5. Incorrect Blood Component Transfused

Definition

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.

524 completed IBCT questionnaires were received.

Thirty-nine reports were withdrawn by the analysts. Thirteen of 39 were 'right blood to right patient' incidents, in which the patient received the intended component despite a serious breach of protocol. These are discussed at the end of this section. A further 26 did not meet the criteria for IBCT, one of these was transferred to the Acute Transfusion Reaction chapter of the report.

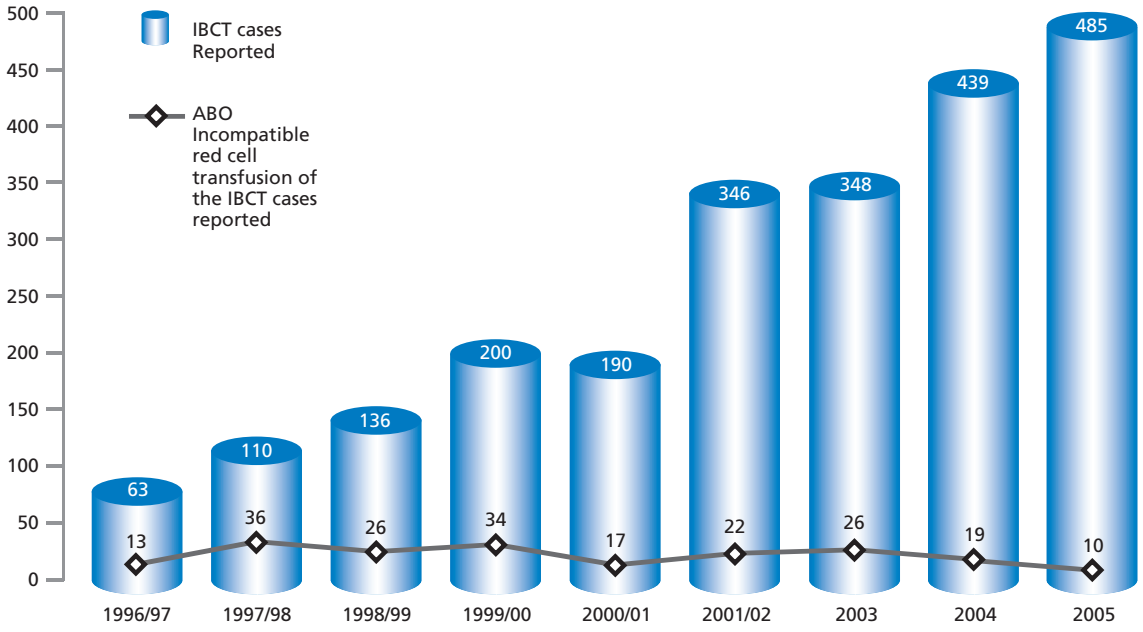
This chapter describes the findings from 485 analysed cases, a 9.3% increase from 2004.

Total numbers of IBCT reports continue to increase, with no sign of a plateau. However the number of 'wrong blood' events, in which there is a risk of a potentially fatal haemolytic transfusion reaction, is the same as in 2004, whilst the number of ABO incompatible red cell transfusions has fallen to 10 (c.f. 19 in 2004).

In figure 6 the blue bars represent the total number of IBCT reports and the black line is the number of ABO incompatible red cell transfusions.

Figure 6

ABO incompatible red cell transfusions



Patients

273 Females

207 Males

5 No data available

Ages ranged from 1 day to 96 years.

Forty-five reports (9%) related to patients under 18 years of whom 25 (5%) were infants under 12 months.

Mortality and morbidity

1 death was due to an ABO incompatible transfusion (Case 1, imputability 3)
1 patient died, possibly related to overtransfusion (Case 17, imputability 1)
1 patient suffered major morbidity due to overtransfusion (Case 18, imputability 2)
1 recipient of an ABO incompatible haemopoietic stem cell transplant received blood of the incorrect group and suffered a severe acute haemolytic reaction

In addition, 2 cases were reported in which misinterpretation of the antibody investigation at antenatal booking resulted in severe haemolytic disease of the fetus, resulting in an intrauterine death in one case and severe morbidity requiring exchange transfusion in another. These cases (Cases 21 and 22) are described in section 7 below.

Analysis of cases

IBCT case reports can be analysed in a number of different ways. This year they are divided into 7 sub-groups, as follows

Type of event	Number (%)
'Wrong blood' events where a patient received a blood component intended for a different patient or of an incorrect group.	87 (18%)
Other pre-transfusion testing errors - including incorrect D groups, missed allo-antibodies and missed serological incompatibility.	22 (4.5%)
Blood of the incorrect group given to recipients of ABO mismatched PBSC or bone marrow transplant.	2 (0.5%)
Failure to provide blood of appropriate specification or that did not meet the patient's special requirements.	141 (29%)
Inappropriate or unnecessary transfusions.	67 (14%)
'Unsafe' transfusions where there were handling or storage errors.	79 (16%)
Events relating to administration of anti-D immunoglobulin.	87 (18%)
Total	**485**

In each sub-group, an attempt has been made to assess the contribution of errors in clinical areas and in laboratories. Because of the increasing emphasis on the importance of good laboratory practice, hospital transfusion laboratory errors, which occurred in 179/485 (37%) of all cases, are summarised in Table 12 at the end of the chapter.

Time and location of transfusion

Previous SHOT Annual Reports have analysed the time and location of transfusion errors, but it has not been possible to draw conclusions from these findings because of lack of denominator data. In September 2005, an observational study on the time and location of blood transfusion was carried out in 28 hospitals in the Northern and Yorkshire regions (H Tinegate, C Thompson, unpublished data).

The fate of all red cell units issued during a 7 day period (n=3118) was recorded, and compared to 169 SHOT reports in which an incorrect blood component was transfused due to an administration error and the time and location was known.

The study found that 888/3118 (28.5%) of red cell units were transfused between 2000 hours and 0800 hours, whereas 63/169 (37%) of blood administration errors took place during this period (p=<0.03). These data support the recommendation that blood should not be transfused at night unless clinically essential.

Transfusions on in-patient wards were associated with excess risk (57.5% of red cells transfused vs 72.2% of errors, p=<0.001), whereas transfusions on day units (12.7% of red cells transfused vs 4.1% of errors, p=<0.001) and intensive care unit (ICU) / high dependency unit (HDU) (13.0% of transfusions vs 5.9% of errors, p=<0.001) were relatively safer.

1 'Wrong blood' events (n=87)

These patients, who received a blood component intended for a different patient or of an incorrect group, could potentially have been at risk of life-threatening haemolytic transfusion reactions.

- Ten patients received ABO incompatible red cell transfusions, 2 of which were also D incompatible.
- Nine patients received ABO incompatible FFP or cryoprecipitate (group O components given to patients of other groups).
- Two patients received ABO incompatible platelets (group O to patients of other groups in error)
- Eight D negative patients inadvertently received D positive cellular components, - none of these was a female of child-bearing age.
- One patient with anti-c received group O rr red cells.
- The remaining 57 patients received components that were fortuitously compatible.

Case 1 - Fatal ABO incompatible transfusion

A 69 year old male with a ruptured abdominal aortic aneurysm was taken to theatre after midnight. The patient's wristband was removed for insertion of an arterial line. A sample had been sent previously to the laboratory for a blood group and antibody screen - the group was recorded as O D positive. Six units of red cells were requested and crossmatched - all were transfused during the operation. A further 4 units were crossmatched and delivered to the satellite blood refrigerator in the theatre suite. When the patient began bleeding again, a nurse was sent for the next 4 units, but instead collected 4 group A D positive units crossmatched for another patient. A staff nurse and a healthcare assistant checked the blood against the compatibility slip. One unit of blood was administered by a consultant anaesthetist and 1 by a specialist registrar (SpR) without a patient identity check. The error was noticed as the 3rd unit was about to be given. The patient suffered an acute haemolytic transfusion reaction, was admitted to ICU for dialysis and ventilation but died 2 days later.

Causes of 'wrong blood' events

Errors occurred at all critical points in the transfusion chain, i.e. patient sampling, laboratory pre-transfusion testing, collection of blood from storage site and administration at the bedside. The site of the primary error, which led to the mistransfusion, is shown in Table 5. This table also illustrates those cases where the primary error could have been detected at a later stage in the chain, but was not. The most common scenario was that the wrong unit of blood was delivered to the clinical area and staff carrying out the pre-transfusion checking procedure failed to detect the error.

Table 5

Site of the primary error that led to mistransfusion

Site of Primary Error	No of cases (%)
CLINICAL (patient sampling)	4 (4.5%)
Also laboratory error	*1*
CLINICAL (wrong blood delivered to clinical area)	23 (26.4%)
Also failure of bedside check	*23*
CLINICAL (blood administered to wrong patient)	23 (26.4%)
LABORATORY	37 (42.5%)
Also failure of bedside check	*4*
Total cases	**87**
Total errors	***115***

Sample errors

Four cases were reported in which the sample for pre-transfusion testing was taken from the wrong patient or labelled with another patient's details. One resulted in an ABO incompatible transfusion. Most such errors can be detected in the transfusion laboratory and are near misses.

Case 2 - Beware patients with the same name!

Fred Bloggs and Joe Bloggs were on the same ward. Neither was previously known to the laboratory. Fred required blood for a revision hip arthroplasty, but the sample was taken from Joe, labelled with Fred's details and grouped as AB D positive. Fred received four units of AB D positive blood; the error was detected when a repeat sample was found to be group O D positive. He suffered no ill effects.

Case 3 - Vigilance needed in the laboratory

A sample for pre-transfusion testing was taken from the wrong patient. The patient's previous record was held on a legacy system but the laboratory staff did not look it up. The blood provided was ABO compatible.

Laboratory errors

In 37/87 (42.5%) of 'wrong blood' reports the originating error occurred in the hospital transfusion laboratory. In one further case (3 above) an error in sampling that could have been picked up by the laboratory was missed due to a previous group being on a legacy system. Twenty-seven errors involved testing and 10 were errors in component selection and labelling.

In 22 cases there was an error in ABO typing. In 9 the wrong sample was selected for testing, in 10 cases there were transcription/recording errors, in 2 cases interpretation errors and in one case the reason for the incorrect result could not be ascertained. Where the wrong sample was selected, manual tests were being performed in 5 cases, in 1 case the wrong sample was labelled before being loaded onto an analyser and in 3 cases the error was unclear. Transcription errors occurred during manual testing in 6 cases and in 4 cases where automation was used without an interface connection. Fifteen of these 22 errors occurred 'out of hours' and 6 occurred during routine working hours, whilst in 1 the time of error was not given. Twelve of the cases were classified as urgent, 6 as routine and in 4 cases the urgency of the test was not given. Three of these 22 patients received ABO incompatible red cell transfusions, and 6 incompatible FFP.

In 9 cases there were component selection errors. Three of these were group O FFP or cryoprecipitate provided for patients of group A or B, one of which was a group B D negative infant who also received D positive platelets. A further 4 D positive components (red cells in 3 cases and platelets in 1) were supplied in error to D negative patients. One report was of issue of platelets to the wrong patient and in another case two human leucocyte antigen (HLA) matched platelets that arrived in the laboratory at the same time were switched and issued to the wrong patients.

The remaining 6 cases include 3 incorrect D types (one where the wrong sample was tested, one recording error and one historic error that could not be investigated), 2 crossmatching errors (incorrect sample used in both cases) and a labelling error.

It is of interest to note that 12 of the 27 laboratory 'testing' errors occurred because the wrong sample was selected for test.

22 of these 37 errors (59%) occurred outside of core hours.

Learning points

- Basic training for biomedical scientists must reiterate careful sample identification at the point of test.
- Robust systems must be in place for recording results of both manual and automated tests if electronic interfaces are not in place.
- Competency based training for laboratory staff must include those working out of hours.
- A laboratory quality system, as required by the Blood Safety and Quality Regulations, must include internal incident reporting mechanisms and appropriate, documented, corrective actions.

Collection and administration errors

In 23 cases the wrong blood was collected from the refrigerator and delivered to the clinical area, and the error was not detected when the blood was administered to the patient. In a further 23 cases, the correct blood was delivered to the clinical area but was given to the wrong patient. Four cases were reported in which a laboratory error might have been detected at the bedside but was not. Thus there were 50 cases where the pre-transfusion checking procedure was carried out incorrectly or omitted altogether.

Seven of these errors resulted in ABO incompatible transfusions - it is notable that in 6 of these the 'checking' of the blood was done using the compatibility form, whilst in the seventh a theatre prescription was used as the patient wristband was inaccessible.

Case 4 - Transfusion errors may affect more than one patient.

'Emergency O D negative' blood was requested for a patient bleeding in theatre. A nurse collected 2 units that were group O D negative but crossmatched and labelled for 2 other patients. One unit was blood of a very rare phenotype - the intended recipient's planned surgery had to be postponed whilst the blood service screened further units.

Case 5 - Safety systems are only effective if correct procedures are followed.

A nurse was asked to set up a transfusion for Jill Archer. She found that Jill was not wearing a special 'red label' transfusion wristband, and the laboratory informed her that no blood had been requested. She informed a doctor who promised to 'sort it out'. Meanwhile blood was delivered to the ward for Kathy Perks, together with some spare 'red label' numbers. The nurse assumed that the blood was for Jill Archer, she attached the labels to a wristband and transfused the blood. A second doctor discovered the error when reviewing Jill Archer and finding that blood had not been prescribed. The blood was compatible.

Learning points

- A final patient identification check must always be carried out before transfusion using the identity band or formally risk assessed alternative attached to the patient.
- Safety systems must be supported by training and education of all staff involved in transfusion, to ensure that correct procedures are followed.
- Routine pre-transfusion testing should not be done outside of core hours unless there are adequate numbers of appropriately skilled staff.
- Administration of blood should only take place at night when clinically essential.
- Procedures must be in place for collection of blood from refrigerators and must include the requirement to check against the patient's minimum identification dataset.

2 Other pre-transfusion testing errors - incorrect D groups, missed alloantibodies and missed incompatibilities (n=22)

Three of these 22 cases involved neonates and 12/22 occurred 'out of hours'.
Cases where antigen negative blood should have been selected for a patient with a known antibody, but was not, are included in the 'Special requirements not met' section.

The 22 errors can be split into procedural errors i.e. incorrect test/component selection (15 cases of which 3 were neonates) and testing errors i.e. the correct tests were performed but incorrect results were obtained (7 cases).

10/22 errors (6/7 testing errors and 4 procedural errors) involved the antibody screen. In 3 of these cases, all neonatal patients, the antibody screen was either not performed when it should have been or maternal results were not looked up. In 3 cases a positive antibody screen was 'missed' due to software problems in automated systems, in 1 case a weakly positive result was modified to negative on an automated system, in 1 case a weak antibody was missed by a manual technique and investigation of the case revealed a pipetting problem, and in 1 case the BMS forgot to read the antibody screen. In one case outdated screening cells were used.

The seventh testing error was a missed anti-A1.

A further 5 procedural errors included 1 case where a repeat antibody identification panel should have been set up and was not, 2 cases where crossmatch compatible blood was issued without selection of appropriate antigen negative units, a case where electronic issue was used when an indirect antiglobulin test (IAT) crossmatch should have been performed and a case in which the laboratory failed to look for a masked allo-antibody in a patient with a positive direct antiglobulin test (DAT), resulting in a haemolytic transfusion reaction.

In 5 cases, laboratories failed to request fresh samples for pre-transfusion testing from recently transfused patients, contravening BCSH guidelines and running the risk of missing a recently developed allo-antibody.

In 1 case a BMS thought that 'high risk' patients need not be tested pre-transfusion and entered negative results for a crossmatch that had not been performed.

A number of cases of laboratory errors appear to show chaotic practices either because laboratories are too busy or because of 'poor housekeeping'.

Case 6

A patient had undergone emergency plastic surgery and was found to have a post-operative Hb 6.5g/dL. Four units of blood were requested. There was no historical transfusion record. The on-call BMS carried out a group and antibody screen, and issued 4 units red cells as compatible by immediate spin cross-match, but failed to read the antibody screen. This was only noticed to be positive when an antibody screen on another patient was read. Anti-E was identified by panel. The BMS phoned the ward to halt the transfusion - the patient had received <50 mL with no adverse sequelae.

Case 7

A crossmatch request was received via A & E for a patient with a fractured neck of femur. The laboratory staff processed the sample on the IBG analyser; results showed a positive antibody screen. As the blood was not required immediately, a decision was made to perform an antibody panel during the next routine day. Later that afternoon, during the on-call period, a request was made for 2 units of blood. A panel was then performed and the results suggested an antibody, but the results were not consistent with those of the antibody screen. This was later found to be due to the fact that the screening cells had been changed in the last 24 hours but the result sheet had not been changed to the new batch - unknown to the on-call member of staff. Six units of blood were put up for crossmatch of which 2 were compatible. In view of the disparity between panel and screen, these 2 units were issued as crossmatch compatible with the appropriate documentation and were not screened for the presence of the suspected antigen.

3 Blood of wrong group given to recipients of ABO mismatched haemopoetic stem cell transplants (n=2)

Recipients of ABO mismatched stem cell transplants require the utmost care in provision of blood components during engraftment.[18] Two cases were reported in 2005 in which patients were given blood components of an incorrect ABO group.

In 1 case the laboratory was not informed that the patient had received a transplant, and only suspected this when discrepant ABO grouping results started to develop. In the second case the laboratory staff did not adhere to the protocol and selected blood of the incorrect group, then compounded the error by incorrectly performing the crossmatch and failing to detect incompatibility. The patient suffered an acute haemolytic transfusion reaction.

4 Failure to provide components of appropriate specification or that did not meet special requirements (n=141)

There was a similar number of cases in this category to last year (143).

These cases are summarised in Table 6.

In this subgroup of cases, errors occurred at all points in the transfusion process and all types of hospital, including specialist centres with a high throughput of patients with special transfusion requirements.

Selection of unsuitable components by laboratory staff is common and, if the wrong product is issued, failures in the clinical process often lead to mistransfusion. The majority of selection errors are made by regular, experienced staff during normal working hours, although on-call staff who do not routinely work in the laboratory may be less likely to consult the historical transfusion record - this finding has clear implications for training and regular reinforcement /audit of standard operating procedures.

Table 6

Special requirements not met

Special requirement	No of cases
Irradiated components	89
CMV negative components	6
Irradiated and CMV negative	16
Antigen negative red cells for patient with known antibody	20
Antigen negative and Irradiated	1
HPA1a/5b negative platelets for NAITP	2
Neonatal red cell transfusion, exchange transfusion	4
Viral inactivated non-UK FFP for a child	1
HLA matched platelets	1
Pre-deposited autologous red cells	1
Total	**141**

Irradiated components

As in previous years, failure to provide irradiated components formed the large majority of cases in this category. One hundred and six patients (c.f. 84 in 2004) were placed at risk of TA-GvHD although no actual cases of TA-GvHD were reported in 2005. There were 58 males and 48 females with a mean age of 49.5 years (range 6 days to 95 years). Between them, these patients received 204 units of red cells and 28 platelet transfusions. The clinical indications for irradiation in these patients are shown in Table 7.

Table 7

Indication for irradiated products

Indication for irradiated components	No of cases
Purine analogue therapy	44
Stem cell transplantation	29
Hodgkin's Disease	17
Di George syndrome	5
Other T-cell immunodeficiency	2
Severe aplastic anaemia/ALG	3
Neonate, previous *in utero* transfusion	1
Miscellaneous	5
Total	**106**

The site of the primary error, which led to the failure to provide irradiated components, is shown in Table 8. This table also illustrates those cases where further significant errors in the transfusion chain occurred and contributed to the transfusion incident (e.g. the primary error may have occurred in the laboratory, but clinical errors in requesting, prescription or bedside checking allowed the component to be transfused).

Table 8

Site of the primary error that led to the failure to provide irradiated components

Site of Primary Error	No of cases (%)
LABORATORY	30 (28%)
(also clinical error)	*27*
CLINICAL	70 (66%)
(also laboratory error)	*9*
ADMINISTRATIVE OR I.T. ERROR	3
(also laboratory or clinical error)	*2*
PHARMACY	1
(also laboratory or clinical error)	*1*
BLOOD SERVICE	2
(also laboratory or clinical error)	*2*
Total cases	**106**

Although laboratory errors are a common cause of failure to administer irradiated products, in almost every case a concomitant clinical error removed an opportunity to prevent the mistransfusion. Sixteen of the 30 cases would have been prevented by a correctly performed final bedside check against the accurately completed prescription sheet. Laboratory errors equally involved failure to check (or correctly interpret) the historical record (16 cases) or failure to notice or action the requirement for irradiated products indicated on the request form (14 cases). Twenty-eight of the 30 laboratory errors (93%) in this category were made by regular transfusion BMS staff during normal working hours.

Clinicians continue to be unaware of the indications for irradiated products in their patients (especially Hodgkin's disease), fail to communicate with the laboratory and make errors in requesting and prescribing. Better communication between clinical teams 'sharing care' for patients is essential. Thirty-seven per cent of the patients who had received purine analogues and 16% of cases involving stem cell transplantation had been treated at another hospital but no record of their special transfusion requirement had been communicated to the local hospital or transfusion laboratory.

This report includes 5 cases of babies or children with Di George syndrome undergoing surgery for congenital heart disease. In 4 cases the clinical team failed to indicate the diagnosis or order irradiated products and 1 case was due to laboratory error.

Errors primarily caused by administrative or IT problems included a patient with duplicate hospital numbers (the *Irradiated Products* flag was only recorded under one of the numbers), an episode caused by implementing a new laboratory computer system which didn't automatically transfer warning 'flags' and a case where a new hospital Patient Administration System led to failure to locate the correct historical record on the laboratory computer (case 8 below). One patient had several volumes of hospital notes but the *Irradiated Products* sticker was only on one of them.

One of the two Blood Centre errors involved emergency issue of non-irradiated red cells to a hospital that routinely uses *only* irradiated cellular blood products. The non-irradiated red cells were 'missed' by both the hospital transfusion laboratory and the clinical area. In the other case, clinical urgency did not allow time to irradiate the red cells before issue.

Twenty-six of the 106 cases (24%) could have been prevented by a properly performed bedside check against the accurately completed prescription. Twenty-one cases (20%) could have been prevented if all hospital laboratories could access a common database.

Many hospitals have a system where the pharmacy informs the transfusion laboratory of all patients prescribed purine analogues. However, in two cases, the information downloads were only carried out monthly and a patient was transfused with irradiated products in the interval between prescription and notification of the transfusion laboratory.

Case 8

A new Patient Administration System generates dates of birth in US format (month/day/year). The laboratory computer cannot search by unique indicators (hospital or NHS number) and historical records are located by entering date of birth, first name and surname. Using the date of birth format from the request form failed to locate the correct patient record that contained an Irradiated Products *flag.*

Cytomegalovirus (CMV) negative components

Sixteen of the 22 cases of failure to transfuse CMV negative components (73%) were also associated with failure to issue irradiated components. Affected patients ranged from 1 day to 82 years of age (mean 35 years). None of these cases was reported to result in CMV transmission.

Ten cases were primarily caused by laboratory errors, 11 were clinical errors and one case resulted from failure of the Blood Centre to issue CMV negative red cells in an extreme emergency. Analysis shows that the root causes of failure were much the same as for irradiated products. Only one case involved the emergency issue of blood components. Regular staff, working during normal hours, made 90% of the laboratory errors. Two cases involved specialist clinical teams being unaware of the local policy, based on consensus advice,[19] for the provision of CMV negative products in patients with HIV infection.

Seven of the cases (32%) could have been prevented by a properly performed bedside check against the accurate prescription.

Antigen negative red cells for patient with known antibody

There were 21 reports in this category, in patients ranging from 2 months to 89 years of age. Nineteen of these cases (90%) were due to laboratory error. Eight involved failure to consult the historical record on the laboratory computer (6 were perpetrated by on-call staff who do not work routinely in the transfusion laboratory and 2 of these were locum staff). In 4 cases laboratory staff, because of incorrect interpretation of results or 'human error', selected an incorrect component. Two cases were communication errors. In one case staff failed to communicate information between shifts and, in the other, incompatible computer systems in two laboratories *in the same Trust* were unable to transfer the historical record between sites. Transcription errors in manually transferring historical data to a new laboratory computer system led to two reports from the same hospital (Cases 9 & 10).

Two cases were due to clinical errors. In one case the ward medical staff failed to contact the laboratory even though the patient produced an antibody warning card from another hospital. In the second case, there was a failure to inform the laboratory when the donor for an allogeneic blood stem cell transplant was changed (Case 11).

Cases 9 and 10

A hospital commissioned a new laboratory computer system. Unfortunately, it was not possible to transfer data electronically from the old system to the new. Manual transcription of the historical record led to two errors. In the first case, a patient with anti-c and anti-E was transcribed as anti-C and anti-E. The second case was altered from anti-Lu(a) and anti-E to anti-Lu(a) and anti-e. This led to the transfusion of 9 units of red cells of the inappropriate groups, but with no significant clinical sequelae.

Case 11

A D positive patient underwent haemopoietic stem cell transplantation from a D positive donor. Unfortunately, the graft failed and the patient underwent a second transplant, this time from a D negative donor. The laboratory was not informed of the second transplant and continued to supply D positive red cells. The immunosuppressed patient received a total of 79 D positive red cell transfusions over a 5 month period without any adverse reactions or becoming sensitised to the D antigen.

Neonatal transfusions

There were 6 incidents involving neonatal transfusions of red cells or platelets outwith the above categories.

In two cases of neonatal alloimmune thrombocytopenia (NAITP) there was a failure to issue HPA1a/5b negative platelets. One case was a combination of poor clinical communication and failure to consult the historical record (the baby had already had intrauterine platelet transfusion). In the second case, HLA-matched platelets for another patient arrived in the same urgent delivery from the blood centre as the HPA1a/5b negative platelets for the baby. There was poor communication between the clinical team and the laboratory and 'HLA-matched platelets' were written on the baby's prescription chart. The HLA-matched platelets were issued and transfused to the baby with no adverse clinical sequelae.

Two neonates needing urgent red cell transfusion were given the emergency O D negative blood intended for adult patients rather than the emergency paediatric pack. In both cases the clinical staff (Special Care Baby Unit and Obstetric Operating Theatre) were unaware of the location of the emergency paediatric blood or the special requirements of their patient.

Failure to issue viral-inactivated non-UK FFP for a child less than 16 years

In 2005 there was only one reported case, compared to 9 in 2004.

Preoperative autologous donation of red cells (PAD)

One case was reported to SHOT in 2005.

Case 12

A 64-year-old woman was scheduled for primary total hip replacement. The orthopaedic surgeon arranged for 2 units of autologous red cells to be collected in the hospital prior to surgery. The laboratory procedure was not to 'reserve' the autologous units on the patient's laboratory computer record until a request for blood was received. When the clinical team requested blood, the on-call biomedical scientist (who did not work regularly in the transfusion laboratory) crossmatched and issued 2 units of allogeneic blood, which were transfused to the patient.

As well as highlighting problems with internal laboratory procedures, communication and clinical checking, this case well illustrates that PAD does not protect patients against the most common serious hazard of transfusion, i.e. transfusion of an incorrect component. The patient's preoperative Hb was only 10.8g/dL after the donations, increasing her risk of needing perioperative transfusion and exposing her to transfusion hazards. Preoperative optimisation of Hb, strict transfusion triggers and use of cell salvage, where appropriate, obviates the need for transfusion in most such cases. 'Routine' use of PAD is no longer supported by the National Blood Transfusion Committee for England and North Wales or the English National Blood Service.

Learning points

- Hospital and laboratory IT systems should use compatible patient ID parameters to ensure that correct historical transfusion records are accessed rapidly and efficiently. Laboratory IT systems should be updated with special requirements and data should be transferred electronically to new systems. Systems should, if possible, be routinely updated with new rules, e.g. methylene blue non-UK FFP for patients under 16.
- Several laboratory errors were caused by failure to notice the *Special Requirements* box on the transfusion request form. The format of transfusion request forms should be reviewed to ensure this section is appropriately prominent. Electronic requesting systems should ensure completion of this section is mandatory. Laboratories should also insist on appropriate clinical details on request forms - 'anaemia' or 'pre-op' is not sufficient.
- Clinicians have a responsibility to be aware of the special transfusion needs of their patients and to ensure that local systems for notifying the laboratory are followed. Hospitals should consider implementing a system of informing the laboratory as soon as the requirement for irradiated components is identified. In the case of purine analogue therapy, routine notification of the transfusion laboratory by the hospital pharmacy is an effective safety measure, although data should be transferred at frequent intervals to prevent patients receiving non-irradiated products in the 'window period'. Where patients have several volumes of hospital notes, each should be 'flagged' with the special transfusion requirements.
- Blood request forms must be accurately completed and transfusion prescriptions must indicate special requirements.
- The final bedside check is the last barrier to mistransfusion and appears to fail in 20 to 40% of cases - research into ways of improving its effectiveness and evaluation of new technologies to improve the process is essential.
- Communication, both between clinicians in specialist treatment centres and local hospitals, and between clinical teams within hospitals, must be improved. Data on special transfusion requirements should be communicated between transfusion laboratories in hospitals that routinely 'share' patients.
- Greater emphasis should be placed on involving patients in ensuring their special transfusion requirements are met. Simply issuing 'Irradiated Component' cards to patients appears to have been of limited benefit. The introduction of a patient held booklet (analogous to the commonly used anticoagulant booklet), together with targeted education, should be considered for patients following stem cell transplantation and purine analogue therapy and would be a suitable area for clinical research and pilot studies.

5 Inappropriate or unnecessary transfusions (n=67)

Reports of these cases, in which patients received blood components unnecessarily, have increased from 56 in 2004. The underlying causes are shown in table 9. SHOT does not currently accept reports of non-compliance with guidelines on appropriate use. Such cases are difficult to assess retrospectively by a third party, and appropriate use of blood is best evaluated by well constructed prospective clinical audit such as the National Blood Service/Royal College of Physicians National Comparative Audit.

However 7 cases are included in which patients were grossly overtransfused, contributing to the death of one patient and major morbidity in another. We plan in future years to include a category of transfusion associated circulatory overload (TACO) and have included these cases in anticipation of this development.

Table 9

Site/stage of primary error leading to inappropriate transfusion

Primary error	Number
Unsuitable sample for FBC, e.g. from 'drip arm or from wrong patient (CLINICAL)	27
Also laboratory error	*6*
Also clinical (request) error	*5*
Analytical error (HAEMATOLOGY LABORATORY)	10
Also clinical (request) error	*2*
Near-patient testing error (CLINICAL)	5
FBC misinterpreted or wrongly transcribed resulting in request error (CLINICAL)	5
Wrong component/product selected (TRANSFUSION LABORATORY)	4
Wrong component collected from hospital transfusion laboratory (CLINICAL)	9
Also failure of pre-transfusion check against prescription	*15*
Overtransfusion due to clinical misjudgement (CLINICAL)	7
Total cases	**67**
Total errors	***95***

The most frequent underlying cause in this sub-category was faulty blood sampling; from a 'drip arm' in 11 cases, settled in a syringe in 3, haemolysed in 1, insufficient in 1. In a further case a sample was taken from a Hickman line, apparently using the correct technique, but was dilute. Two cases resulted from a full blood count (FBC) sample taken from the wrong patient. In the remaining 8 cases the cause of the sample error was not found. In 3 cases the haematology laboratory issued a provisional report and requested a repeat sample, but instead the patient was transfused. In 6 cases the haematology laboratory failed to investigate a large discrepancy between the current and recent result, subsequently found in 4 cases to be due to clots in the sample.

Case 13 - Faulty blood sample and lack of communication results in unnecessary transfusion.

Samples for full blood count and biochemistry were taken from a patient using a syringe, because of difficulties with venous access. The biochemistry laboratory reported that the sample was haemolysed and requested a repeat. The haematology laboratory were not alerted to the potential problem and did not notice the haemolysis. They processed the sample and issued an erroneous report, as a result of which the patient was transfused with 2 units of blood.

Case 14 - Does the clinical picture fit the laboratory report?

A female patient was admitted as an emergency with an intra-uterine death. The full blood count results and coagulation screen suggested a diagnosis of disseminated intravascular coagulation but there were no clinical signs of this complication. The ward queried the results with the laboratory and were reassured that they were genuine. Two units of red cells and 4 units of cryoprecipitate were transfused. The sample was subsequently discovered to contain clots.

A further 15 cases resulted from analytical errors, 5 of which were near-patient testing, including 2 haemoglobin results from blood gas analysers.

Case 15 - Haemoglobin result from blood gas analyser cannot be relied upon.

A collapsed patient was admitted to a coronary care unit. A haemoglobin estimation on a blood gas analyser gave a result of 2g/dL. A sample was sent to the laboratory and in the meantime 2 units of uncrossmatched group O D negative blood were transfused. The haemoglobin result from the laboratory was 10.7g/dL. The patient suffered no ill effects as a result of the transfusion.

In 4 cases, a decision to transfuse was based on a laboratory report that was either misunderstood (in one case a white cell count was mistaken by a junior doctor for a haemoglobin and in one case the red cell distribution width (RDW) was taken to be the platelet count) or wrongly transcribed (in one a mother's FBC result was written in her infant's notes).

Thirteen cases were reported in which there was apparent confusion over which blood component had been recommended and/or prescribed, reflecting a lack of knowledge of the indications, and in some cases the appearance, of components, and a lack of rigour in prescribing and administering blood.

Case 16 - Be careful how you delegate!

A haematology SpR requested platelets from the transfusion laboratory for his patient, and instructed the house officer to 'write them up'. The house officer asked a nurse how to prescribe platelets and was advised to write '2 bags FFP over 30 mins'. A different nurse, on seeing the prescription, telephoned the laboratory to request FFP, which was provided and transfused. The SpR discovered the error on finding the labelled platelets still on the agitator next morning

Learning points

- All staff undertaking phlebotomy must understand the importance of correct patient identification and correct sampling technique, and must be assessed as competent.
- Blood should only be prescribed by a doctor who has undergone training in blood transfusion and has been assessed as competent.
- Diagnostic laboratories must carry out checks to identify large changes in parameters ('delta checks') and should communicate discrepancies to other laboratories.
- Near patient testing must be subject to the same standards of validation and quality assurance as the diagnostic laboratory.

Seven reported cases of overtransfusion illustrated the difficulty of evaluating acutely bleeding patients and the importance of clinical and laboratory monitoring.

In 6 of these cases, blood loss was over-estimated and too much blood was given, contributing to one death (case 17) and one case of major morbidity (case 18). The pitfalls of blood administration to infants are illustrated by case 19.

Case 17 - wrong diagnosis leads to inappropriate transfusion.

A 62 year old female patient was admitted in a collapsed state with abdominal distension and thought to have a ruptured abdominal aortic aneurysm. A Hb result on a blood gas analyser was 15g/dL. Notwithstanding, the patient was transfused with 3 units of 'emergency O D negative' blood; the post-transfusion Hb was 18.6g/dL. She developed cardiac failure and subsequently died. The presumptive diagnosis of ruptured abdominal aortic aneurysm was not confirmed and the cause of death was uncertain.

Case 18 - importance of regular monitoring in acute bleeding.

A patient with gastro-intestinal bleeding was admitted with a Hb of 6.3g/dL. Four units of blood were prescribed. During transfusion of the third unit the patient was noted to be pale and was continuing to bleed. A further 6 units of blood were given without any interim monitoring. Following transfusion of all 10 units, the patient had a Hb of 19.6g/dL and had developed severe circulatory overload.

Case 19 - Transfusion to infants needs careful monitoring.

During a surgical procedure on a 3 month old infant, the anaesthetist was administering blood via a 3-way tap. He 'lost count' of the volume of blood transfused and the post-operative haemoglobin level was 20g/dL. The infant was venesected and survived without ill-effect.

6 'Unsafe' transfusions (n=79)

Seventy-nine patients (c.f. 54 last year) received potentially 'unsafe' transfusions - details are given in Table 10. Although these cases of handling errors are relatively low risk, the increase in reporting reflects improved vigilance and awareness of the importance of maintaining integrity of the 'cold chain' in hospital, and of adherence to national guidelines (BCSH and Handbook of Transfusion Medicine)[20],[12] on blood component handling and administration. These cases have not been analysed according to laboratory or clinical responsibility, as in many cases responsibilities for satellite refrigerators were not clearly assigned.

There was no resulting mortality or serious morbidity.

Table 10

Type of error	Number
Blood out of temperature control	43[1]
Blood component given was past its expiry or suitability date	24[2]
Blood components transfused over an excessive time period	9[3]
Other	3[4]
Total errors	**79**

[1] ***Blood out of temperature control (n=43)***

In 3 of these cases the transfusion was also prolonged.
13 cases related to the same incident, in which there was failure of a satellite refrigerator in a clinical area, the refrigerator was taken out of use and was clearly marked, but ward staff continued to remove blood from the main blood issue refrigerator and store it in the failed refrigerator.
In another incident, a satellite refrigerator in a theatre suite failed, the alarm sounded, and theatre staff re-set the temperature in order to silence the alarm.
In 2 cases an electronic tracking system was over-ridden.
In 2 cases blood was stored in a ward drug refrigerator, and in 1 case in a satellite blood refrigerator that was not yet commissioned.
Five reports related to the same incident, in which a cold room failure occurred following a planned electrical shut-down at a weekend. The laboratory was unattended and the remote alarm did not sound.
Two cases related to failure of a hospital transfusion laboratory refrigerator and also of the alarm.
Two cases related to units of blood that were left in a satellite refrigerator during cleaning by a medical laboratory assistant. The temperature in the refrigerator was later noted to be outside acceptable levels during and for several hours after cleaning.
In one case blood was out of temperature control during transit with a patient between hospitals. The laboratory at the receiving hospital accepted it into stock and subsequently issued it.
In 1 case FFP had been out of temperature control in transit from the blood centre. The receiving hospital was not informed until 17 days later, by which time 3 patients had been transfused.
In one case thawed FFP was held on a ward at room temperature for over 4 hours prior to transfusion.
In 12 cases red cells were in uncontrolled conditions in clinical areas for >30 minutes, before either being transfused over a period of >4 hours or returned to stock and subsequently re-issued and transfused.

[2] ***Blood given past its expiry or suitability date (n=24)***

In 2 cases the blood was also out of temperature control prior to transfusion, in one of which the transfusion was prolonged.
In 8 cases there was a failure of stock control by the laboratory, followed in all 8 cases by failure to note the expiry date when the blood was given. One of these was a neonate in extremis, - O D negative blood was taken from the emergency stock and transfused, 2 days past expiry.
In 5 cases blood components were issued close to expiry, and clearly labelled, but transfusion was delayed. In one of these cases an electronic system was by-passed.
In 9 cases the 'crossmatch expiry' was marked on the compatibility label but was not adhered to by clinical staff giving the blood. One of these units was also past its expiry date.

[3] ***Blood components transfused over an excessive time period. (n=9)***

UK guidance[12] recommends that:

- From starting the infusion of red cells (puncturing the pack with the infusion set) to completion, infusion of the pack should take a maximum of 4 hours
- Platelets should be infused over not more than 30 minutes
- Infusion of FFP should be completed within 4 hours

[4] ***Others. (n=3)***

In one a gelatinous precipitate was present in solvent detergent FFP (SD-FFP), and in another an unsuitable giving set was used.
Case 20 showed a lack of understanding by nursing and laboratory staff of correct procedures for handling blood components.

Case 20

Two units of FFP were requested and thawed, but were not labelled. They were collected from the laboratory by a porter and delivered to ICU. Two nurses 'checked' the FFP and set up the first unit. The BMS then discovered the labels on the bench and recalled the FFP. The first unit was taken down, a spigot was inserted and it was returned to the laboratory. The BMS attached the labels and returned the FFP to the ICU where the transfusion was re-commenced.

Learning points

- The need for every satellite refrigerator should be carefully risk assessed and reviewed regularly. Clear protocols establishing the responsibilities of the laboratory and nursing staff must be implemented.
- Transfusion laboratory stock control procedures should ensure that expired units are cleared from issue locations.
- Nurses giving blood must be familiar with current guidelines on the handling of blood components.
- Competency training for ward staff must reiterate the requirement for red cells to ONLY be stored in monitored blood refrigerators and must highlight the differences between a blood refrigerator and a normal ward refrigerator.
- Pre-transfusion checking procedures must include checking of the expiry date of the component and noting any end-date for suitability provided by the laboratory.

7 Adverse events relating to anti-D immunoglobulin (Ig) (n=87)

Eighty-seven events were related to anti-D immunoglobulin administration (c.f. 67 in 2004) and are summarised in table 11 below.

Table 11

Primary errors in cases involving anti-D Ig administration

Type of event	Number
Omission or late administration of anti-D Ig Clinical error in 20 (7/15 in community) Laboratory error in 7 (2 also clinical errors)	27
Anti-D Ig given to D positive patient All clinical errors (7/23 in community, 2 also laboratory error)	23
Anti-D Ig given to patient with immune anti-D Clinical error in 4 (2/4 in community) Laboratory error in 3 (1 also clinical error)	7
Anti-D Ig given to patient with weak D antigen [1] All laboratory errors	6
Anti-D Ig given to mother of D negative infant Laboratory error in 4 (1 also clinical error) Clinical error in 3	7
Anti-D Ig given to wrong patient All clinical errors in hospitals	6
Expired anti-D Ig given All clinical errors (8/9 in community)	9
Other[2] (1 in laboratory, 1 clinical error)	2
Total cases	**87**
Total errors	***93***

[1] These events should probably be regarded as limitations of available technology and not errors.

[2] One patient given 10 x correct dose issued by laboratory, 1 given IV preparation because of incorrect ward protocol.

For the first time, cases were reported in which misinterpretation of the antibody investigation at booking resulted in severe haemolytic disease of the fetus, resulting in an intrauterine death in one case (case 21) and severe morbidity requiring exchange transfusion in another (case 22). In a further case (case 23) no routine antenatal serology was done. This case has not been included in the numerical analysis as it does not fulfil the criteria for IBCT.

Case 21

Anti-D was detected at booking and a repeat sample requested by the laboratory. This was not sent; the GP interpreted the results as normal, and entered the patient on the routine antenatal anti-D prophylaxis (RAADP) programme. The reference laboratory did quantitation on the 28 week sample and found the anti-D level to be 141iu/mL. They alerted the Fetal Medicine Unit who attempted to contact the GP, but in the meantime the patient was admitted with an intrauterine death.

Case 22

Anti-D was detected at booking but assumed by the laboratory to be due to prophylactic anti-D Ig given to cover amniocentesis. No quantification or follow-up was carried out. In fact the patient had been found to have immune anti-D in 1994, but the laboratory computer records prior to 1995 were not accessible and the clinical staff had not looked up the notes of the previous pregnancy. No quantification was done during pregnancy - at delivery the infant had severe haemolytic disease of the newborn (HDN) and required exchange transfusion.

Case 23 (not included in numbers)

A patient delivered an infant with severe HDN. No samples had been taken during pregnancy. A historic group O D negative was recorded in the notes.

Learning points

- Training and competency assessment of BMSs in antenatal serology testing and the indications for issue of anti-D Ig must be comprehensive.
- There is an urgent need for education of primary care staff in the basic principles of antenatal serology and current relevant guidelines.

Table 12

Summary of blood transfusion laboratory errors - all cases (where known)

	Total Errors	Wrong Sample	Transcription	Interpretation	Component Selection Errors	Labelling	Procedural Errors	Incorrect Protocol	Testing	Not known
'Wrong Blood' - ABO group	22	9	10	2						1
'Wrong Blood' - Others	15	3	1		9	1				1
ABO mismatched transplant	1						1			
Special Requirements Not Met	72				72					
Inappropriate Transfusion	4				4					
Anti-D Errors	23	1	3				13	1	5	
Unsafe Tx	20						20			
Other Pre-tx Testing Errors	22						15		7	
Total errors	**179**	**13**	**14**	**2**	**85**	**1**	**49**	**1**	**12**	**2**

'Right blood to right patient' (RBRP) (n=67)

As in previous years, we have given reporters the opportunity to report incidents where the right blood was transfused to the right patient despite one or more errors which should have led to the unit being rejected. These incidents do not fit the definition for IBCT but are, nevertheless, instructive. They are not included in the overall numbers of IBCT.

The 67 cases are summarised in table 13.

Table 13
Right blood to right patient episodes

Elements which were wrong on blood packs, documentation, identity bands etc.	Number of incidents
DOB alone or with other elements	22
Name alone or with other elements	16
Hospital or NHS number	11
Transposed labels on 2 units	7
Units unlabelled	3
Hospital transfusion lab records not signed on collection	3
Miscellaneous:	
2 labels on 1 unit	1
Address only	1
Platelets issued retrospectively	1
DOB missing completely	1
1 unit given without prescription	1

Regardless of what the error was or where it was made or by whom, the vast majority of these transfusions (90%) should have been prevented by one or more checking procedures.

Table 14 shows where the error(s) should have been picked up but were not or were ignored.

Table 14

The checking procedure(s) which failed to identify the error(s)

Checking procedure	Number of incidents
Bedside checking	40
Clinical decision to proceed	5
Laboratory + collection + bedside checking	4
Laboratory	3
Sampling and bedside checking	2
Laboratory + bedside checking	2
Collection	1
Collection + bedside checking	1
Blood centre + laboratory + bedside checking	1

In IBCT cases, except in very unusual circumstances, if there was a clinical decision to transfuse despite the component being in some way unsuitable, the incident would not be included in the analysis. However, in the case of 'right blood to right patient', clinical decisions to transfuse are often taken because the clinician is unable to see the potential for error and such decisions are made in routine situations as often as in emergencies.

RBRP case 48

A sample from a premature baby was taken and labelled as 'Baby Girl' instead of 'Baby Boy'. This was noticed by the doctor who took the decision to proceed despite the non-urgent situation. Mis-labelling in the case of neonates is particularly hazardous until the child has been given a full name.

Incidents in which patients are transfused with units labelled with completely the wrong details often involve such a gross failure of the checking procedure that it is difficult to imagine how this can have happened. On the other hand, 'right blood to right patient' incidents illustrate how vital it is to carry out the bedside check in minute detail. It is quite possible that 2 patients on the same ward may have almost identical details which may perhaps differ only by a variation in the spelling of one of their names. Small differences in spelling may be easy to miss but still have the potential for disaster.

RBRP case 60

A misspelt surname on a request form from a hospital to a blood service laboratory went unnoticed by the Blood Centre, who issued a report form and unit labels with the same misspelling. This error was not picked up by the hospital laboratory, nor at collection or at the bedside. The error was eventually noticed at the bedside check for a second unit.

Learning points

- Clinicians should be aware of the potential dangers of transfusing patients when the checking process has highlighted a discrepancy in available information. If the situation is not an emergency it must be standard policy not to transfuse and to begin the process again.
- Staff carrying out the bedside check must check all details in minute detail since a discrepancy in only one letter or digit is potentially dangerous.

COMMENTARY

Notable findings this year were

- There has been a further encouraging reduction in ABO incompatible transfusions, but patient mis-identification continues to cause 'wrong blood' events. The NPSA Safer Practice Notices on wristbands[5] and 'Right patient-right blood'[4] are welcome initiatives.
- Comparison of SHOT reports with denominator data indicates an excess of errors at night.
- Hospital transfusion laboratory errors occurred in 37% of all IBCT cases, an increase from previous years.
- Reports of failure to provide blood of the correct specification for the patient are increasing.
- The reported infant mortality and morbidity due to haemolytic disease of the newborn as a result of misinterpretation of antenatal serology is of major concern.
- In 6 of the 7 reports of ABO incompatible transfusion due to administration error, the pre-transfusion check was carried out away from the bedside using the compatibility form.

RECOMMENDATIONS

The first four recommendations relating to these findings are incorporated in the main recommendations and appear in the Summary. They are repeated here for completeness.

- **Avoid blood transfusions outside of core hours:** Blood administration and pre-transfusion testing outside of core hours have been shown to be less safe and should be avoided unless clinically essential. Hospitals planning to move to 24/7 working must ensure that adequate numbers of appropriately skilled clinical and laboratory staff are available to ensure transfusion safety. It may be useful to audit the occurrence of patient safety incidents in hospitals during different time periods.

  Action: Hospital CEOs, consultant haematologists with responsibility for transfusion together with HTCs and HTTs.

- **Better laboratory practice:** An initiative aimed at improving practice in hospital transfusion laboratories is under way, led by the professional bodies. In the meantime, local quality improvements must be supported and resources provided to underpin the development of quality systems. It is essential that the quality and responsiveness of hospital transfusion laboratories is maintained as Pathology Services in England face major reorganisation following the Carter Report,[11] with the possible development of independent Pathology Trusts and diversification of providers of pathology services.

  Action: Hospital CEOs.

- **Communication of complex transfusion requirements:** Effective mechanisms must be developed for communication of information on complex transfusion requirements (e.g. for patients requiring irradiated components, those with allo-antibodies, stem-cell transplant recipients). Patient awareness and empowerment should be encouraged. Organisations should work together to implement and where necessary develop appropriate tools (e.g. documentation for patients transferred between hospitals, patient held booklets, standard antibody cards with accompanying advice).

  Action: UK National and Regional Blood Transfusion Committees to facilitate and co-ordinate, Hospital CEOs to implement.

- **Improve safety of routine antenatal anti-D prophylaxis:** Implementation of routine antenatal anti-D prophylaxis[15] must be supported by education of primary care clinicians and hospital laboratory staff. Current legislation[16] does not permit issue of anti-D Ig from the laboratory without a clinical request. National guidelines[17] on antenatal testing must be incorporated into agreed local policies and subject to clinical audit.

  Action: Royal Colleges of Midwives, General Practitioners, Obstetricians and Gynaecologists, Consultant haematologists, HTCs and HTTs.

- Hospital transfusion teams should review their system for blood issue and consider whether the compatibility form can be withdrawn.

  Action: Consultant haematologists with responsibility for transfusion.