20. Paediatric Cases

Definition

Paediatric cases comprise all those occurring in patients under 18 years of age.

Paediatric cases 2009

This chapter analyses the data on paediatric cases from the other chapters in this annual report. All the cases are also included in the data in their respective chapters. All children < 18 years of age are included and have been subdivided by age groups – neonates ≤ 28 days; infants > 4 weeks and < 1 year old; and children < 16 years – because each of these has recommendations regarding blood components. The chapter particularly highlights the cases related to the age of the patient.

Table 46
Summary of paediatric cases 2009

Category of case	No. ≤ 4 wks	No. > 4 wks – < 1 yr	No. 1 – < 16 yrs	No. 16 – < 18 yrs	Total paediatric cases
IBCT	**7**	**9**	**21**	**3**	**40**
Administration	4	1	0	0	5
Lab error	1	4	4	1	10
SRNM (total)	2	4	17	2	25
Irrad/CMV negative	2	3	7	2	14
MB-FFP requirement (or SD-FFP)	0	1	6	0	7
Others	0	0	4	0	4
WBIT	0	0	0	0	0
Handling and Storage	**6**	**0**	**2**	**1**	**9**
Inappropriate & unnecessary	**4**	**2**	**7**	**2**	**15**
Anti-D related	**0**	**0**	**0**	**3**	**3**
ATR	**2**	**3**	**28**	**4**	**37**
HTR	**0**	**0**	**2**	**0**	**2**
TACO	**0**	**0**	**0**	**0**	**0**
TRALI	**0**	**0**	**0**	**2**	**2**
PTP	**0**	**0**	**0**	**0**	**0**
TA-GvHD	**0**	**0**	**0**	**0**	**0**
TTI	**0**	**1**	**0**	**0**	**1**
Autologous (cell salvage)	**0**	**0**	**0**	**1**	**1**
TOTAL	**19**	**15**	**60**	**16**	**110**

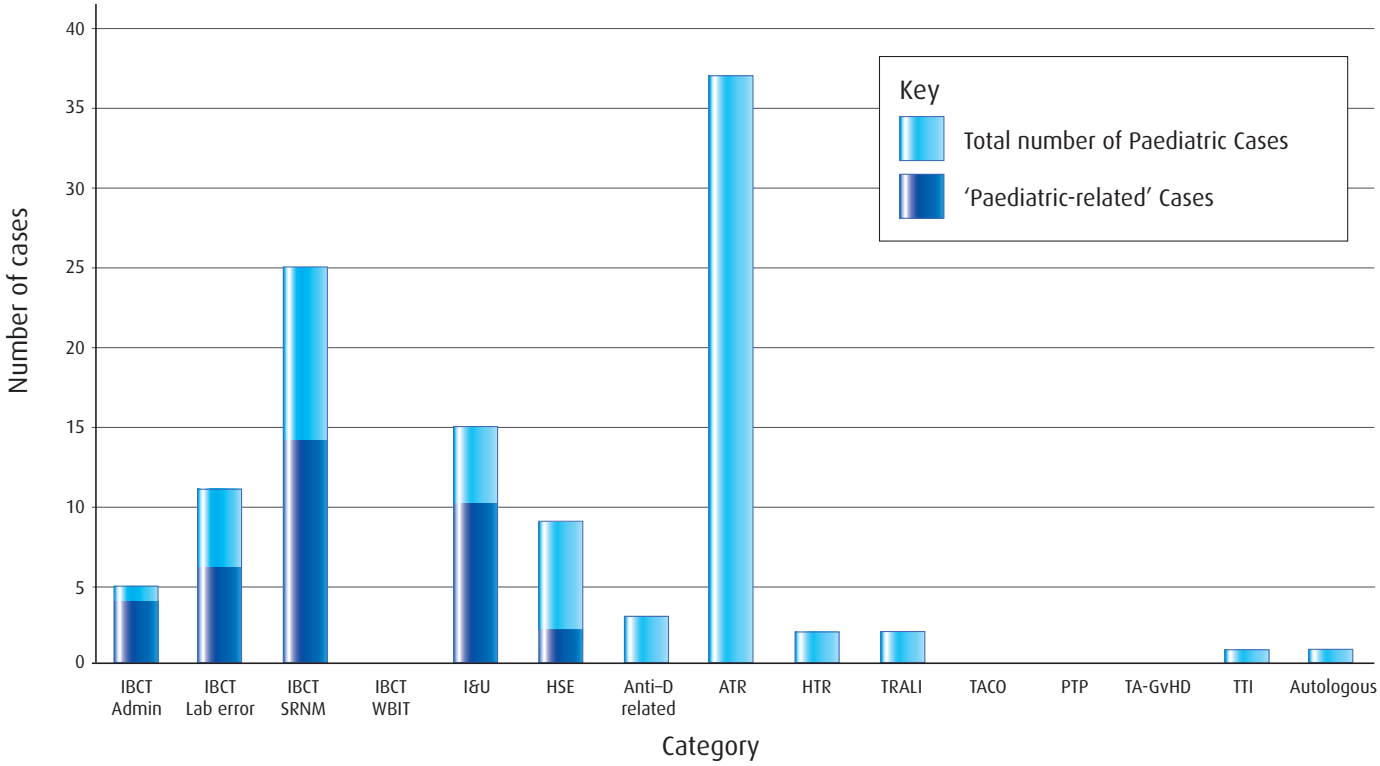
Introduction and overall trends

In 2009, 110 of the total 1279 reports (8.6%) involved patients < 18 years (yr). Furthermore, 94/1279 (7.3%) reports were in children < 16 yr, 34/1279 (2.7%) in infants < 1 yr, and 19/1279 (1.5%) in neonates ≤ 4 weeks. Although this represented an increase in the total number of paediatric reports compared with previously, it mirrors the overall increase in reports; the proportions in different age groups are similar to those in 2008. Thirty-four (31%) of paediatric reports were from infants < 1yr of age, of whom 19/34 (56%) were neonates ≤ 4 weeks old. As discussed previously, there is a disproportionally high number of reports in children compared with adults (see SHOT 2008 for further discussion of paediatric reporting trends).

As before, the majority of paediatric reports were error related (IBCT, handling and storage, inappropriate and unnecessary), comprising 64/110 (58%) reports. For the infant age group, error reports are a higher proportion, with 28/34 (82%) this year. This compares with the adult figure of 570/1279 (45%). The factors leading to many types of errors are the same in adults and children. However, some factors may be more likely to occur in the paediatric age group, including those that are unique to these patients such as age-related special component requirements. Reports involving these factors are described as 'paediatric-related' in the chapter, and this year were estimated to be 35/64 (55%) of all paediatric error reports with a higher proportion in the infant age group, at 23/28 (82%).

ATR cases followed the trend established in 2008, with 37/110 (34%) paediatric cases, an increase in total cases from the 25 reported last year.

Figure 23
Number of paediatric cases in each reporting category
For the error reports, the proportion of 'paediatric-related' cases is also illustrated



ERROR-RELATED REPORTS *n* = 64

Incorrect blood component transfused (IBCT)

IBCT – Special requirements not met (SRNM) *n* = 25

SRNM continues to be the largest subgroup of paediatric reports, with 25/110 cases (23%), 14 of which were considered to be paediatric-related. For infants < 1 year, there were 5 cases of failure to give irradiated blood when indicated, of which 3 involved patients who had had intrauterine transfusions (IUT) and 1 where a diagnosis of SCID was being queried. For the children ≥ 1 yr there were a total of 19 cases. Eight were considered paediatric-related, 6 of which reported the giving of standard FFP rather than imported pathogen inactivated FFP and 2 where non-apheresis platelets were used. However, there were also 6 cases where irradiated blood was not given and 3 where the CMV negative requirement alone was missed, where the reasons for special requirements (such as bone marrow transplantation, BMT) could have occurred at any age. In 1 case the need for platelets in platelet additive solution was missed, as the laboratory flag was unclear.

Fourteen of the SRNM errors could be attributed primarily to the laboratory, 5 primarily to clinicians, and 6 to both groups. Two of the reports where non-irradiated components were given to BMT patients involved problems with flags being removed from the laboratory computer system. There were also 2 reports of poor communication as part of shared care. These reports highlight the difficulty in putting tight systems in place to communicate special requirement needs, both between hospitals and within hospitals.

Case 1

Lack of awareness of the need for irradiated blood post IUT

A baby who had undergone IUT for HDN and with no signs of haemolysis at birth was admitted aged 7 weeks with an Hb of 4.4 g/dL and transfused with a paedipak of non-irradiated blood. Neither the request form nor the prescription indicated that irradiated blood was required. The laboratory SOP was unclear, and the BMS believed that blood for a top-up transfusion post IUT did not require irradiation. Finally, the nursing staff did not notice that the baby required irradiated blood.

This case illustrates poor clinical and laboratory understanding of the implications of fetal transfusions and the need for these to be highlighted adequately postnatally.

IBCT – Lab error *n* = 10

The second largest subgroup of error reports were lab errors with 10 cases, none of which had adverse outcomes recorded. The 5 infant cases were all < 2 months old and in 3 of these there were issues over maternal grouping/antibodies. In the first, a preterm neonate was grouped as A D negative but there was no evidence that the mother's group and antibody status was sought. The baby was given group A D negative paedipaks rather than group O D negative. A 1-month-old infant was manually grouped as O D positive and given group O red cells and platelets. The child was subsequently grouped as AB D positive. In the third case, a 1-month-old infant of a mother with multiple red cell antibodies including Jk^b was given Jk^b positive blood. The red cells were crossmatched against the infant's plasma and issued as compatible but they should have been antigen negative, and crossmatched with the maternal plasma if possible. A fourth case involved complications due to a 1-month-old infant having 2 hospital numbers, 1 which recorded the presence of maternal anti-D and the other which didn't. Blood was erroneously issued without crossmatch as a result of this confusion. The 5 cases in older children were not considered paediatric-related.

In addition to paediatric reports in the laboratory error category, the laboratory contributed to errors in other categories: 19/25 SRNM and 4/9 HSE reports. This gives a total of 33/110 (30%) paediatric reports in which laboratory error was a factor, although in many of these cases there were multiple contributory steps where clinical staff either contributed to the error or subsequently failed to detect that it had been made.

IBCT – Administration *n* = 5

All of the paediatric cases in this IBCT subcategory (administration errors) involved errors with 'flying squad' red cells. Three paediatric patients received emergency group O D negative blood that was intended for adult use despite paedipak group O D negative units suitable for neonates being available. In 1 case a crossmatched group O D negative unit labelled for an individual patient was collected and transfused instead of the available emergency units. In a further

incident group O D negative units were inappropriately transfused to a neonate with HDN due to anti-c which was well documented, and mother and baby had attended for management of this throughout the pregnancy.

Case 2

Doctor unaware of provision of emergency neonatal specification units in satellite fridge

A baby was delivered prematurely by emergency LSCS and had an Hb of 6.2 g/dL requiring emergency transfusion. The staff grade doctor borrowed a midwife's blood fridge access ID card. He removed a unit of adult emergency group O D negative blood, not the paediatric emergency unit which was also present. The baby received 100 mL of the adult unit with no adverse reaction. The incident came to light when the satellite fridge was being restocked by the transfusion laboratory BMS.

This case highlights a lack of knowledge in the doctor, but it is also an example of abuse of the ID-based electronic fridge system, which was in place to help prevent such errors.

Case 3

Baby with known anti-c HDN given group O D negative red cells in error

A baby was born by emergency LSCS with HDN secondary to maternal anti-c which had been known to be at a very high titre throughout pregnancy. In the emergency, group O D negative blood was requested but was unsuitable due to high maternal anti-c detected in pregnancy. The 'flying squad' blood was then removed without informing the laboratory of the need for emergency transfusion. The laboratory at first prepared group O D negative blood, but as the crossmatch was positive it was not issued. Subsequently, with some delay, group O D positive c negative blood was supplied. After receiving the standard 'flying squad' blood the baby suffered an immediate mild reaction, which fully resolved. The bilirubin climbed further, requiring exchange, and this may have been accelerated by the incompatible transfusion.

This case is likely to be as much due to lack of knowing the details of the particular patient as lack of understanding about HDN – all compounded by communication deficiencies.

These cases suggest a worrying problem with confusion of adult and neonatal blood for emergency perinatal use, and in some cases confusion over where to go for emergency blood.

Handling and storage errors *n* = 9

Most of the 9 paediatric reports were considered unrelated to the age of recipient. Six reports were from neonates and 3 from older children. The neonatal reports included 1 case of red cells and 2 of platelets being given after expiry without being noticed at the bedside check, and 1 where the transfusion was not complete until 4 hours 45 minutes after removal from cold storage. There were 3 reports in older children, including the use of an IV giving set instead of a transfusion set, a cold chain error, and inadequate packing of red cells and platelets for transfer with a patient.

Inappropriate and unnecessary transfusion *n* = 15

There were twice as many reports in this category as in 2008. Ten reports involved paediatric-related situations. In 3 the doctor prescribed too much blood. The first related to 3 separate preterm neonatal prescriptions by the same junior doctor who increased the transfusion volume by 20 mL to account for the volume of blood in lines. In the second, the doctor miscalculated the volume needed for a 2 year-old, and in the third a doctor prescribed 2 adult units for a 5 year-old with sickle cell disease, raising the Hb to 14.9 g/dL from 7.0 g/dL. There were 5 paediatric reports where there were nursing errors potentially causing over-transfusion. These involved a combination of wrong pump settings and confusion over administering units as opposed to mL of blood. One neonate received 30 mL of blood instead of 20 mL due to incorrect pump settings. A 750g neonate on restricted fluids was prescribed 11 mL red cells over 4 hours. The pump was initially set too slowly, but then at too high a rate in order to catch up, before a senior nurse noted the risk of over-transfusion. For a 4 year-old, in calculating the hourly infusion rate needed to give a red cell unit over 2 hours, the nurses multiplied the volume of the unit by 2 instead of dividing it; this was discovered rapidly so there was no

adverse outcome. In that report, a unit of blood was prescribed rather than the exact volume. The following 2 cases involve clinically significant over-transfusion.

Case 4

A request was made for 110 mL of blood as a top-up transfusion for a 12-month-old child with endocarditis being ventilated and on inotropes on paediatric intensive care. One adult unit of blood (230 mL) was issued, and the nursing staff transfused the entire unit. The post-transfusion Hb was 19 g/dL and the patient required venesection.

Case 5

A prescription was made for 140 mL of red cells for a 6-month-old infant on intensive care following surgery for congenital heart disease. The nurse asked the doctor if she should give 1 unit, and he agreed. The unit issued was an adult bag with 257 mL. The entire unit was transfused but there was no adverse outcome other than excessive flushing.

One neonate had a delayed transfusion due to communication failures, misunderstandings and portering delays (see I&U chapter, page 66). In the final paediatric-related report there was confusion between the results for twin neonates. One had a low platelet count but platelets were requested and transfused to the other twin.

There were 5 reports where age of the recipient was not a major factor in accounting for the problem. In 3 of these the patients were transfused platelets based on an initial platelet count that was subsequently highlighted as erroneous due to platelet clumping. One patient with lethargy and pallor was transfused on the basis of a low Hb of 7.8 g/dL later discovered to be from the week before. The Hb from the day of transfusion was 11 g/dL.

TRANSFUSION REACTIONS *n* = 42

Acute transfusion reaction *n* = 37

In 2008 there was a striking increase in the number of paediatric ATRs reported, particularly from platelets (18 reported). This year, there were a similar number of reactions to platelets (14/37; 38%), but the majority of cases were in red cells with an increase in reports to 19/37 (51%). There were only a few ATR reports after FFP transfusion (3/37; 8%). These proportions are similar to the paediatric summary data 1996–2005.[55]

Only 5/37 (14%) paediatric ATR reports were in infants < 1 yr old, including 2 in the neonatal group of which 1 was an anaphylactic reaction to platelets. A high proportion of reports in the ≥ 1 yr age group are of ATR, accounting for 32/76 (42%) total reports for this group, similar to 2008.

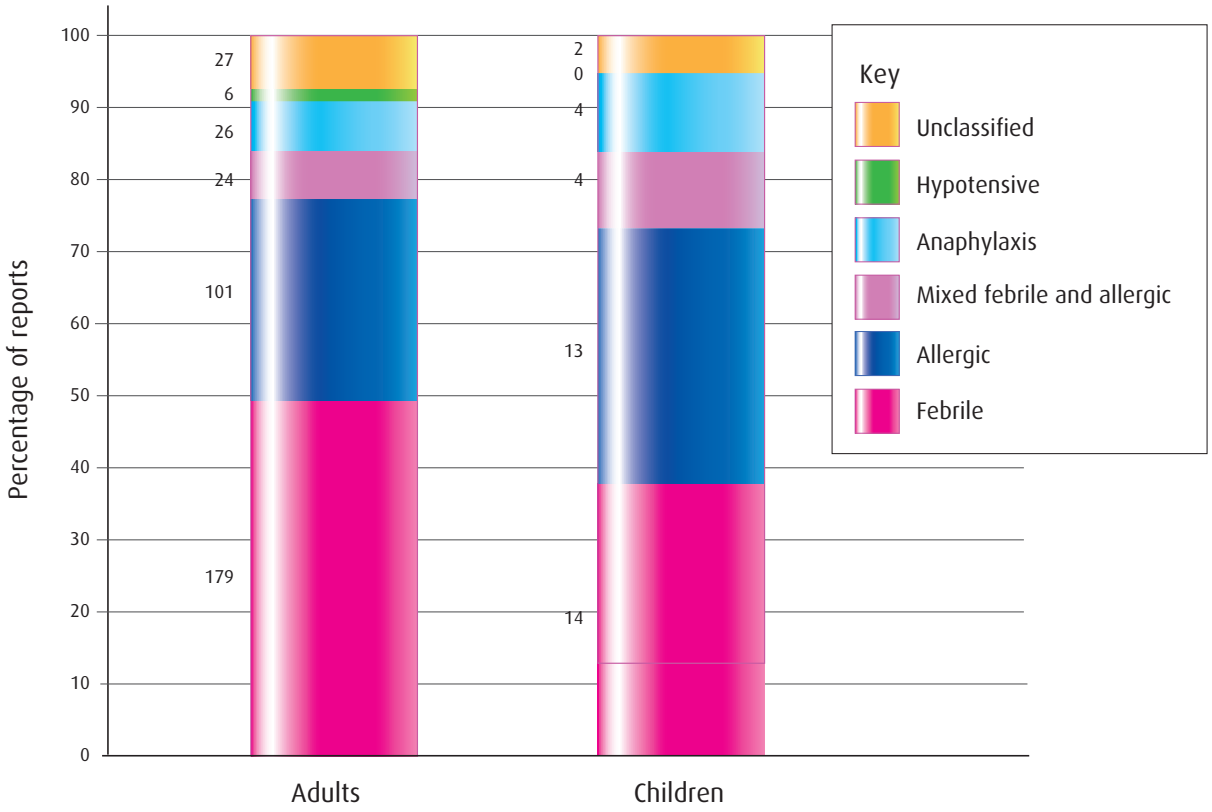
Paediatric reports constitute 7% of all red cell ATR, but 16% of platelet ATR. The types of reactions reported are in broadly similar proportions to adults (see Figure 24), and there were more paediatric febrile reactions to red cells reported this year than in 2008. Allergic reactions mostly constituted rashes, frequently treated with antihistamines.

One paediatric ATR report involved 3 paedipaks from the same donor being given to 3 different children and in each case there was an allergic reaction with rashes (see ATR chapter, page 88 for description). Paedipaks are usually employed for multiple transfusions to the same neonate in order to reduce donor exposure. This report does highlight that on occasion there can be disadvantages to having multiple donations from the same donor.

Table 47
Types of reactions for each component comparing paediatric with adult reports

Reaction	Red cells		Total platelets		FFP		Multiple components		Total	
	Adults	< 18 yrs	Adults	< 18 yrs	Adults	< 18 yrs	Adults	< 18 yrs	Adults	< 18 yrs
Febrile	158	9	16	4	4	1	1	0	179	14
Allergic	43	5	34	8	22	0	2	0	101	13
Mixed febrile and allergic	14	2	6	0	4	2	0	0	24	4
Anaphylaxis	4	1	10	2	10	0	2	1	26	4
Hypotensive	5	0	1	0	0	0	0	0	6	0
Unclassified	21	2	5	0	1	0	0	0	27	2
Total	**245**	**19**	**72**	**14**	**41**	**3**	**5**	**1**	**363**	**37**

Figure 24
Type of acute transfusion reactions – comparison between adult and paediatric reports



Haemolytic transfusion reaction *n* = 2

Both paediatric HTR reports were in patients with sickle cell disease, aged 4 and 7 years. One developed probably mild haemolysis post transfusion with JK^b positive units and was found to have developed an anti-JK^b. The second had had anti-M and anti-S detected at another hospital and was subsequently transfused with an S-positive unit (see HTR chapter, page 98, for further details).

Transfusion-related acute lung injury *n* = 2

Both paediatric reports of TRALI were in patients between 16 and 17 years of age. One developed symptoms of TRALI 4 hours after red cell transfusion following sepsis and a laparotomy. The second became symptomatic 1 hour after red cell transfusion for bleeding after an incomplete miscarriage. As previously noted, there have been only rare reports of children in younger age groups and this may be due to a lack of recognition (see SHOT 2008 report).

TACO, PTP, TA-GvHD

There were no paediatric cases in these categories.

Transfusion-transmitted infection *n* = 1

The single paediatric TTI was of *Strep. pneumoniae* in an 8-month-old baby with refractory AML following platelet transfusion (see TTI chapter for more details). The baby was given 3 of 4 neonatal packs on 3 subsequent days. Following both the second and third transfusions, the baby became acutely unwell with a high fever but this was felt at the time to be due to the patient's general condition so was not reported as a transfusion reaction. The case has been highlighted in a letter from NHSBT to paediatricians and neonatologists.

OTHER *n* = 4

Anti-D related events *n* = 3

There were 3 reports in the 16–17 age group, none of which had a paediatric-related reason for the error.

Autologous transfusion *n* = 1

The single report was from a patient aged 17 years.

COMMENTARY AND LEARNING POINTS

- The proportion of reports that were paediatric, and their pattern, was similar to before. This year the types of ATR in children were fairly similar in distribution to those in adults, partly reflecting an increase in the number of reports of febrile reactions to red cells. In contrast to previous years, there were no reports of haemolysis following transfusion of group O platelets to non-group O recipients. As before, there were few adverse reactions reported in the neonatal and infant age groups; clinicians need to be alert to possible paediatric transfusion reactions, highlighted this year by the missed bacterial contamination of platelets given to a neonate.

- Errors in neonatal pre-transfusion testing continue to occur in the laboratory, emphasising the need to check the maternal results and to follow the BCSH transfusion guidelines for neonates and older children (2004).[24] Future guidelines should further clarify the length of time that the maternal sample should be used for red cell compatibility testing in situations where there is a maternal antibody present.

- Children frequently have special transfusion requirements. The recent BCSH guidelines on the administration of blood components (2009)[19] separated these into clinical special requirements, defined by the patient's underlying condition, as opposed to automatic special requirements for a particular age group. The former will

always require notification by clinicians, but the latter should be flagged for and automatically provided by the laboratory. The varied causes of the recurrent paediatric SRNM cases include missed or erroneously removed laboratory flags and inadequate clinical processes with lack of communication of special requirements to the lab and inadequate bedside checks. There is need for continuing education and awareness, laboratory IT systems that reliably retain special requirement flags, and better clinical communication systems such as improved prescription chart design to facilitate adequate prescribing.

- The requirement for irradiation of neonatal red cells following IUT needs particular emphasis, both for clinicians and laboratory staff. As transfusions to affected neonates may take place in a different hospital to the IUT, adequate communication between hospitals is vital. It is also important that the parents are informed that transfusions given to the baby would need to be irradiated, and that they are given an irradiation card.

- There were a striking number of reports of over-transfusion and this is a concerning recurrent issue. Although some were due to incorrect prescription including specifying units rather than a specific volume as previously, there were several nursing errors in setting up infusion pumps (see recommendations below).

- There are repeated reports of confusion over 'flying squad' blood, particularly the use of obstetric adult 'flying squad' blood for neonates. There need to be rigorous local procedures and training to ensure that red cells for neonatal resuscitation are available, clearly distinguishable from obstetric emergency blood, and that nurses and doctors are aware of the distinction.

- The HSE case of a neonatal transfusion which took 4 hours and 45 minutes is a reminder that although neonatal transfusions frequently take 4 hours, for this group it is still emphasised that there should be no more than 30 minutes between removing the component from the temperature controlled environment and starting the transfusion; the transfusion itself should take no more than 4 hours.[19]

RECOMMENDATIONS

New recommendations from this year

- The correct prescription of paediatric transfusions is vital and an area of recurrent errors. Local consideration should be given to the design of paediatric prescription charts in order to facilitate the correct prescription of both blood component volumes/rates and clinical special requirements.

  Action: HTCs, HTTs, pharmacists

- Nursing staff involved in paediatric transfusion must be sufficiently skilled and competent in the use of pumps/blood infusion devices, appropriate transfusion volumes/rates, and the need for special requirements in order to reduce these types of errors. These aspects should be included in their transfusion training as required by the BCSH (2009) guidelines on the administration of blood components.[19]

  Action: HTCs, HTTs, RCN, RCM, NMC

Recommendations still active from previous years

Year first made	Recommendation	Target	Progress
2008	The trend in increasing ATR cases, in particular in relation to platelets, needs careful monitoring.	**SHOT**	This year there was a similar proportion of paediatric ATR cases, but the number of platelet cases was stable, and fewer than cases involving red cells.
2008	Clinical staff should be encouraged to report all ward-based reactions and events including possible TACO and TRALI and neonatal ATR cases.	**HTTs**	There has been little change in reporting patterns, and without a prospective clinical study it may be difficult to capture these cases. The need for clinicians to be alert to transfusion reactions has been illustrated by the 2009 paediatric TTI report.
2007	Laboratory BMSs must be aware of special component requirements in patients under 16, and routine checking for additional flags should be carried out based on the date of birth.	**HTT, hospital transfusion laboratories and consultant haematologists with responsibility for transfusion**	This recommendation continues to need emphasis in 2009, and laboratories need sufficient manpower and IT support. Laboratories must also demand that they are given requests for paediatric transfusions in mL and not units.
2007	Prescribing for paediatric patients should be carried out only by those with appropriate knowledge and expertise in calculating dosage and administration rates for this group.	**HTT and clinical users of blood**	The 2009 report demonstrates a need for continuing training in this area.
2007	Special requirements are more common in paediatric patients, because of the range of congenital and malignant conditions for which they may be hospitalised, and particular care is needed to ensure that documentation, handover, communication and bedside checking are effective and comprehensive.	**HTT and clinical users of blood**	This has been re-emphasised by the 2009 BCSH administration guidelines. By separating 'clinical special requirements' from those related to requirements automatic for certain ages, it may now be more practical to include clinical requirements on the prescription chart, helping to improve clinical communication.
2003	BCSH guidelines on transfusion of neonates and children should be implemented.	**RCPCH, RCN, staff in paediatric units and transfusion laboratories**	SHOT 'Lessons for Paediatric Staff' was produced 2006. SHOT in obstetrics was produced in 2007. NBS Paediatric conference was held in Feb 2007.