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National Comparative Audit of Blood Transfusion

NHS Blood and Transplant

2010 Re-audit of the Use of Group O RhD Negative Red Cells

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It is customary for us to produce reports which give results for hospitals participating in an audit, but on this occasion this report contains national statistics only. Statistics for individual participating hospitals can be found in the Regional Slideshows. This report is based on the 2008 report, and readers may like to refer to that report to make fuller comparisons.

Executive Summary

Background

Balance between supply and demand of O RhD negative red cells remains a challenge for almost every blood service. In 2008 the Chief Medical Officer's National Blood Transfusion Committee (NBTC) commissioned an audit for the use of O RhD negative red cells in order to understand patterns of their usage. The findings from this audit were widely circulated and discussed at National, Regional and NHS Trust levels. One of the key recommendations of this audit was to aim to reduce O RhD negative stockholding to at least 12% in every hospital by December 2009.

The NBTC issued reviewed guidance in January 2009 and advised hospitals to develop policies allowing the transfusion of group O RhD positive blood to O RhD negative male patients and females without childbearing potential, particularly in the event of massive blood loss. In addition, local stock management policies should be worded so as to minimise the elective transfusion of O RhD negative red cells to prevent time expiry.

The Blood Stocks Management Scheme completed a survey for the prevalence of different blood groups in the hospital population during 2009, and more recently NHS Blood and Transplant (NHSBT) asked hospitals not to hold more than 10.5% of their stocks as O RhD negative in order to be able to respond to escalating demands.

Current findings

In June 2010 the National Comparative Audit of Blood Transfusion re-audited usage of O RhD negative red cells. The 2008 and 2010 audits are not directly comparable due to the differences in participation and also to the modification of some questions in order to address certain issues more clearly. However some analysis has been undertaken to compare hospitals that participated in both audits, and stock holding levels appeared to be reduced in the current audit (although the reduction was not statistically significant).

Only 16% of participating sites keep less than 10.5% of their red cell stocks as O RhD negative. 38% of sites keep stock levels of less than 12% and 15% of sites keep more than 20% of their stocks as O RhD negative. 10% of blood audited in June 2010 was transfused to non O RhD negative patients in order to prevent time expiry. Transfusions to prevent time expiry clearly correlated with stock levels.

Stock levels correlated with the size of hospitals (very low and very high users tend to keep a higher proportion of their red cell stock as O RhD negative red cells). Hospitals keeping more than 20 units in different satellite fridges tend to keep a higher proportion of their red cell stock as O RhD negative In addition, as was found in the previous audit, hospitals located closer to blood centres (emergency delivery time of less than 15 minutes) tend to stock much higher levels of O RhD negative red cells.

Emergency units were used in 5.5% of transfusion episodes averaging 2.2 units per episode. In almost 2% of transfusion episodes patients received more than 3 units of O RhD negative red cells as emergency units. For a third of those episodes, transfusion beyond two units could have been avoided. Following the analysis of patients with alloantibodies and taking into consideration the prevalence of different blood group antigens in the general population, it is possible to identify group specific, phenotypically matched blood fairly easily, particularly for patients of O RhD positive blood group. Provision of group specific phenotyped blood by NHSBT will reduce further unnecessary usage of O RhD negative red cells.

Examples of good clinical practice

- Hospitals with policies or guidance in place to provide O RhD positive red cells to O RhD negative patients (males and females with no childbearing potential and without anti-D detectable where they were undergoing massive blood transfusion) stock less O RhD negative blood.

- Hospitals able to provide group specific blood in less than 15 min use up to 50% less emergency O RhD negative red cells.

Recommendations

1. Hospitals must regularly review use of O RhD negative red cells for emergencies and investigate incidents where its use is considered inappropriate.

2. Hospitals must provide group specific red cells rapidly to avoid unnecessary use of emergency group O RhD negative red cells.

3. In some cases in an emergency non-O Rhd negative patients are being unnecessarily transfused with more than 3 units of O RhD negative red cells, and hospitals should regularly review practice to ensure that this is kept to a minimum.

4. For Group O RhD positive recipients with alloantibodies all efforts must be made to identify phenotypically matched group specific blood.

5. NHSBT/ Blood Services must provide a sufficient number of extensively phenotyped O RhD positive units of blood in order to enable the appropriate selection of group specific blood for patients with alloantibodies.

6. Hospitals must reduce their stock levels of O RhD negative red cells to the recommended level of 10.5% in order to avoid transfusions to non-O RhD negative patients and thus avoid wastage due to time expiry.

7. Appropriate policies which guide use of O RhD negative red cells should be introduced in order to reduce unnecessarily high stockholding levels.

Introduction

The O RhD negative blood group is sometimes known as the 'universal' blood group because it can be transfused to non-immunised patients of any blood group. For this reason, O RhD negative red cells can be used in emergencies where the patient's blood group is unknown and in instances where group specific stock is unavailable.

Over the last few years it has been recognised that a significant misuse of this blood occurs, and it is also recognised that there is significant regional variability in use and stockholding [(1)] . A recent survey conducted by the Blood Stocks Management Scheme in order to investigate the distribution of the ABO RhD blood groups within the hospital population of England, Wales and Northern Ireland indicated that 7.81% of hospital population is Group O RhD negative with a regional variation from 5.9% to 9.04% [(2)].

The Blood Stocks Management Scheme data indicates that current NHSBT issues of group O RhD negative red cells are10.5% of all units issued. Any usage higher than this puts UK Blood Services under pressure to maintain the supply of Group O RhD negative red cells to hospitals. Consistently high demand may lead to shortages. NHSBT aims to keep a stock of units of all groups within a target range of 5 to 9 days in 'normal' situations. Recently, on several occasions, the stock of O RhD negative red cells has fallen to below 3 days stock. Any fall to below 2 days stock would activate contingency plans to ensure sufficient O RhD negative red cells for those patients with mandatory or recommended indications.

NBTC guidelines for the use of Group O RhD negative red cells provide standards for its use as well as general principles for stock management [(3)].

Aim

The aim of this audit is to determine whether the stockholding and the use of group O RhD negative red cells is appropriate according to national guidelines.

Objectives

The objectives of the audit are to:-

- determine the proportion of transfusions involving at least one unit of group O RhD negative red cells that can be deemed appropriate
- determine the reasons behind any inappropriate use
- determine the proportion of O RhD negative red cells that are transfused to non-O RhD negative patients and the reasons for these transfusions
- identify hospital practices associated with high use / stockholding of this blood and understand why this might occur
- identify examples of good practice that can be shared widely

Standards

The following standards have been developed from the National Blood Transfusion Committee guidance for the appropriate use of group O RhD negative red cells [3], and from NHSBT recommendations to hospitals. Nationally over the last few months NHSBT has been issuing around 10.7% of total stock as O RhD negative red cells. With the knowledge that many large hospitals can operate with a stock that is below 10%, a 10.5% target is desirable and balances the hospital's needs with the ability of the NHSBT to respond to escalating requirements.

Standard Statement 1

Hospitals do not routinely stock or use more than 10.5% of all red cells as group O RhD negative.

Standard Statement 2

Group O RhD negative red cells are used in accordance with the Mandatory, Recommended and Acceptable indications shown in Table 3 (p.17) of this report.

Standard Statement 3

When group O RhD negative red cells are unavailable, or in extremely short supply, it is acceptable to use O RhD positive red cells for group O RhD negative females with no child bearing potential and unimmunised males, provided no anti D is detected on pre-transfusion testing.

Indications for use

Indications for use are split in to 4 groups – Mandatory, Recommended, Acceptable, and Unacceptable, and these indications are used to categorise the transfusions audited, as a measure of appropriateness. Use that does not specifically fall into these categories are considered 'not assigned'

Indications for use

Mandatory indications

- O RhD negative patients with Anti-D
- O RhD negative females aged 60 or under
- Emergency use for females aged 60 or under where the blood group is unknown

Recommended indications

- O RhD negative patients who receive/are likely to receive repeated transfusions (e.g. haemoglobinopathies, aplastic anaemia and myelodysplastic syndrome)

Acceptable indications

- O RhD negative males with no anti-D where less than or equal to 8 O RhD negative red cell units are transfused
- O RhD negative females over the age of 60 years old with no anti-D where less than or equal to 8 O RhD negative red cell units are transfused
- Non-O RhD negative infants under or equal to the age of 1 year old where group specific units are unavailable
- Emergency patients where the blood group is unknown at the point of transfusion, up to 2 units
- Non-O RhD negative patients requiring special phenotype where group specific units are unavailable

Unacceptable indications

- O RhD negative females over the age of 60 years old with no anti-D where more than 8 O RhD negative red cell units are required
- O RhD negative males with no anti-D where more than 8 O RhD negative red cell units are required
- Emergency where group is unknown and patient received 3 or more units

Using O RhD Positive Red Cells for O RhD Negative Patients

In order to conserve stocks of group O RhD negative red cells, O RhD positive red cells should be used in large volume blood replacement (e.g. more than 8 units of red cells) in females with no child-bearing potential and adult males in whom no anti-D is detectable. When O RhD negative red cells are unavailable or in extremely short supply, it is acceptable to use O RhD positive red cells for O RhD negative female patients with no child-bearing potential and unimmunised males, provided no anti-D is detected on pre-transfusion testing.

Method

Hospitals from throughout England, Scotland, Wales and Northern Ireland were invited to take part.

This audit consisted of three strands. Firstly, participating hospitals were asked to collect transfusion data on the first 40 transfusion episodes from 1st June 2010 which involved at least one unit of group O RhD negative red cells. Transfusion episodes involving the use of paedipacks were excluded from this audit and hospitals were asked not to include the same patient twice. This was to minimise the possibility that a large proportion of the quota for some hospitals would be taken up by transfusion-dependent patients. This part of the audit ended when data on 40 transfusion episodes had been collected or on 30th June 2010, whichever came sooner. Data was entered via an online data collection system.

The second strand consisted of collecting stockholding data. Hospitals were asked to record their stock levels of each blood group at the same point daily on every day in June 2010. This information was collected via the Blood Stocks Management Scheme where participating sites gave consent, but sites had the option to provide their own stockholding data using paper based forms for the same period if they did not participate in the Scheme or did not consent to data sharing. Data for Scottish hospitals was collected directly from the Scottish National Blood Transfusion Service.

The final part of the audit involved an organisational questionnaire which asked for details about specialist services in the participating hospitals (e.g. were they a trauma centre?) and their internal policies (e.g. did they routinely stock irradiated O RhD negative red cells?). Both the second and final parts of the audit were completed using paper-based forms.

For each day in June 2010 the total number of O RhD negative red cells units in stock was divided by the total number of units for all blood groups in stock and multiplied by 100. This gave the % of total stock that was O negative on each day. Over the month a simple mean average of the daily % of O negative stock was computed to give an O negative stock summary statistic for each site. This site statistic is what is used in analysis to compare between subgroups of sites. We have noted, though, that the distribution of this site statistic is skewed and for this reason we decided to report the median of the site statistic since it is largely unaffected by such skewness and typically best reflects the centre of the spread of a set of site statistics. Accordingly some of the key results from the previous audit were reworked so as to allow greater comparability with the current audit.

More generally, the two audits are not comparable because the mix of sites participating in them varied.

Data collected
214 sites contributed data on 5108 transfusion episodes, and 211 sites contributed organisational data. 215 sites contributed blood stockholding data, and 198 sites contributed all 3 types of data.

Stakeholders

All Trusts / hospitals in the United Kingdom
NHS Blood & Transplant
Scottish National Blood Transfusion Service
Welsh Blood Service
Northern Ireland Blood Transfusion Service

Results – Part 1: Transfusion Episode data

Data were received on 5108 transfusions from 214 sites (median 22, IQR 15-33, range 1-79, n=23 sites with <10), and some 'sites' chose to take part as Trusts rather than as separate hospitals*. It was calculated that 248 sites (162 English NHS Trusts, 4 Trusts in Northern Ireland, 13 in Scotland, 7 Health Boards in Wales and 62 Independent hospitals with a transfusion laboratory) were eligible to take part giving a participation rate of 86%. Table 1 below shows the regional breakdown by NHS Trust of sites that submitted transfusion episode data by RTC region / blood service

Table 1 – Regional breakdown of transfusion episode data submission from NHS Trusts by RTC region / blood service. (Where NHS sites participated as hospitals, they have been amalgamated into their NHS Trust in the table below)*

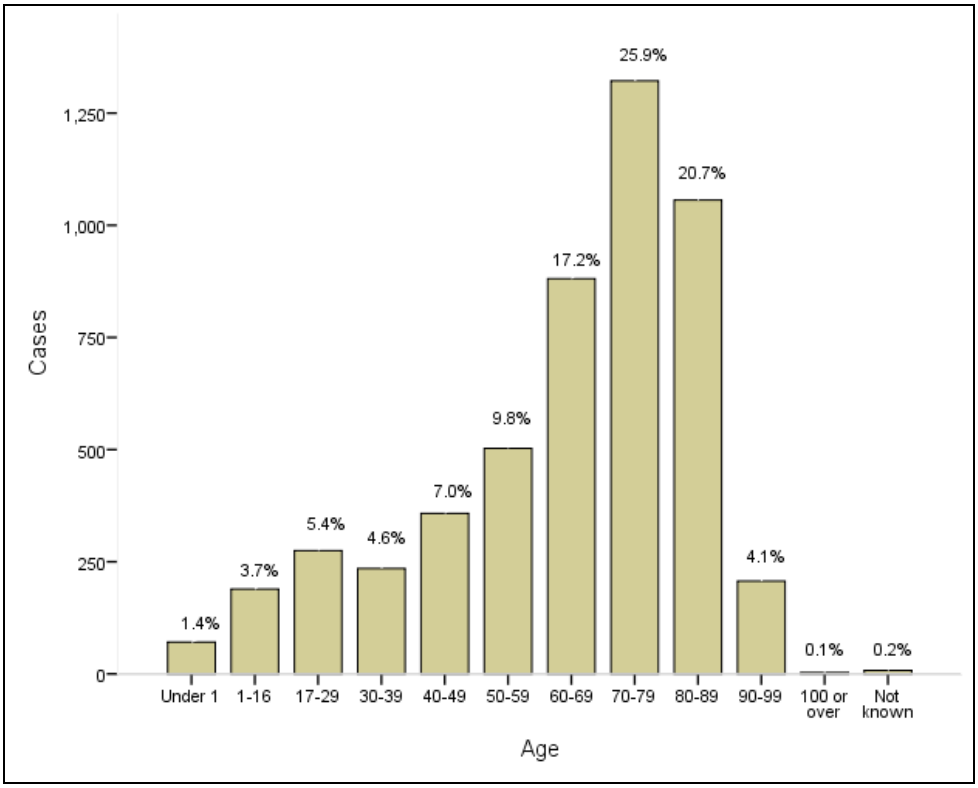
RTC Region / Blood Service	No. of Participating NHS Trusts	No. of Possible NHS Trusts	Participation Rate	No. of Transfusion Episodes Returned
East of England	18	18	100%	436
East Midlands	6	8	75%	247
London	21	28	75%	709
North East	7	8	88%	202
North West & North Wales	26	29	90%	660
South Central	8	11	73%	257
South East Coast	11	12	92%	429
South West	16	17	94%	476
West Midlands	16	19	84%	377
Yorkshire & Humber	12	15	80%	394
England	141	165	85%	4187
N Ireland	8	8	100%	181
Scotland	15	15	100%	419
Wales	11	11	100%	262
NHS	175	199	88%	5049
Independent	14	-	-	59
Total	189	-	-	5108

14 of the 214 (7%) participating sites were independent sector hospitals who accounted for 59 (1%) transfusion episodes, and 34 of these 59 (58%) were from two independent hospitals.

Demographics

The gender of the audit sample was 51% male (2592) and 49% female (2514). 1222/5108 (22.9%) cases were transfusion dependent patients. Recipients of O RhD negative red cells in this audit came from across all specialties. 14% of patients were reported to experience some form of bleeding, and 1.9% of patients suffered from transfusion dependent haemoglobinopathies, while a further 2% were trauma patients.

Figure 1 – Age distribution of patients audited (n=5108)



The median age of males was 69 years, IQR 55-79, mean 63, and the median age for females was 70 years, IQR 50-81, mean 63. Range was <1 – 109 years old, whilst the overall median age was 70. 68% (3469/5105) of the patients were aged 60 or over suggesting that the increased level of morbidity in the elderly reflects an increased need for transfusion.

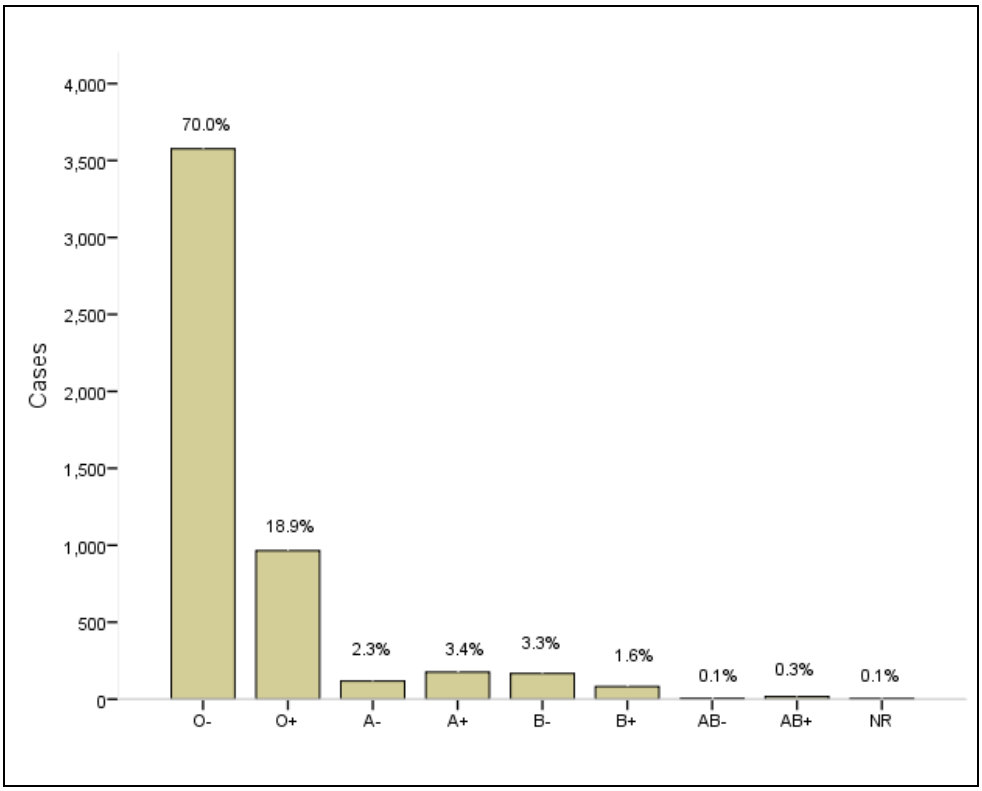
This age distribution corresponds with similar audits carried out elsewhere in the UK on red cell usage. [(4) (5) (6)]

Table 2 - Prevalence of all blood groups in patient's population and proportion of patients of various blood groups who received a Group O RhD negative red cell transfusion [(2)]

	East Midlands	East of England	London	North East	North West inc N Wales	South Central	South East Coast	South West	West Midlands	Yorkshire & The Humber	ENGLAND
O - in population	8.83	8.67	5.90	9.04	7.90	7.49	7.70	7.89	7.86	7.92	**7.81**
O - audited recipients	71.26	75.69	56.99	72.14	75.34	66.67	67.74	71.88	66.49	79.10	**69.67**
O + in population	35.35	35.59	39.01	39.17	39.12	37.14	36.57	36.91	37.41	37.47	**37.66**
O + audited recipients	17.41	14.91	27.95	17.41	18.15	17.41	23.73	18.33	21.20	11.44	**19.61**
A - in population	8.33	8.50	5.05	6.96	6.36	7.03	7.26	7.74	7.08	6.89	**6.94**
A - audited recipients	1.21	2.06	2.47	2.49	0.61	4.44	1.38	2.08	1.83	1.99	**1.93**
A + in population	34.90	34.14	30.52	31.30	31.81	33.48	34.87	34.83	33.11	32.83	**32.90**
A + audited recipients	4.05	3.67	3.56	2.99	2.72	5.56	2.53	2.29	3.93	3.73	**3.37**
B- in population	1.70	1.78	1.60	1.90	1.64	1.65	1.73	1.49	1.64	1.69	**1.68**
B- audited recipients	3.64	2.06	4.79	3.98	1.66	2.22	2.30	5.00	4.71	2.99	**3.35**
B+ in population	7.54	7.80	13.53	8.40	9.64	9.34	8.08	7.69	9.26	9.42	**9.32**
B+ audited recipients	0.81	1.15	3.15	1.00	1.36	2.59	2.07	0.42	1.83	0.75	**1.63**
AB- in population	0.67	0.67	0.51	0.83	0.54	0.61	0.77	0.61	0.59	0.60	**0.64**
AB- audited recipients	0.40	0.23	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	**0.12**
AB+ in population	2.68	2.85	3.88	2.39	2.99	3.27	3.01	2.84	3.04	3.19	**3.04**
AB+ audited recipients	1.21	0.23	1.10	0.00	0.15	0.00	0.23	0.00	0.00	0.00	**0.33**
N in population	40607	116116	168866	169274	219455	133418	124931	159057	130693	107256	**1369673**
N cases audited	247	436	730	201	661	270	434	480	382	402	**4243**

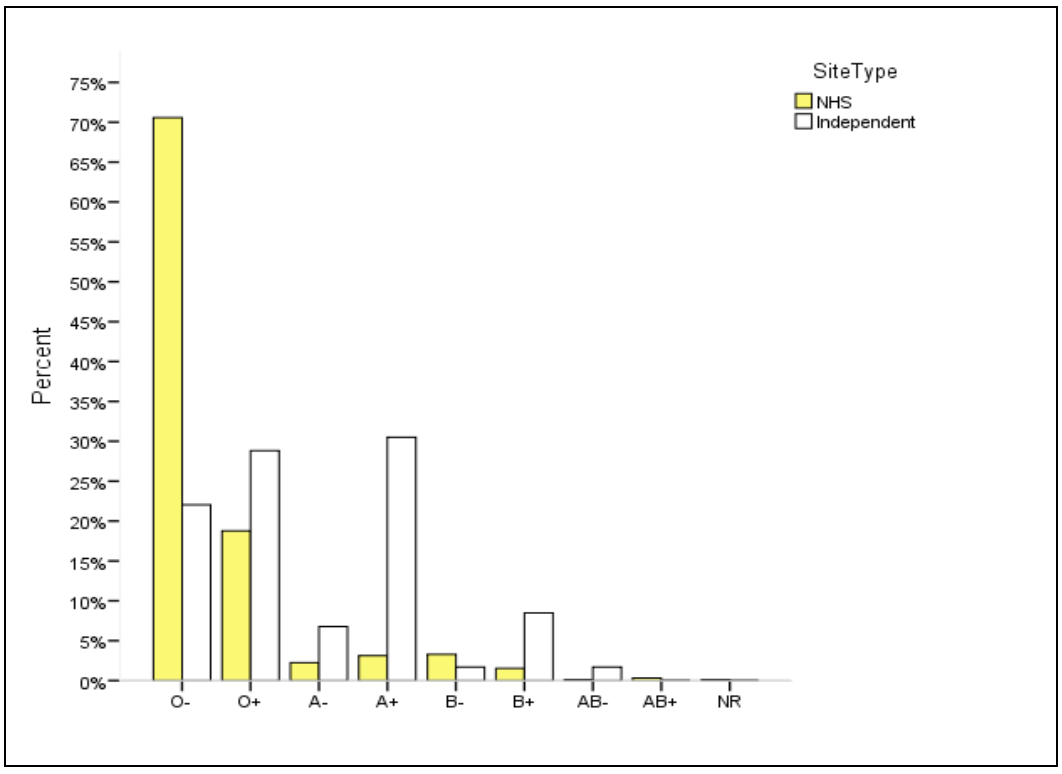
The table presents distribution of blood groups in different RTC areas in England and North Wales, and also contains information on the relative % of the blood group of the recipients of O RhD negative blood audited. Note that in the London area, where 5.9% of the population is Group O RhD negative, 56.99% of blood was transfused to O RhD negative recipients. Interestingly, London's prevalence of B+ recipients is 13.53% and they received 3.15% of Group O RhD negative blood in this audit.

Figure 2 – Recipient blood groups (n=5108)



In total, 70% of O RhD negative red cells were transfused to O RhD negative recipients. The remainder (30% [1532/5108]) was transfused to non-O RhD negative recipients as shown in figure 2.

Figure 3 – Recipient blood groups - NHS and Independent sites

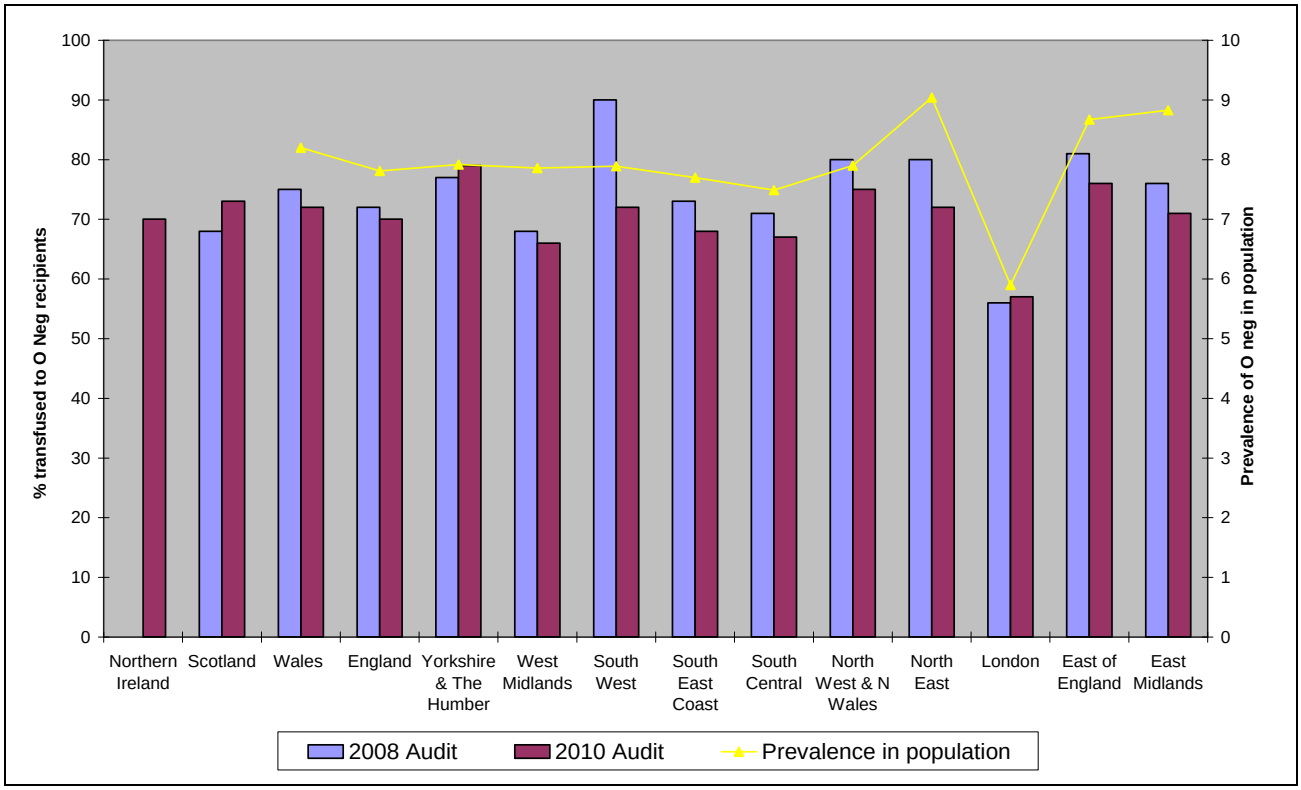


In the independent sector sample (58 transfusions mainly from 2 sites), just above 20% of blood was transfused to O RhD negative recipients, with disproportionally higher numbers of transfusions going to non-Group O RhD patients.

O RhD negative red cells should primarily be transfused to O RhD negative patients. It is always expected, though, that a proportion of O RhD negative red cells will be transfused to O RhD positive patients and often to non group O patients. However, the practice of persistently transfusing O RhD negative red cells to non O RhD negative individuals outside the agreed indications is associated with overstocking of O RhD negative red cells as has been shown in previous audits.

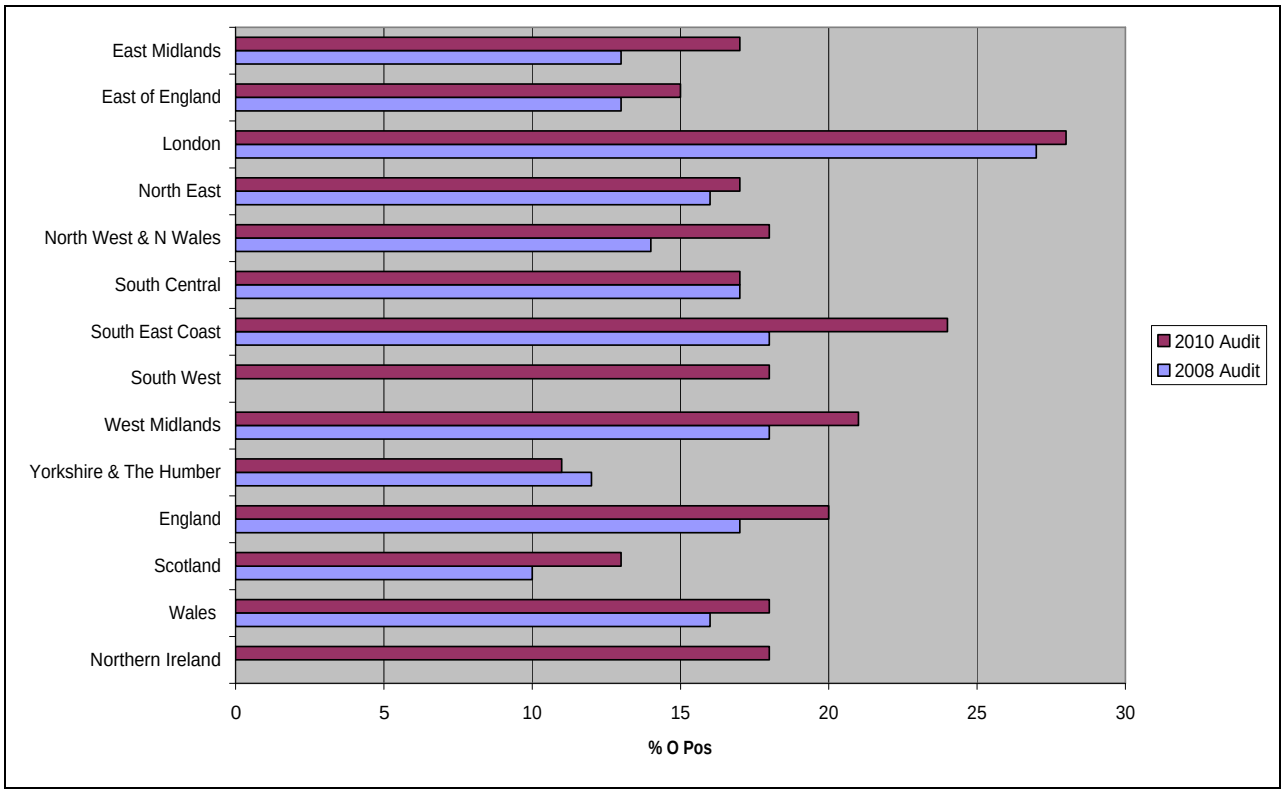
We have analysed the percentage of O RhD negative red cells transfused to blood group O RhD negative, O RhD positive and non group O patients in different regions (as defined by the Regional Transfusion Committees) to give an overview but hospitals should relate this to their own practice.

Figure 4 – % of O RhD negative red cells transfused to O RhD negative recipients in different RTC areas.



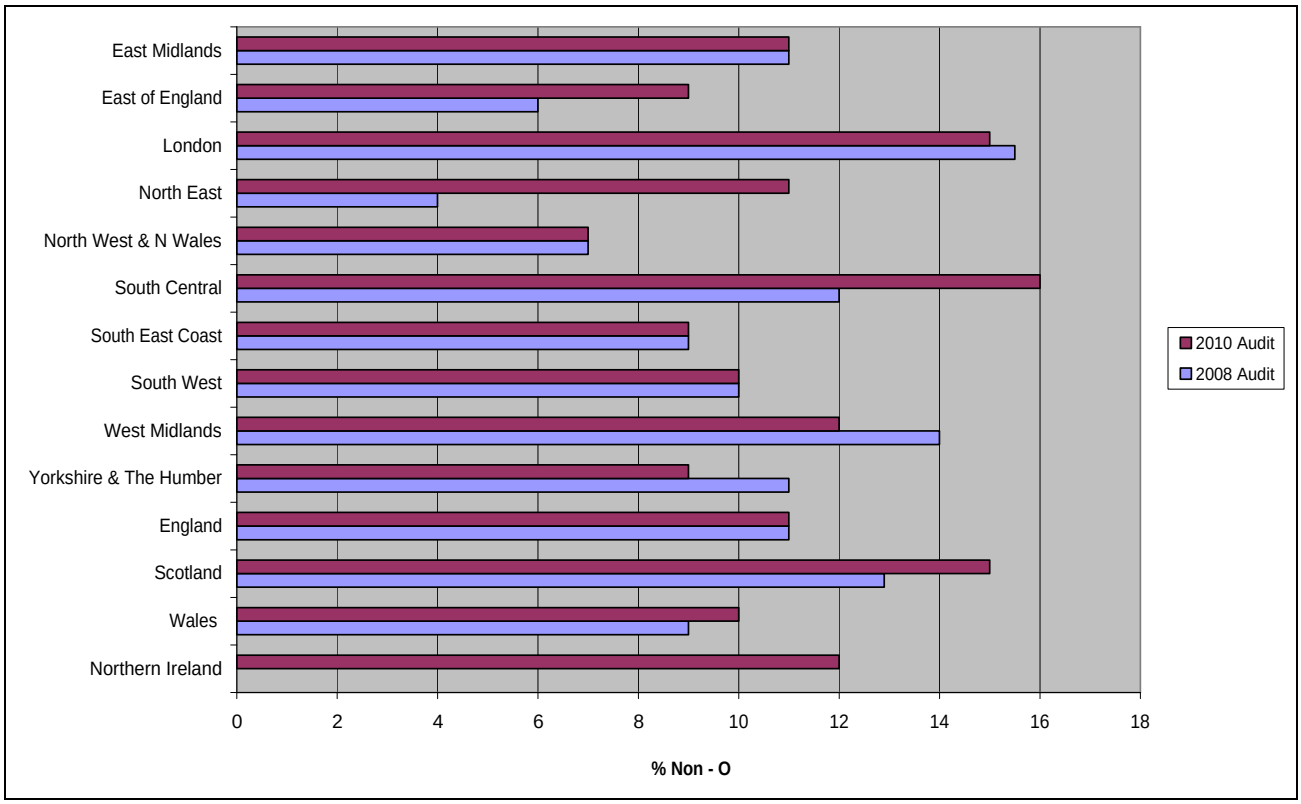
Comparison is made with findings in the 2008 audit with reference to the prevalence of Group O RhD negative blood group in the population.

Figure 5 - % of O RhD negative red cells transfused to O RhD positive recipients in different RTC areas.



Comparison is made with findings in the 2008 audit. Note that data is not available for the 2008 audit in South West and Northern Ireland.

Figure 6 - % of O RhD negative red cells transfused to Non Group O recipients in different RTC areas



Comparison is made with findings in the 2008 audit.

Total number of units transfused

In total, the number of units transfused was available for 5076 / 5108 (99.4%) transfusion episodes. 12989 units were transfused of which 10 920 (84%) were group O RhD negative units. For individual transfusions, the number of O RhD negative units used ranged from 1 – 17 with a mean of 2.17 units. The total number of units ranged from 1– 48 with a mean average of 2.56 units. For independent hospitals, the mean number of O RhD negative units per transfusion was 1.83 (range 1-4) and the mean total units per transfusion was 2.31 (range 1-5).

Of the 59 transfusion episodes submitted by independent hospitals, the recipient was O RhD positive in 29% (17) of cases and O RhD negative in 22% (13). The recipient was a non-O blood group in 49% (29) of cases.

Indications for Use

In order to understand the appropriateness of transfusion episodes where at least one unit of Group O RhD red cells was used, we classified the audited cases as either Mandatory, Recommended, Acceptable or Unacceptable, using a hierarchy structure (Table 4). Some cases could not be classified to one of these criteria, but the reasons for transfusion for these unassigned episodes are given in Table 5.

Table 3 - Indications for Group O RhD Negative Red Cell Usage N = 5108

Indication		**No. of transfusions for this indication**	**As % of all transfusion episodes**
Mandatory	- O RhD negative patients with anti-D	147	2.9%
	- O RhD negative females aged 60 or under	552	10.8%
	- Emergency use for females aged 60 or under where the blood group is unknown	75	1.5%
Total number of transfusions for at least one mandatory indication		*735*	*14.4%*
Recommended	- O RhD negative patients who receive / are likely to receive repeated transfusions (e.g. thalassaemia, myelodysplastic syndrome)	679	13.3%
Total number of transfusions for at least one recommended indication		*679*	*13.3%*
Acceptable	- O RhD negative males with no anti-D where less than or equal to 8 O RhD negative units are transfused	1717	33.6%
	- O RhD negative females over the age of 60 years old with no anti-D where less than or equal to 8 O RhD negative units are transfused	1160	22.7%
	- Non-O RhD negative infants under or equal to the age of 1 year old where group specific units are unavailable	71	1.4%
	- Emergency patients where the blood group is unknown at the point of transfusion up to 2 units	313	6.1%
	Non-O RhD negative patients requiring special phenotype where group specific units are unavailable [this includes 38 instances where mismatched blood was supplied by NHSBT]	229	4.5%
Total number of transfusions for at least one acceptable indication		*3343*	*65.4%*
Unacceptable	- O RhD negative females over the age of 60 years old with no anti-D where more than 8 O RhD negative units are required	2	0.04%
	- O RhD negative males with no anti-D where more than 8 O RhD negative units are required.	13	0.3%
	- Emergency where group is unknown and patient received 3 or more units	101	2.0%
Total number of transfusions for at least one unacceptable indication		*114*	*2.2%*
Total number of transfusions for mandatory, recommended, acceptable or unacceptable indications		*4049*	*79.3%*
Total number of transfusions which could not be assigned to any of the above indications (See Table 5)		*1059*	*20.7%*

Hierarchy Structure: more than half of the transfusions with one or more unacceptable indications were also found to have mandatory, recommended or acceptable indications. The hierarchy showing the strongest indicator for transfusion is shown in Table 4 below:

Table 4 – Hierarchy structure

Number of transfusions classified according to indications for use		
	n	**%**
Mandatory	735	14.4
Recommended	542	10.6
Acceptable	2725	53.3
Unacceptable	47	0.9
Not assigned	1059	20.7
Total	**5108**	**100**

Table 5 – Unassigned reasons for use

Reasons for transfusion of Group O RhD negative red cells where none of the guideline categories (Mandatory, Recommended, Acceptable, Unacceptable) could apply		
Prevent wastage due to time expiry	638	60%
Patient's special requirements (CMV negative or irradiated required)	144	14%
Unable to provide group specific blood because insufficient stock available	123	12%
Allogeneic bone marrow transplant patient	49	5%
Unable to provide group specific blood because patient was Ro	28	3%
Other	9	1%
Blank	68	6%
Total	**1059**	
NB: Only 15/1059 (1.4%) of patients were Group O RhD Negative		

Note: The reason for transfusion of O RhD negative red cells to non-O RhD negative patients in 60% of cases where none of the guideline categories applied was elective transfusion to prevent time expiry of standard or irradiated units.

Emergency Use

Emergency units (e.g. uncrossmatched emergency O RhD negative, emergency O RhD negative from a satellite fridge, emergency O RhD negative from the issues fridge, or emergency O RhD negative from “flying squad” boxes), were used in 280/5108 (5.5%) transfusion episodes. In total, 601/10 920 (5.5%) units were transfused as emergency. In the independent sector, in 59 transfusion episodes, 108 O RhD negative units were transfused and 7 of those were transfused in an emergency (6.5%). For 241/280 (86.1%) cases using emergency units sites stated that use was in accordance with their policy. 17/280 (6.1%) were not used in accordance with policy and in 7.9% of cases no information was available.

In almost two thirds (30/47) of transfusions deemed unacceptable, O RhD negative red cells included emergency units. Interestingly, in 20/30 episodes deemed unacceptable, hospitals considered usage of emergency units to be in accordance with their local policy.

The total number of emergency O RhD negative units transfused ranged from 1 to 12 (median 2).

The main reason given for transfusing more than 2 units was inadequately labelled or unavailable sample, followed by emergency use and request according to policy.

When blood was used as an emergency where the blood group was unknown at the point of issue, the number of emergency units used in a transfusion episode ranged from 1 – 12, averaging 2.2 units per episode. Patients received up to 2 units in 313/5108 (6%) transfusions. In 101/5108 (1.9%) transfusions patients received 3 units or more (total number of units 463). In 34/101 cases use of O RhD negative red cells beyond 2 units could have been avoided, with a potential saving of 81units. 26/101 cases were trauma patients, but only in 12 of those cases did patients receive more than 2 units without further justification. These patients received in total 58 units and switching to group specific blood after the first 2 units could have saved 34 units.

Hospitals were asked in the organisational audit how long it took to provide group specific, uncrossmatched blood in the presence of a current valid sample, in an emergency. 5/211(2.4%) did not allow the issue of group specific uncrossmatched blood in the presence of a current valid sample in an emergency. In the presence of an historical blood group, 158/203 hospitals were able to provide group specific blood in less than 15 minutes. In the absence of an historical blood group, 117/203 hospitals were able to provide blood in less than 15 minutes.

Correlating the use of emergency O RhD negative red cells with the time taken to provide group specific uncrossmatched blood for a patient with an historical blood group
NHS sites that are able to provide blood in less than 15 minutes use up to 50% less emergency O RhD negative blood (median 2.7 Vs 4.5 units, Mann-Whitney test p=0.054).

Correlating the use of emergency O RhD negative red cells with the time taken to provide group specific uncrossmatched blood for a patient without an historical blood group
A similar though weaker trend is noticed for NHS patients without an historical blood group, but with weaker correlation (median 2.5 Vs 3.7 units, Mann-Whitney test p=0.18).

In NHS sites issuing blood electronically, there was no evidence of correlation between the amount of Group O RhD negative red cells used as an emergency and the number of samples required by their laboratory protocol to issue blood (median 3.3 for 1 sample Vs 2.9 for 2 samples, Mann-Whitney test p=0.75).

Recommendations

1. Hospitals must regularly review use of O RhD negative red cells for emergencies and investigate incidents where its use is considered inappropriate.

2. Hospitals must provide group specific red cells rapidly to avoid unnecessary use of emergency group O RhD negative red cells.

3. In some cases patients are being unnecessarily transfused with more than 3 units of O RhD negative red cells, and hospitals should regularly review practice to ensure that this is kept to a minimum.

Patients with antibodies
For the purpose of this audit it is considered acceptable to transfuse patients with antibodies with phenotypically matched and crossmatch compatible O RhD negative red cells. For the purpose of this audit we considered all these transfusions to be acceptable. However, when we further analysed transfusion to non-RhD negative recipients we identified instances where practice can be improved and where use can be avoided.

There were 170 non O RhD negative recipients with antibodies, illustrated in Table Six

Table Six – Distribution of non-Group O RhD negative recipients with antibodies

Group	Number	% of total	Population** frequency	Variance from normal frequency
O pos	107	63	37.4	X 1.7
A pos	14	8.2	33.3	X 0.3
A neg	13	7.6	6.7	X 1.1
B pos	13	7.6	9.2	X 0.8
B neg	21	12.4	1.8	X 6.9
AB pos	2	1.2	3.3	X 0.4

The use of O RhD negative is disproportionately high in O RhD positive (x1.7) and B RhD negative (x6.9) compared to their frequency in the general population.

The only alternative to O RhD positive is O RhD negative however O RhD positive stocks are normally reasonably high therefore there is a higher likelihood of finding antigen negative red cells from stock.

The only alternative to B RhD negative (where antibodies are present) is O RhD negative however B RhD negative stock levels are certain to be low with little chance of finding antigen negative red cells.

The use of O RhD negative is disproportionately low in A RhD positive (x0.3) and AB RhD positive (x0.4) possibly due to wide availability of alternatives.

O RhD positive recipients with antibodies

- Transfusion of O RhD negative to 2 of 107 (1.9%) O RhD positive recipients was mandatory due to emergency.
- Transfusion of O RhD negative to 13 of 107 (12.1%) O RhD positive recipients was mandatory due to presence of anti-D.
- Of the remaining 92, percentage compatibility in the general population was:

Table Seven - Percentage compatibility in the general population

% compatibility	Number (% of total)
0 – 10	14 (15.2)
10.1 – 20	15(16.3)
20.1 – 30	11(12.0)
30.1 – 40	13(14.1)
40.1 – 50	0(0)
50.1 – 60	16(17.4)
60.1 – 90	0(0)
90.1 – 100	23(25.0)

Compatibility is calculated based on the frequency of clinically significant antigens in the general population and expresses the probability of identifying group specific blood in patients with specific phenotypic requirements. **(*The Blood Group Antigen Facts Book; Christine Lomas-Francis, Academic Press, Harcourt Brace & Co. 1997).*

The % compatibility does not influence the decision to transfusion O RhD negative red cells in O RhD positive patients (patients with 90.1 to 100% compatibility could be transfused with group specific blood as their specific phenotypic requirements can be met).

Non Group O recipients with antibodies

- Transfusion of O RhD negative to 8 of 63 (12.7%) non-O recipients was mandatory due to emergency (2 also had anti-D).
- Transfusion of O RhD negative to 2 of 63 (3.2%) (additional to above) non-O recipients was mandatory due to presence of anti-D.
- Of the remaining 53, percentage compatibility in the general population was:

Table Eight - Percentage compatibility in the general population

% compatibility	Number (% of total)
0 – 10	18(34.0)
10.1 – 20	22(41.5)
20.1 – 30	5(9.4)
30.1 – 50	2(3.8)
50.1 – 60	2(3.8)
90.1 – 100	4(7.5)

The lower the % compatibility increases the likelihood of transfusion of O RhD negative red cells in non O patients.

Recommendations

4. For Group O RhD positive recipients all efforts must be made to identify phenotypically matched group specific blood.

5. NHSBT/ Blood Services should provide a sufficient number of extensively phenotyped O RhD positive units of blood in order to enable the appropriate selection of group specific blood.

Results – Part 2: Stockholding of O RhD negative red cells

Participating sites were asked to record their daily stock levels of all units throughout each day in June 2010. There were two methods by which they could return data. The first was using a proforma supplied by the audit project group, on which the sites were asked to record on a daily basis how many units of group A,B,AB and O, both RhD positive and RhD negative, blood they had in stock.

The second method was that they were invited to give the project group consent to obtain the stocks data from the Blood Stocks Management Scheme, which was established in 2001 to understand and improve blood inventory management across the blood supply chain.

Hospitals and Blood Centres from England, Wales, and Northern Ireland are currently participating in the scheme. In total, 215 sites returned some form of stockholding data – the difference from the number of participating sites to return transfusion data as described in part 1 can be explained by:-

- Some sites completing part 1 (clinical patient data) as a Trust but submitting stockholding data for each hospital within that Trust;

- Some sites completing stockholding data but not submitting data on any transfusion episodes (in contrast, some sites submitted transfusion data but not stockholding data).

Table Nine – Median stockholding of Group O RhD negative red cells – 2008 audit and 2010 re-audit

		NHS sites only 2010		Independent sector hospitals 2010		ALL sites 2008		
RTC Region / Blood Service	Number of Sites 2010 NHS (independent) = Total	Median % O RhD negative stockholding	Range	% O RhD negative stockholding	Range	Median % O RhD negative stockholding	Range	Number of Sites 2008
East of England	18 (0) = 18	11.4	8.4-21.7	-	-	13.6	7.7% - 18.4%	16
East Midlands	8 (0) = 8	11.7	8.9-15.3	-	-	16.2	8.8% - 22.3%	13
London	31 (1) = 32	12.9	6.7-28.4	One site: 24.6%		14.7	7.3% - 57.4%	29
North East	13 (0) = 13	13.1	9.8-18.8	-	-	17.4	12.0% - 40.1%	14
North West & North Wales	29 (1) = 30	11.4	7.3-26.7	One site: 33.5%		14.7	6.9% - 29.7%	31
South Central	8 (3) = 11	13.5	11.4-23.6	Three sites: 45.0, 45.6, 59.0 %		16.1	0.0% - 35.2%	11
South East Coast	16 (2) = 18	13.1	9.8-22.0	Two sites: 16.9, 31.1 %		13.4	9.9% - 50.8%	15
South West	18 (2) = 20	12.4	6.0-19.8	Two sites: 37.3, 40.9 %		14.7	14.7%	1
West Midlands	19 (2) = 21	14.5	11.6-39.9	Two sites: 24.5, 48.1 %		19.5	14.5% - 39.6%	13
Yorkshire & Humber	17 (1) = 18	13.2	9.6-25.7	One site: 11.2%		15.1	9.9% - 26.5%	15
England	177 (12) = 189	12.8	6.0-39.9	Median 35.4	11.2-59.0	15.0	0.0% - 57.4%	158
N Ireland	6 (0) = 6	16.2	12.0-25.2	-	-	-	-	0
Scotland	10 (0) = 10	15.9	11.0-36.5	-	-	14.8	12.1% - 31.8%	15
Wales	9 (1) = 10	12.8	10.7-17.1	One site: 31.3%		13.7	9.7% - 25.9%	12
Total UK	202 (13) = 215	12.9	6.0-39.9	Median 33.5	11.2-59.0	14.8	0.0% - 57.4%	185

In 2010, stocks of O RhD negative red cells averaged 12.9% with an inter-quartile range of 11.0% - 15.6% and range of 6.0% - 39.9% for NHS sites. For the independent sector the stockholding levels averaged 35.4%, inter-quartile range 24.5% - 45.3% with a range of 11.2% to 59%.

In the 2008 audit report the average stockholding data was expressed as a mean. Based on the distribution of cases in the current audit and the number of outliers, the average was expressed as a median. For comparisons, 2008 data were recalculated to show median values (for an explanation, see Methods section). The national average stockholding data for NHS hospitals was not compared with the average of independent hospitals due to the small number of participants from the independent sector.

Table Ten - % of all blood stocks that was Group O RhD negative

	All sites (n & %)	NHS sites (n & %)	Independent sites (n & %)
Up to 10.5% of stock	35/215 (16%)	35/202 (17%)	0/13 (0%)
Less than 12% of stock	82/215 (38%)	81/202 (40%)	1/13 (8%)
More than 20% of stock	33/215 (15%)	22/202 (11%)	11/13 (85%)

Comment - *Stocks of O RhD negative red cells did not show any weekly variation nor variation according to the day of the week.*

124 sites participated in both the 2008 and 2010 audits, 119 NHS and 5 independent. In order to identify statistically significant differences of stockholding in the 2 different audits, analysis could only be performed on the data from hospitals that participated in both audits. So for the NHS hospitals, although the stockholding levels appear to be reduced in the current audit, this is not statistically significant.

Table Eleven – Comparison of Group O RhD negative red cell stock levels - 2008 and 2010 audits

Comparison of Group O RhD unit stock levels 2008 & 2010		
	NHS (N=119)	Independent
Median 2008	14.5	35.2
IQR 2008	11.6 - 16.8	
Range 2008	6.9 - 42.2	7.3 - 50.8
Median 2010	13.5	31.1
IQR 2010	11.2 - 15.9	
Range 2010	8.0 - 39.9	11.2 - 48.1
Median 2010 - 2008	-0.3	8.5
IQR 2010 - 2008	-2.5 to +1.4	
Range 2010 - 2008	-14.2 to +8.9	-19.8 to +17.2
Wilcoxon Matched pairs test of 2010 Vs 2008	P=0.89	P=0.89

Correlation of O RhD negative red cells stockholding data with daily total units stocked

Table Twelve - Average daily total units

Average daily total units (all groups) stocked in DECILES*		O RhD negative %				
		Mean	Median	Minimum	Maximum	N
NHS	≤ 54.14	17.6	17.1	10.2	25.7	10
	54.15 - 74.91	16.6	15.3	9.2	36.5	23
	74.92 - 88.12	14.9	13.7	8.0	28.1	22
	88.13 - 97.81	14.2	12.4	7.3	25.2	22
	97.82 - 108.67	11.9	11.9	6.7	18.0	23
	108.68 - 121.09	12.4	11.6	8.4	22.0	21
	121.10 - 134.17	13.1	12.8	9.5	17.5	21
	134.18 - 165.07	14.6	13.6	9.4	39.9	22
	165.08 - 198.57	12.8	11.6	6.0	28.4	21
	198.58+	15.4	14.4	9.6	28.5	17
	Total	**14.2**	**12.9**	**6.0**	**39.9**	**202**

*deciles were computed using the stock levels for all participants, not just NHS. Kruskal-Wallis (10 groups): P=0.001

For 202 NHS sites the Spearman correlation of total stock size with % O negative RhD red cells stock was -0.176 p=0.012. For all 215 sites the correlation was -0.277, p<0.001. 12 of the 13 independent sites were in the lowest decile (≤54.14) for total stock size and for all 22 sites combined (12 independent & 10 NHS) in this lowest decile the median O negative stock level was 27.3%).

The above indicates that percentages of O RhD negative stocks are higher in hospitals keeping low or very high daily stocks.

BSMS site usage category – Blood Stocks Management Scheme categorises each hospital as very high, high, moderate, low or very low according to their annual issue of red cells. In this audit, the median daily stockholding level of O RhD negative was 33.5% in 9 very low usage sites (all independent), 15.2% in 27 low usage sites and 11.9 to 12.9% in higher usage sites.

In an attempt to ascertain whether any other factors may have an impact on the level of units stocked, several other characteristics of sites have been analysed to assess the average percentage of units stocked. In summary, for characteristics such as an onsite Accident & Emergency Department, designated trauma centre and on site maternity unit there is no evidence of correlation with average stockholding levels. Neither is there any apparent effect of routine stocking of irradiated, CMV negative or irradiated CMV negative units. Also, the number of satellite fridges in use does not seem to have any effect on levels of O RhD negative red cell stocks. Hospitals were also asked for the total number of emergency units held in all possible locations. A clinically-relevant sub-group of NHS hospitals has been identified for those holding more than 20 emergency units - for these 11 hospitals the median daily stockholding was 16.9%, in contrast to medians ranging from 12.0% to 12.9% for sites holding <3, 3-5, 6-9 or 10-19 emergency units.

Out of 10920 O RhD negative units audited in NHS hospitals, 1058 (10%) were transfused to non O RhD negative recipients in order to avoid wastage due to time expiry. For the independent hospitals, 48/108 (44%) were transfused for the same reason. There is a clear correlation in NHS hospitals of the % of O RhD negative blood transfused to avoid time expiry with the total O RhD negative red cells transfused at site level, as obtained from stockholding data (Spearman Coefficient =0.23,p=0.002).

Table Thirteen – Time expiry as reason for use v units transfused

% of O RhD negative red cells transfused to avoid time expiry v total O RhD negative red cells transfused		
%	**Median stockholding**	**n sites**
0	11.9	50
1 - 9	12.6	53
10 - 29	13.8	56
30+	12.9	19

Recommendation

6. Hospitals must reduce their stock levels of O RhD negative red cells to the recommended level of 10.5% in order to avoid transfusions to non-O RhD negative patients and thus avoid wastage due to time expiry.

Interestingly, the % of O RhD negative red cell units transfused to avoid wastage did not correlate with the total number of emergency units of O RhD negative red cells held in all possible locations at different sites (Spearman coefficient= -0.04, p=0.60).

Emergency delivery time and stockholding levels

In the 2008 audit those sites with an emergency delivery time (from NHSBT Blood Centre to the site) of 15 minutes or less had a higher average stockholding level than any other time frame – 19.9%.

In 2010, that figure was 19.6%, demonstrating no significant difference between the two audit findings. The table below shows the average daily stockholding for sites for whom emergency delivery takes either less than 15 minutes, 16 to 30 minutes, 31 to 60 minutes, or over 60 minutes.

Table Fourteen – Stock levels v emergency delivery time

Emergency delivery time to site from NHSBT	Average daily % of O RhD negative red cells
Less than 15 minutes	19.6%
16 to 30 minutes	13.5%
31 to 60 minutes	14.4%
More than 60 minutes	13.8%

Results – Part 3: Organisational Information

Participating sites were asked to complete a questionnaire which in addition to giving contextual information about the sites also asked for information about policies and procedures surrounding O RhD negative red cell use. In total, 211 organisational questionnaires were returned – the difference when comparing against participation in parts 1 and 2 can be explained by the same reasons as stated on page 21.

Is the use of emergency O RhD negative red cells reviewed by your HTT/HTC?
Despite recommendations from previous audits, for almost a third (30%, 63/211) of hospitals participating in this audit, use has not been reviewed by the HTT/HTC. Systematic review of use of emergency units can identify cases of possible inappropriate use, for example cases where a switch to group specific blood could have been made earlier, or in the case of older female and male patients with no anti-D where a switch to group O RhD positive could have been made.

Do you have a policy/guidance document that advises the rotation of O RhD negative red cells?
Of the 19/211 sites (18 NHS, 1 independent) who indicated that they did not have a policy or guidance in place to rotate emergency units to prevent wastage through time expiry, none indicated that they did actually rotate the units.

Sites were also asked about their primary mechanism for blood issue. 83/211 (39%) were 100% serological matching sites, 4 sites stated their primary mechanism as “remote issue” for between 1 and 16% of issues and 69/211 (33%) stated that electronic issue accounted for 80% or more of their blood issues.

Transfusion of O RhD positive red cells to O RhD negative male patients or females with no child bearing potential with no anti-D detected on pre-transfusion testing
154/ 211 (73%) sites indicated that they had a policy or guidance in place to provide RhD positive red cells to O RhD negative males or females of more than 60 years old with no anti-D who receive massive blood transfusion. A significant number of hospitals (54/211 (26%)), despite the guideline’s recommendations, do not have relevant policies or guidance in place.

For those that gave an indication of the approximate number of units issued before switching to RhD positive red cells, the consensus was around 4-10 units. Some hospitals indicated they review each case individually and they switch depending on clinical information and stock availability. A small number of hospitals transfuse O RhD positive red cells from the start.

NHS hospitals with a policy or guidance in place to provide O RhD positive red cells to O RhD negative male patients and females more than 60 years old (and females not of child-bearing capacity) with no anti-D detectable when they are undergoing massive blood loss transfusion do tend to stock less O RhD negative blood in comparison with those without such policies or guidance. (Median 2.7 Vs 3.7 units. Mann-Whitney Test p=0.04).

Recommendation

7. Appropriate policies which guide use of O RhD negative red cells should be introduced in order to reduce unnecessarily high stockholding levels.

OTHER ORGANISATIONAL OUTPUT

182/211 (86%) sites reported having an Accident and Emergency department and 80/211 (38%) consider themselves to be a trauma centre. Data for this audit were collected prior to the designation of Major Trauma Centres. 172/211 (82%) participants supply blood to maternity units, and 136/211 (64%) hospitals treat patients with transfusion dependant haemoglobinopathies. From those, 20/136 (15%) treat more than 30 patients per year.

91% (192) of hospitals have a policy or guidance document that advises the rotation of O RhD negative red cells in satellite fridges. For most of these (172/192) the rotation is based on date of expiry. Most hospitals (72%, 123/172) rotate 6-10 days before the expiry date, whilst 15% (26) rotate their blood less than 5 days prior to expiry.

Key Findings

- 3469/5108 (68%) patients receiving transfusions involving at least one unit of O RhD negative red cells were aged 60 or over.
- The blood group of the recipients of the transfusion was O RhD negative in 70% of cases. 19% of recipients were O RhD positive and 11% were of a non-O blood group.
- In total,78% of transfusion episodes of O RhD negative blood met at least one mandatory, recommended or acceptable indication
- For 60% (638/1059) of transfusions not in accordance with a mandatory, recommended, acceptable or unacceptable indication, the reason for transfusion was given as prevention of the time expiry of standard or irradiated units.
- Emergency units were used in 5.5% (280/5108) of transfusion episodes. The number of emergency units used in a transfusion episode ranged from 1 – 12, averaging 2.2 units per episode. 3 or more units of O RhD negative red cells were used in 101/5108 (2%) transfusion episodes involving emergency units where the blood group was unknown at the time of transfusion. The number of emergency units transfused correlated with the time taken to provide group specific blood.
- 38/5108 transfusions to non-O RhD negative patients were as a result of the supply of mismatched units by NHSBT and 28/5108 patients of Ro group received O RhD negative red cells.
- Only 16% (35/215) of sites had an average daily stockholding of O RhD negative red cells below the recommended level of 10.5%, with 38% (82/215) of sites averaging less than 12% of stock.
- Sites furthest away from blood issue centres did not necessarily have higher O RhD negative stockholding levels.
- Those sites with very small overall stocks and also the very largest sites appear to hold proportionally greater stocks of O RhD negative red cell units.
- There is a link between the proportion of transfusions of O RhD negative red cells given to avoid time expiry and the stockholding levels of O RhD negative red cells.

Conclusions

Data on 5108 transfusion episodes occurring during the month of June 2010 where at least 1 unit of O RhD negative blood was transfused were analysed for this audit.

In NHS hospitals a total 10920 units of O RhD negative red cells were transfused. In 1532/5108 (30%) transfusion episodes, O RhD negative red cells were transfused to non-O RhD negative recipients. 4002/5108 (79%) met either Mandatory, Recommended or Acceptable indications according to national guidelines. For example, blood was given in emergency circumstances, in particular to female patients of child bearing age. In 47/5108 cases use of O RhD negative red cells was unacceptable. 1059/5108 cases could not be assigned to any categories of the guidelines, and in 638/1059 (60%) of these 1059 cases O RhD negative blood was transfused to prevent wastage due to time expiry. In total, 1058/10920 (10%) O RhD negative red cell units audited were transfused to avoid time expiry.

In addition, the audit revealed stocks of O RhD negative red cells averaged 12.9%, with an inter-quartile range of 11.0% - 15.6% and range of 6.0% - 39.9% for NHS sites. For the independent sector the stockholding levels averaged 35.4%, inter-quartile range 24.5% - 45.3%, range 11.2% to 59.0%. Sites with very high usage of blood were found to stock a higher percentage of O RhD negative red cell units as a proportion of their total stock. Higher stock levels were correlated with higher % of O RhD negative red cells transfused to prevent wastage due to time expiry.

These hospitals should review their stock holding policies and reduce stocks of O RhD negative red cells to at least 10.5% in order to use O RhD negative red cells appropriately.

Useful information can be provided by the Blood Stocks Management Scheme in order to monitor and adjust stockholding levels as well as providing peer-reviewed data that can be discussed at Regional Transfusion Committee meetings.

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