestinal haemorrhage and cerebrovascular accident. A sample drawn from the drip arm gave an Hb result of 81g/L and a transfusion of 4 units of red cells was given. The Hb post-transfusion was 176g/L suggesting that that the pre-transfusion Hb result was spurious. The patient developed cardiac problems and died shortly afterwards. It was felt that the unnecessary transfusion may have contributed to her death.

Case 17

Inappropriate transfusion contributing to death of a patient

A 96 year old woman was admitted with a gastrointestinal haemorrhage. A full blood count sample sent to the laboratory was underfilled and gave an Hb result of 50g/L. The result was phoned to the ward with a request to repeat the test as soon as possible. The result was authorised in the computer with a text comment "sample underfilled, result subject to error". No repeat sample was sent but a 6 unit cross-match was ordered. Further samples were requested by the hospital transfusion laboratory as the group and screen sample was also small. Three units were transfused and a post-transfusion Hb was 200g/L. The patient developed circulatory overload and an emergency venesection was requested. The patient died the following day. The pre-transfusion Hb was, in fact, 170g/L. The ward computer access to the patient's results did not display text comments.

Case 18

Failure of bedside check leading to intravascular haemolysis

A 67 year old woman was terminally ill due to bronchiectasis and had a history of poorly controlled diabetes. She was not intended to receive a transfusion and no pre-transfusion sample had been sent. One unit of Group A RhD positive blood which had been matched for another patient was administered to this patient who was Group O RhD negative. She developed loin pain and became jaundiced, with an elevated alanine aminotransferase. Following this the patient elected to receive no further treatment and died 5 days after the event. Although the patient was already terminally ill at the time of the error it was felt that this hastened her demise.

Case 19

Dangers of incompatible plasma infusions (1)

A 21 year old man with a haematological malignancy who was Group B received 4 units of incompatible Group O FFP. The FFP had been selected from the freezer out-of-hours by a Nurse Practitioner in a hospital where there was no on-call transfusion service. The patient developed hypotension and haemoglobinuria and subsequently went on to develop hepatorenal failure, leading to death. It is not clear how much of this was due to the transfusion reaction or to progression of his malignancy. This hospital is considering issuing only AB FFP out-of-hours in future and an on-call transfusion service is to be introduced.

Major morbidity

Four patients who received ABO incompatible transfusions experienced major morbidity and one female patient who received a RhD incompatible transfusion developed anti-D which is likely to affect future pregnancies. Two further female patients who received RhD incompatible components were of potentially child-bearing age. Case 25, below, is recorded as dying of unrelated causes but clearly suffered major morbidity due to the transfusion error before her demise.

Case 20

Blood collection error leading to ABO incompatibility

A 58 year-old man, Group O RhD positive, who had undergone transurethral resection of bladder tumour received approximately 200mL of Group A RhD positive blood. He experienced rigors, hypotension and subsequently developed renal failure. The incorrect unit had been collected from a satellite refrigerator by a qualified nurse and a single qualified nurse had checked and set up the transfusion. The patient made a good recovery after being transferred to a high-dependency unit.

Case 21

Dangers of incompatible plasma infusions

A 7 year-old boy with leukaemia who was Group B received a transfusion of pooled platelets which were Group O and which had not been shown to have low titres of anti-B. He became anaemic and jaundiced, with a positive DAT and an incompatible cross-match against Group B red cells. He required in-patient admission and a red cell transfusion.

Case 22

Laboratory labelling error and failure of bedside check result in ABO-incompatible red cell transfusion

A 30 year old man with gastrointestinal bleeding became febrile, developed rigors, back pain and bronchospasm and became hypotensive within the first 50mL of a red cell transfusion. The patient was Group O and the pack, which was labelled with his details, was Group A. A second wrongly labelled unit was returned to the laboratory which noticed the error and immediately contacted the ward, but the transfusion had already been commenced. The error in the labelling was not identified by the two nurses who carried out the bedside check. The patient recovered from the effects of intravascular haemolysis.

Case 23

Discrepant RhD-typing leading to RhD-immunisation

A 23 year old woman was transfused during an acute attack of porphyria. She had been previously grouped as O RhD negative but on more recent re-grouping using an automated Diamed system she grouped unequivocally as O RhD positive on 2 occasions. It was assumed that she had a weak D and she subsequently received 2 units of Group O RhD positive blood. She developed anti-D and had a positive Direct Antiglobulin Test months later. It is possible that this patient has a Partial D phenotype but no subtyping had been carried out at the time of submission of the report.

Case 24

Failure to manage a detected error effectively leads to mismatched transfusion

This teenage girl was admitted with major trauma due to a road traffic accident and was being resuscitated in the Accident and Emergency Unit. Units of blood for another patient (different name, DOB and hospital number) were collected by an anaesthetist from the blood bank refrigerator but this error had been noted by the nurses performing the bedside check. The units were placed on a bench away from the bedside but in the same resuscitation room and one was subsequently picked up and administered by another doctor without further checking. This group O RhD positive patient received over 100 mL of group B RhD positive red cells. She developed acute intravascular haemolysis and severe anaemia (Hb 25g/l) though the anaemia was at least in part due to her injuries from which she subsequently died.

The outcome of all IBCT cases is summarised in Table 24

Table 24

Outcome of cases of incorrect blood component transfused (n=346)

Category	Survived / no ill effects	Major morbidity	Died unrelated to tx.	Died possibly related to tx.	Died probably related to tx.	Died definitely related to tx.	Outcome unknown	TOTAL
Major ABO incompatibility[1]	23	4[2]	3	2	0	0	0	**32**
RhD incompatible	18	1[3]	0	0	0	0	0	**19**
ABO/RhD compatible	97	0	5	1	0	0	3	**106**
Other red cell incompatibility	15	1	2	0	0	0	0	**18**
Inappropriate transfusion	27	2	1	0	1	0	0	**31**
Special requirements not met [4]	73	1	7	0	0	0	2	**83**
Anti-D	43	0	0	0	0	0	0	**43**
Other	14	0	0	0	0	0	0	**14**
Total	**310**	**9**	**18**	**3**	**1**	**0**	**5**	**346**

1 Includes 2 case which was also RhD incompatible
2 Includes recovered from intravascular haemolysis
3 RhD sensitisation in female of child bearing potential
4 Irradiation/CMV negative/phenotype selection/ blood suitable for a neonate etc.

Procedural review

Table 25
Hospital Transfusion Committees

Number of responses	Response
8	No response
230	No, but will be discussed at a future meeting
107	Yes
1	No Transfusion Committee in place

Table 26
Summary of changes made to policies / procedures (n=194)

Number of changes	Summary of change
88	Changes to or new documentation, techniques, policies, procedures, etc.
24	New or additional training
26	Review of existing policies / procedures / protocols
6	Upgrade, renewal, or acquisition of equipment, including computer
16	Reiteration of existing policies / procedures / protocols
7	Introduction of new policies / procedures / protocols
2	Meeting pending – problem to be discussed
6	New or amended software introduced now or later
2	Patients carry cards
6	Developing a system of communication / liaison for shared care patients
2	Audit of existing procedures
2	Considering introduction of bar coding
6	Considering acquiring new or additional resources (including staff)
1	Unspecified

Table 27
Summary of comments made by reporters who said that no changes had been made or who did not respond to the question (n=52)

Number of comments	Summary of comments
23	Current policies / procedures / protocols reiterated
9	Case has been or will be reviewed internally
3	Proposal forwarded to Trust
2	Staff removed from rota
1	Counselling of staff
6	Policies / procedures / protocols under review
1	Risk assessment underway
4	Corrective action to be taken later
3	Staff re-trained

COMMENTARY

- For the sixth consecutive year, even after taking into account the change in the reporting period, transfusion errors remain by far the commonest serious adverse event reported to SHOT (71.7%) and the trend shows no signs of a plateau. It is encouraging that staff are demonstrating increasing awareness of, and confidence in, the SHOT scheme. This is may be the cause of the continued steep rise in reporting, rather than that more errors are being made.

- There remains evidence of weakness at all stages of the transfusion process, particularly at the time of collection of blood from storage sites and bedside checking, the latter being the commonest site for errors (103/552, 18.7%). Good practice guidelines covering these aspects of transfusion practice were published in 1999[6] but have not been widely implemented into practice. The guidelines are currently under review. 'Bedside' checking may frequently take place away from the bedside and focus on the paperwork, losing sight of the main purpose which is to check that the right blood is being given to the right patient. In most reported errors two members of staff have been involved in the bedside check, - denominator data is required to establish whether checking by a single or 2 person(s) is more reliable. Positive identification of patients is a major safety issue with potential impact not only on blood transfusion but also on drug administration, dietary management, performance of diagnostic procedures and surgical interventions.

- Collection of the wrong unit from a theatre satellite refrigerator occurred in 39/346 (11.3%) cases and administration was not prevented by the bedside check. Theatre patients may have their name bands removed to allow vascular access, and early signs of a transfusion reaction may be obscured by the unconscious state. A surgical patient who requires blood may be considered to have other reasons for developing a tachycardia or hypotension and a transfusion error may not be suspected until one or more units have been transfused.

- Almost a third of all errors (157/552, 28.4%) continue to occur in hospital transfusion laboratories and, as yet, there has been no major initiative to address this. In many cases BCSH guidelines on pre-transfusion testing[13] have not been adhered to, and the underlying reasons for this need to be identified.

- Shared care arrangements, particularly for patients with malignancies who have undergone stem cell transplants, fail repeatedly, with lack of communication of special transfusion requirements to other hospitals or even to other departments within the same hospital. Haematology medical staff have apparently been unaware of guidelines on irradiation of blood components[7] and improved induction and education is needed. Failure to irradiate components for recipients of fludarabine, particularly oral preparations, has occurred in at least 18 cases. In the 60 failures to request irradiated components there has been no mention that the patient carried a card indicating this requirement or that the hospital pharmacy was involved in local protocols.

- There is only limited evidence that errors are being fully investigated and seen as learning opportunities. This raises concerns about how transfusion errors are being managed within hospitals.

- Anti-D administration errors comprised 43/346 (12.4%) of all reports, the most common scenario being administration of anti-D to RhD positive recipients. It is not clear to what degree this is a training issue.

RECOMMENDATIONS

- **Continued reporting of transfusion errors to SHOT is essential, as directed by HSC 2002/009[2] and in the earlier HSC 1998/224[1]. All hospitals, and all departments within hospitals should participate in the scheme and SHOT recommendations should be considered by hospital Clinical Governance Committees to determine what local action needs to be taken.**

- **In order for patients and staff to derive full benefit from the SHOT scheme, local initiatives to disseminate the main messages of the SHOT report are essential. These could form part of induction sessions for all staff groups or be regular sessions at hospital "Grand Rounds" sessions or departmental training programmes.**

- **Reporting should be the norm and full investigation of reported incidents should be carried out by individuals who are familiar with good practice guidelines for transfusion. SHOT findings should be part of mandatory training for all staff involved in the transfusion process.**

- **All staff should be made aware through the Risk Management Committee of transfusion errors occurring in their department and in other departments within the hospital. This should not reveal the identities of individuals concerned, the emphasis being on avoiding repetition of errors and encouraging staff to analyse their working practices to identify potential "weak links" which can be remedied.**

- **Clear policies must be developed for communicating special transfusion needs of patients to other hospitals or units which may share their care. This is particularly relevant to stem cell transplant recipients. Active involvement of patients in this aspect of their care could reduce the frequency of these errors.**

- **Increasing use of fludarabine, particularly oral preparations, means that many more patients are susceptible to TA-GVHD. Pharmacy departments should play a role in notifying patients and hospital blood banks when this therapy is commenced. The forthcoming BCSH guidelines on the avoidance of Transfusion Associated GVHD (which extend the current guidelines for irradiation[7]) include advice on communication where there is shared care and include input from the Pharmacists/Pharmacologists community.**

- **Improved training of midwives in relation to anti-D administration is necessary. There is increasing risk of mis-administration with the rolling out of the routine antenatal prophylaxis programme. More secure and explicit communication of antenatal and postnatal results is required.**

- **Human error in relation to patient identification is still the commonest problem leading to wrong-blood-in-patient. Educational initiatives have been inadequate in resolving this problem. Patients should be empowered to be involved in the bedside checking procedure.**

- **Investment in the development and evaluation of technological solutions is essential if errors in the transfusion process are to be significantly reduced.**