

2018 Survey of Group O D Negative Red Cell Use



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Executive Summary

Background

Balance between supply and demand of O D negative red cells remains a challenge for almost every blood service.

In 2008 the National Blood Transfusion Committee (NBTC) commissioned an audit for the use of O D negative red cells.¹ Following the publication of the audit, the NBTC, reviewed the Guideline on the 'Usage of O RhD negative red cells'.²

The Blood Stocks Management Scheme completed a survey for the prevalence of different blood groups in the hospital population during 2009³, and during the same year, NHS Blood and Transplant (NHSBT) asked hospitals not to hold more than 10.5% of their stocks as O D negative in order to be able to respond to escalating demands.

The 2010 audit⁴ of the use of O D negative blood found that only 16% of participating sites kept less than 10.5% of their red cell stocks as O D negative. 38% of sites kept stock levels of less than 12% and 15% of sites kept more than 20% of their stocks as O D negative blood. 10% of blood audited in June 2010 was transfused to non- O D negative patients to prevent time expiry. Transfusions to prevent time expiry clearly correlated with stock levels.

A more localised audit in the East of England region (2012) indicated that 23% of O D negative blood was given to non-O D negative patients. This involved 49 units of which 19 (39%) were transfused to avoid time expiry.⁵

In 2015, survey findings suggest that many of the recommendations from 2010 audit were not being implemented particularly in relation to stockholding levels and the use of O D negative blood to avoid time expiry (Bassey et al 2015).

In July 2019 the National Blood Transfusion Committee published updated guidance regarding the use of O D negative red cells.⁵

Hospitals can access updated information and materials regarding appropriate usage of O D negative red cells at the 'O D negative tool kit' accessible via the Hospitals and Science website of the NHSBT.⁶

Current survey of O D Negative Red Cells 2018

The focus on the 2018 survey of O D negative red cells use was to ascertain the fate of all O D negative blood issued to NHS hospitals covering a defined two-week period. Units issued as a substitution were not included in the survey unless they were issued from the Red Cell Immunology (RCI) laboratories. In addition, an organisational survey was carried out to determine policies and procedures in relation to O D negative blood use along with stockholding practice.

Key findings:

- 59.3% of O D negative red cells are transfused to O D negative patients. This is a significant change in practice from the 2010 O D negative audit where 70% of O D negative red cells were transfused to O D negative patients.
- 16% (794/4970) of the total number of units were used as "emergency units". In 2010, "emergency units" were used in 280/5108 (5.5%) transfusion episodes.
- 12.6% O D negative red cells were transfused to avoid wastage due to time expiry and 5% were wasted.

- 6 % O D negative red cells were transfused in an emergency to males and females aged over 50 years. It is worth noting that 31% of sites do not have a policy to provide O D positive red cells in an emergency to unknown males and females aged over 50 years.
- 10.8% of O D negative red cells were used as a substitution by hospital laboratories. Approximately half of those needs could have been met by suitable O D positive red cells. Availability of extensively phenotyped units of O D positive red cells as well as red cells meeting other special requirements (irradiated, CMV negative) could have reduced those substitutions.
- O D Negative stockholding greater than 12.5% has increased from 46% of sites in 2010 to 64% of sites in 2018.

Recommendations

Hospitals should review:

- Local transfusion policies and ensure they include recommendations for the use of O D positive red cells for unknown/O D negative adult male patients and female patients of non-childbearing potential in an emergency.

Hospitals should monitor:

- **Transfusion of O D negative red cells to non-O D negative patients to avoid time expiry:** A high percentage of O D negative red cells to non-O D negative individuals could indicate overstocking and stock adjustment may be required.
- **The number of days stock is held before transfusion (Issuable Stock Index - ISI):** aim for an ISI for O D negative of 3 to 4 days.
- **Use of O D negative red cells in emergencies (including (air)ambulance):** appropriate use and wastage of red cells should be audited regularly. The number of units carried in pre-hospital care boxes should be adjusted accordingly.
- **Use of O D negative red cells held in satellite fridges:** consider reducing the number of units held. O D negative red cells kept in satellite fridges must be rotated to avoid wastage.
- **Use of O D negative red cells held in remote issue fridges:** regularly review the stocks of O D negative red cells in each fridge. All stock held in remote fridges should be rotated back into stock with enough shelf life remaining to allow the units to be used appropriately before time expiry. Adequate numbers of O D positive red cells must be kept to avoid unnecessary use of O D negative as a substitution.

Hospitals should aim for:

- O D negative red cell stockholding of less than 12.5%.
- 10 to 20% of O D negative stock to be K+ to support stability of the supply chain.
- Stock sharing if possible (private hospitals, smaller NHS hospitals and between sites of the same Trust).
- O D negative wastage of less than 4%.
- Sharing of usage and wastage data at Regional Transfusion Committees (RTC).
- Provision and ordering of group specific (and if appropriate O D positive) phenotyped red cells (including those where additional specific requirements are need e.g. irradiated) where possible.

Introduction

O D negative red cells are considered to be a 'universal' blood component. They 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 an increasing reliance to O D negative red cells has been observed, with stable or increasing demand despite the overall reduction on the usage of red cells. It is also recognised that there is significant regional variability in use and stockholding.⁽¹⁾ A survey conducted by the Blood Stocks Management Scheme (BSMS) to investigate the distribution of blood groups within the hospital population of England, Wales and Northern Ireland indicated that 7.8% of the hospital population is Group O D negative with a regional variation from 5.9% to 9.0%.⁽³⁾ In this exercise, the data from the 2018 organisational survey suggests that hospital O D negative populations are unchanged. 49 sites across the UK provided local O D negative population data. This ranged from 2% to 19% with a median of 8% (IQR = 2).

Currently it is recommended for hospitals to keep O D negative stocks at 12.5% of total issues or less depending on their hospital speciality.

NBTC guidelines for the use of Group O D negative red cells provide standards for its use as well as general principles for stock management.⁵

Since the last National Comparative Re-Audit for the 'Usage of O RhD Negative red cells' (2010)⁴, changes in clinical and laboratory practice have impacted on the demand for O D negative red cells. A continuing reduction in total red cell demand and strong demand for O D negative red cells has resulted in a rising percentage demand for O D negative units. Possible reasons for this include an increased use of O D negative red cells in emergency situations together with the implementation of the BSH 2 sample rule driving demand in the acute setting. Also, the increase in use of remote fridges and changing landscape of 24/7 pathology service provision add to this demand. Clinically, the use of therapeutic red cell exchange regimes for care of sickle cell patients and increasing demand for Ro red cell units also contributes to changes in the supply chain dynamic.

Aims

- Determine the fate of all group O D negative red cells issued to English hospitals by NHSBT using a snapshot approach covering a two-week period in 2018 between 14th and 27th May 2018. Units issued as substitutions during the audit period have been excluded with the exception of those issued by the Red Cell Immunohaematology laboratories (RCI).
- Conduct an organisational survey in participating sites to update information on policies and procedures along with stockholding in UK hospitals with respect to O D negative blood at the same time.
- Determine the prevalence of O D negative patients likely to require a red cell transfusion in the hospital populations.

Objectives

The objectives of the audit were to:

- Determine the proportion of O D negative red cells that are transfused to non-O D negative patients and the reasons for these transfusions.

- Identify hospital practices associated with high use / stockholding of O D negative red cells and understand why this might occur.
- Provide commentary on the distribution of transfusion of O D negative red cells during the survey period.

Standards

The following standards were developed from the National Blood Transfusion Committee guidance for the appropriate use of group O D negative red cells,^{2,5} and NHSBT recommendations to hospitals.⁶

Standard Statement 1

O D negative red cells should primarily be transfused to O D negative recipients and substitutions should be kept to a minimum.

Survey observation: 59.3% (2946/4970) of O D negative red cells are transfused to O D negative patients.

Standard Statement 2

O D negative red cells should be used as a substitution only in the absence of appropriate group specific or O D positive red cells units.

Survey observation: 10.8% (538/4970) of O D negative red cells were transfused as a substitution made by hospital laboratories. Approximately half (5%, 247/4908) of those needs could have been met by suitable O D positive red cells.

Standard Statement 3

In an emergency it is acceptable to use O D positive red cells for adult males and females aged over 50 years who are D negative (no anti-D detected) and for those adult males and females aged over 50 years whose D status is unknown.

Survey observation: 10% (504/4970) of O D negative red cells were transfused to women aged over 50 years of age and adult males.

Standard Statement 4

Hospitals do not routinely stock or use more than 12.5% of all red cells as group O D negative.

Survey observation: Median O D negative red cell stock was 13%.

Standard Statement 5

O D negative red cell wastage should be less than 4%.

Survey observation: 5% (252/5343) of the fated units were wasted due to either time expiry (143/252) or out of temperature control (109/252).

Standard Statement 6

Hospitals should monitor the number of units of O D negative red cells that are transfused to non-O D negative patients to avoid time expiry. Appropriate adjustments must be made to stocks to minimise this practice.

Survey observation: 12.6% O D negative red cells were transfused to avoid wastage due to time expiry.

Methods

English hospitals invited to participate in the survey were provided with an online tool to “fate” all O D negative red cell units issued to them during the period 14th May to the 27th May 2018.

Sufficient time was allowed to ensure these units had either been used or wasted before data entry commenced. The online form required a unique pulse code login and hospitals were presented with a series of specific O D negative red cell unit numbers issued to them during the specified audit period.

In total, 6287 units were issued during this period.

Demographic information was also collected using the same online form. Participating sites were also offered to submit data via a download from their laboratory information systems (LIMS) if they chose to do so. In the event, only two sites chose to provide data via LIMS downloads. Sites cited the difficulties of data extraction with some LIMS systems and avoided this method.

An organisational survey was also provided online to be completed once by each site. This survey asked for information on clinical activities and hospital specialisation, current transfusion policies used by participating sites, stockholding, fridge distribution and other aspects of transfusion practice.

The O D negative “fate” proforma and the organisational survey proforma are provided separately.

Data were returned from 193 (214*) sites. 85% (5343/6287) of units of O D negative blood issued were fated. 141 (211*) sites contributed organisational data (*number of sites contributing to the 2010 O D negative red cell audit).

Data have been analysed proportionately (n, %). Base data were defined as the number of answers provided to each question. Denominators may therefore vary and were adjusted for each question.

Stakeholders

All Trusts / hospitals in England supplied blood from NHS Blood & Transplant. NHS and private hospitals (direct customers to NHSBT) were invited to participate.

Results – Demographics and Response Distribution

Data were received on 5343 units of O D negative red cells from 193 sites (Appendix 1 - list of hospitals that participated). Table 1 shows the breakdown of NHS Hospitals by Regional Transfusion Committee (RTC) region that submitted O D negative blood fate data.

Table 1- Regional breakdown of O D negative red cell fate data submitted from NHS and private hospitals by RTC region (note: participating sites includes only those issued with O D negative units during the two-week survey period)

RTC Region / Blood Service	No. of participating hospitals	No. of possible hospitals	Participation rate	No. of units fated
West Midlands RTC	17	32	53%	568
East Midlands RTC	11	17	65%	393
North West RTC	27	45	60%	629
London RTC	38	60	63%	1071
East of England RTC	16	25	64%	467
North East RTC	11	18	61%	334
South East Coast RTC	15	28	54%	333
South Central RTC	15	26	58%	454
Yorkshire and The Humber RTC	24	30	80%	643
South West RTC	19	27	70%	451
Total	193	308	63%	5343

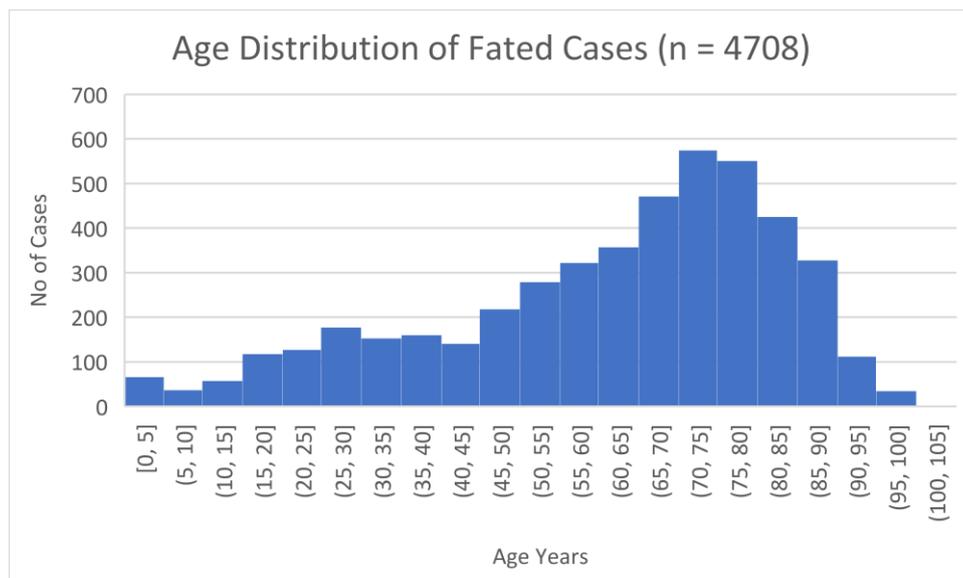
7% (13/193) of participating sites were independent sector hospitals who accounted for less than 2% (91/5343) of O D negative red cell units used.

Demographics and Grouped Patient Diagnoses and specialities

The gender distribution of the survey sample was 52% (51%*) male (2593) and 47% (49%*) female (2358) with 49 cases (0.9%) where it was not recorded on hospital systems and 346 where gender was unknown. (* = 2010 data).

Questions were included in the survey to ascertain the diagnosis and treatment speciality of patients who received O D negative red cells during the audit period. Unfortunately, the text responses received for these questions lacked detail (e.g. anaemia was documented as the most frequent diagnosis but with no accompanying details). After consideration, these fields have not been included in this report or the analysis.

Figure 1 – Age distribution of patients audited (n=4708)



The median age was 67 (70*) years, IQR 49 to 78 years. This age distribution corresponds with similar audits carried out elsewhere in the UK on red cell usage. 12% (635/5343) of units were fated without the age of the recipient provided (* = 2010 data).^{(4) (5) (6)}

Results – Part 1: principle “fate” of O D negative red cells

93% (4970/5343) of the fated units were transfused. In total, 59% (2946/4970) of O D negative red cells were transfused to O D negative recipients, compared to 70% in 2010. The remainder, 41% (2024/4970) were transfused to non-O D negative recipients as shown in Table 2.

5% (252/5343) of the fated units were wasted due to either time expiry (143/252) or out of temperature control (109/252).

1% (67/5343) of units were sent to other hospitals and the fate of the unit was unknown. 9 of these 67 units were sent to private sector hospitals.

The remaining 1% (54/5343) of units not categorized were reported under “other reasons” and the majority of these were wasted. A condensed list of these reasons is given in Appendix 2. These units were reported as “damaged on ward”, “fridge failures”, ordered but not used and frequently issued as “flying squad” units but not subsequently used.

Table 2 - Fate of O D negative red cells (n = 4970) issued by NHSBT during the 2 week survey period that were transfused

	N* (%)
O D negative patient	2946 (59.3%)
Transfused from major haemorrhage pack or "flying squad" fridge/box	794 (16.0%)
Transfused to avoid time expiry (TIMEX)	625 (12.6%)
Extended phenotype required and not available in patient's ABO/D group	182 (3.7%)
Ro phenotype required and not available in patient's ABO/D group	128 (2.6%)
Allogenic Bone Marrow Transplant (BMT) with ABO/D group mismatch	126 (2.5%)
HbS negative unit required and not available in patient's ABO/D group	98 (2.0%)
Patient's ABO/D group unconfirmed	96 (1.9%)
ABO/D Irradiated unit required and not available in patient's group	94 (1.9%)
Tick here in addition if any "substitution" indicated above, was initiated by NHSBT including RCI laboratories to fulfil an order	55 (1.1%)
CMV negative unit required and not available in patient's ABO/D group	25 (0.5%)
Solid organ transplant with ABO/D group mismatch	11 (0.2%)

*Totals = (5180) 210 submissions where more than 1 option was ticked

Table 3 - Fate of unit categorised by Blood Stocks Management Scheme (BSMS) 2017 to 2018 groupings

Blood Stocks Management Scheme categories 2017/18						
	Very High	High	Moderate	Low	Very Low	Extremely Low
Number of units transfused in each BSMS group	2056	1279	1058	500	63	7
Fate of O D negative unit						
Outcomes						
Transfused to O D negative patient	1089 (53.0)	781 (61.1)	719 (68.0)	320 (64.0)	29 (46.0)	6 (85).7
Transfused from major haemorrhage pack	434 (21.1)	214 (16.7)	109 (10.3)	34 (6.8)	0	0
ABO/D group Unconfirmed	55 (2.7)	20 (1.6)	14 (1.3)	6 (1.2)	1 (1.6)	0
Allogenic bone marrow transplant with mismatch	88 (4.3)	12 (0.9)	7 (0.7)	19 (3.8)	0	0
Solid organ transplant with ABO/D mismatch	11 (0.5)	0	0	0	0	0
Transfused to avoid time expiry	151 (7.3)	151 (11.8)	175 (16.5)	112 (22.4)	33 (52.4)	1 (14.3)
Extended phenotype required (not available ABO/D)	90 (4.4)	57 (4.5)	26 (2.5)	9 (1.8)	0	0
Irradiated unit required (not available ABO/D)	50 (2.4)	24 (1.9)	11 (1.0)	9 (1.8)	0	0
CMV negative unit required (not available ABO/D)	14 (0.70)	5 (0.40)	3 (0.30)	3 (0.60)	0	0
HbS unit required (not available ABO/D)	79 (3.8)	15 (1.2)	3 (0.30)	1 (0.20)	0	0
Ro phenotype required (not available ABO/D)	76 (3.7)	42 (3.3)	9 (0.90)	1 (0.20)	0	0
NHSBT initiated substitution	15 (0.7)	33 (2.6)	5 (0.50)	(2) (0.40)	0	0

Excluding the low and very low BSMS groups, there are significant differences in the proportions of O D negative blood going to non-O D negative patients between the BSMS groupings (Chi Square = 73, P < 0.001) with significantly more O D Negative blood going to non-O D negative patients in the very high user group when compared to the other BSMS categories.

There was considerable variation in the fate of O D negative red cells by Regional Transfusion Committees (RTCs). Table 4 shows the percentage of O D negative red cell use in the three main categories accounting for the majority of use.

Table 4 - % O D negative red cell use in three main categories

RTC	O D negative %	TIMEX %	Emergency %
East Midlands	70	14	16
East of England	71	8	12
London	39	19	18
North East	68	15	8
North West	70	10	14
South Central	49	13	18
South East Coast	68	16	11
South West	65	14	14
West Midlands	55	7	23
Yorkshire and The Humber	70	6	15

In the independent sector, 91 units were fated from 13 sites (Table 5). Of these, 15% of red cells were transfused to O D negative recipients, 32% were transfused to avoid time expiry, 25% were wasted due to time expiry. In the 2010 survey, 59 transfusion episodes (mean 1.89 O D negative units per transfusion) were submitted by independent hospitals, the recipient was O D negative in 22% (13/59) of cases.

Table 5 – O D negative red cell fating for independent sector usage (n = 91*)

	N	%
O D negative patient	14	15
Transfused to avoid time expiry	29	32
Wasted due to time expiry	23	25
Returned to NHS hospital	25	27
Sent to another private hospital	2	2

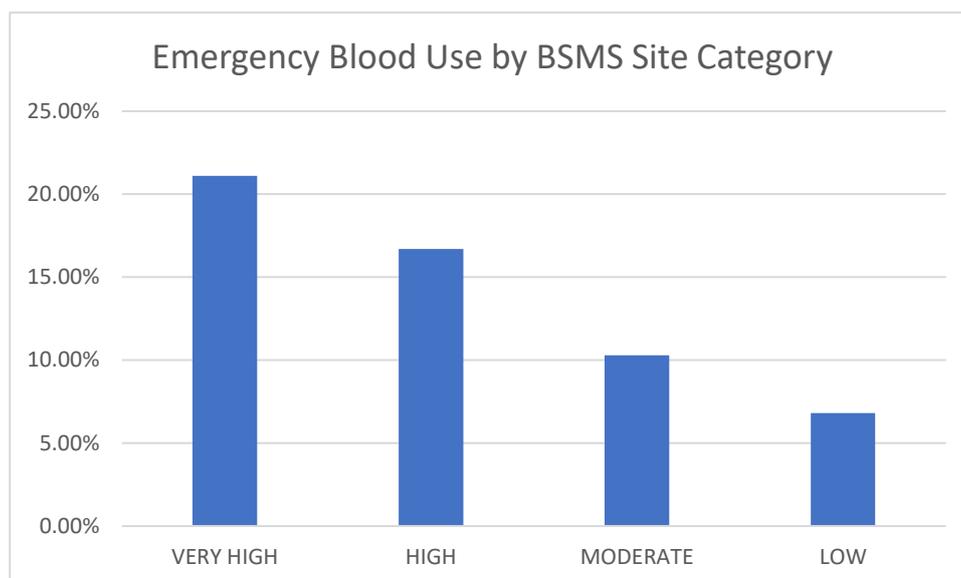
*2 units dual classified

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

Emergency Use

In 2018, 16% (794/4970) of O D negative red blood cell units were fated as “Transfused from major haemorrhage pack or “flying squad” fridge/box”. In 2010, “Emergency units”, were used in 5.5% (280/5108) of transfusion episodes (Figure 2).

Fig 2 – Emergency blood use by BSMS category



Hospitals were asked in the organisational audit how long it took to provide group specific, un-crossmatched red cells in the presence of a current valid sample, in an emergency.

44% (62/141) of hospitals did not allow the issue of group specific uncrossed-matched red cells in the presence of a current valid sample in an emergency.

In the presence of an historical blood group, 71% (91/128) of hospitals were able to provide group specific red cells in less than 15 minutes.

In the absence of an historical blood group, 39% (41/104) of hospitals were able to provide red cells in less than 15 minutes. In the 2010 survey these figures were 77% (158/203) and 57% (117/203) respectively.

Although O D negative red cells are considered appropriate to be transfused as an emergency to patients of all blood groups, this has to be prioritised, aiming to protect the women of child bearing potential (< 50 years old) from developing alloimmunisation to the D antigen. In order to conserve O D negative stocks, it is acceptable for hospitals to transfuse O D positive red cells to adult males (>18 years old) and women of non-child bearing potential (> 50 years old). If this was applied to all potential recipients in this audit, transfusion of 10% (504/4970) of O D negative red cells during the audit period could have been avoided (Table 6).

Table 6: Proportion of O D negative red cell units transfused to women over 50 years old and adult men

	N (%)
Transfused from Major Haemorrhage Pack (female > 50 years)	157 (3.1)
Transfused from Major Haemorrhage Pack (men > 18 years)	347 (6.9)
Totals	504 (10.0)

Transfusion of O D negative red cells to patients of D positive blood group as a substitution selected by the hospital laboratory

Table 7: Use of O D negative red cells by blood grouping of recipients

	Totals	A +	A -	B+	B -	AB +	AB -	O +	O -	Not determined
Total (%)	4908	320 (6.5)	142 (2.9)	136 (2.8)	71 (1.4)	19 (0.4)	7 (0.1)	1154 (23.7)	2923 (59.6)	139 (2.8)
Male (%)	2547 (51.9)	164 (6.4)	84 (3.3)	59 (2.3)	34 (1.3)	11 (0.4)	4 (0.2)	618 (24.3)	1499 (58.9)	79 (3)
Female (%)	2325 (47.4)	156 (6.7)	58 (2.5)	77 (3.3)	37 (1.6)	8 (0.3)	3 (0.1)	546 (23.5)	1421 (61.1)	27 (1.2)
Unknown	36 (0.7)								3 (8.3)	33 (91.7)

A significant proportion of O D negative red cells were transfused to non- O D negative individuals with 24% (1154/4908) transfused to group O D positive individuals.

Table 8: O D negative red cells given to D positive patients

Specification	A +	B+	AB +	O +
Extended phenotype required (not available in ABO/D)	23	6	0	123
ABO/D irradiated unit required (not available ABO/D)	9	10	0	45
CMV negative unit required (not available ABO/D)	6	1	2	12
HbS negative unit required (not available ABO/D)	3	18	0	67
Totals	41	35	2	247

Units of additional characteristics/special requirement should be selected to be identical with the patient's blood group. It is recognised this is often impractical, particularly for rarer blood groups (such as group AB or B). Group O D positive red cells can be a substitution for all D positive patients (with the exception of Ro). During the audit period 5% (247/4908) of units transfused were given to group D positive patients as a substitution (excluding Ro). Transfusion of those units could have been avoided if group specific blood was available. If that was not possible, substitution with O D positive blood meeting patients' additional requirements would have been safe for patients and appropriate.

Kell status

This survey was primarily designed to ascertain the fate of O D negative red cells. Limited information was available to assess appropriateness of usage of O D negative Kell negative red cells. Anti-K antibodies are responsible for severe transfusion reactions and development of haemolytic disease fetus and new-born (HDFN). Usage of O D negative Kell negative red cells should be prioritised according to patients needs aiming to protect the following groups of patients:⁵

- O D negative patients with detectable or historical anti-K.
- O D negative Kell negative or Kell unknown females of childbearing potential (< 50 years old).

- Females less than 50 years old of unknown blood group receiving blood as an emergency
- Regularly transfused O D negative and Kell negative patients requiring Rh and Kell matched red cells
- Bone marrow transplant patients (with the appropriate indication to receive O D negative red cells) where the donor or the recipient has anti-K, until engraftment. Post engraftment transfuse red cells matching the patient's Kell phenotype.

Information was analysed as part of this audit in relation to the Kell status of 4838 units (Table 9).

92% of units were Kell negative (4478 units). From those 51% (2209/4478) were transfused to males and 31% (1408/4478) to females over 50 years of age.

Table 9 – O D red cell transfusion by Kell status

	Total	Male (%)	Female (%)
Kell negative	4478	2209 (51.4)	2131 (47.6)
Kell positive	498	285 (57.2)	213 (42.8)
Unknown	2	0	2

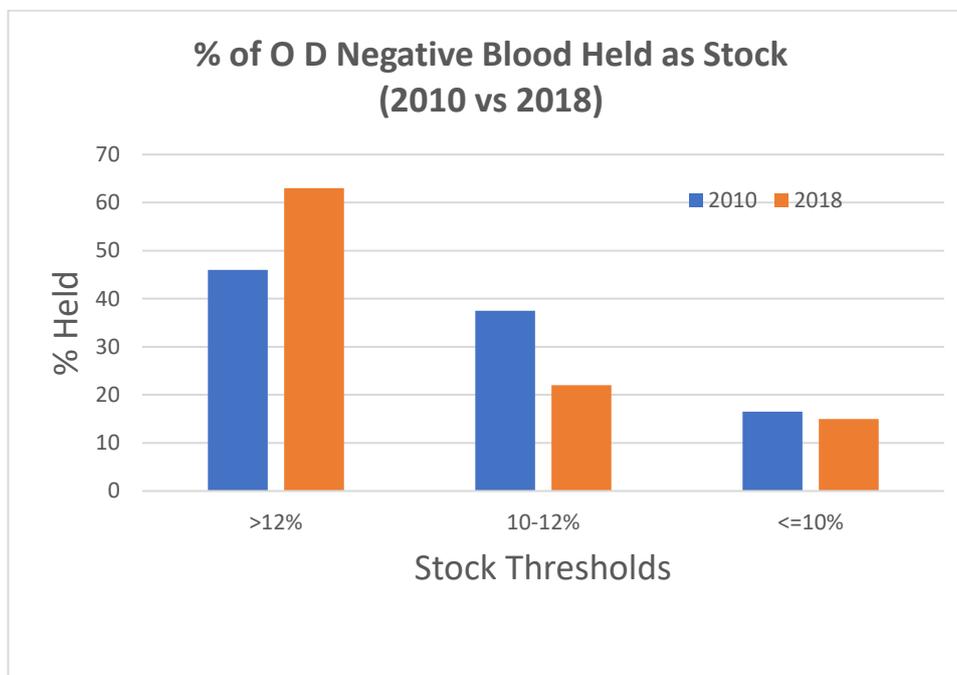
Part 1: Key findings

- 59.3% (2946/4970) of O D negative red cells are transfused to O D negative patients. This is a significant change in practice to the 2010 O D negative audit where 70% of O D negative red cells were transfused to O D negative patients.
 - A higher proportion of O D negative red cell units were going to non-O D negative patients in the BSMS very high user group category compared to other BSMS categories.
 - Only 15% (15/91) of O D negative red cells went to O D negative patients in the private sector hospitals. 63% were either transfused to avoid time expiry (32/91) or wasted due to time expiry (25/91).
- 16% (794/4970) of the total number of units were used as an emergency. In 2010, “emergency units” were used in 5.5% (280/5108) of transfusion episodes.
 - 10% (504/4970) of O D negative red cells were transfused to adult males (> 18 years old) and females over 50 years of age as an emergency.
- 12.6% (625/4970) of O D negative red cells were transfused to avoid time expiry and at least 5% (252/5343) were wasted.
- 10.8% (538/4970) of O D negative red cells were transfused as a substitution made by hospital laboratories. Approximately half (5%, 247/4908) of those needs could have been met by suitable O D positive red cells. Availability of extensively phenotyped units of O D positive red cells as well as red cells meeting other special requirements (irradiated, CMV negative) could have reduced those substitutions.
- There was variation in the proportion of O D red cell use across RTC regions for: O D negative patients; time expiry; and emergency use.

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

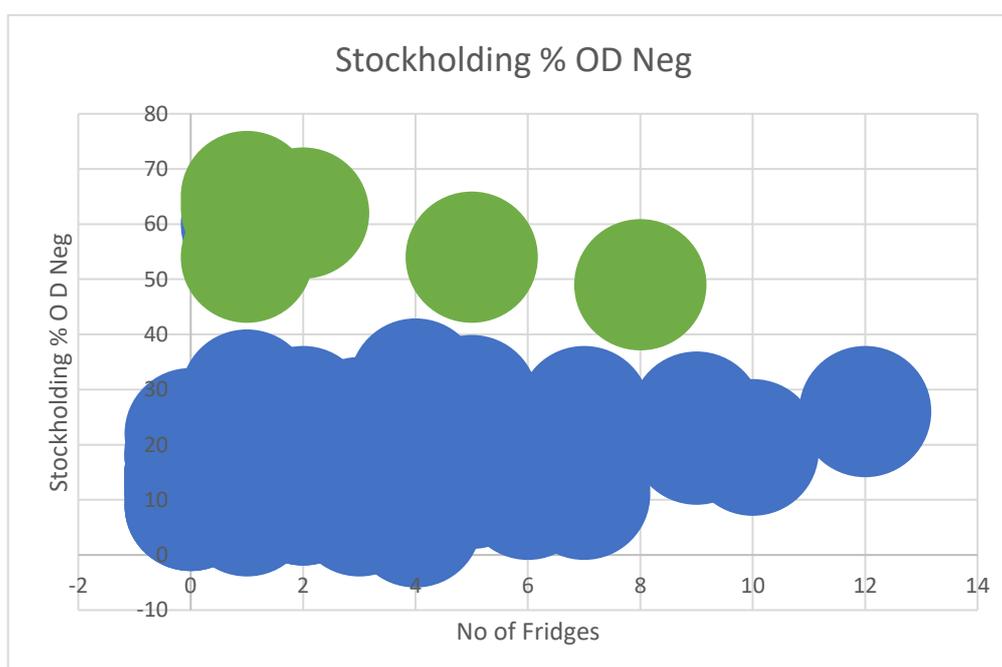
Stockholding data was obtained from the Blood Stocks Management Scheme for the survey period (14th May to the 27th of May 2018). 90 sites had stockholding levels of more than 12%, 32 sites had stockholding levels of 10 to 12% and 12 sites had stockholding levels of less than 10%.

Fig 3 - % O D negative red cells held by hospitals for the survey period



To examine further factors that might determine levels of O D negative red cell use, we looked at a possible relationship between infrastructure (number of fridges) and levels of O D negative red cell stockholding. There were 119 datasets where paired data existed (fridge numbers and stockholding level, Fig 4).

Fig 4 - Relationship between stockholding and number of fridges

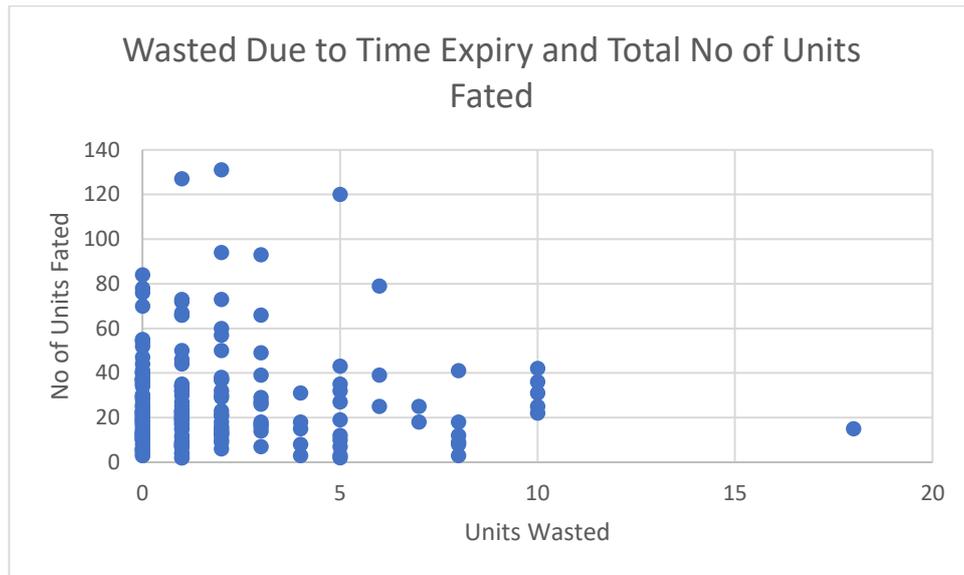


Areas in green represent independent sector hospitals who kept high levels of O D negative red cells as stock.

There was no evidence of a correlation between the number of fridges and stockholding levels (Pearson rank correlation $r = 0.144$, $p = 0.12$).

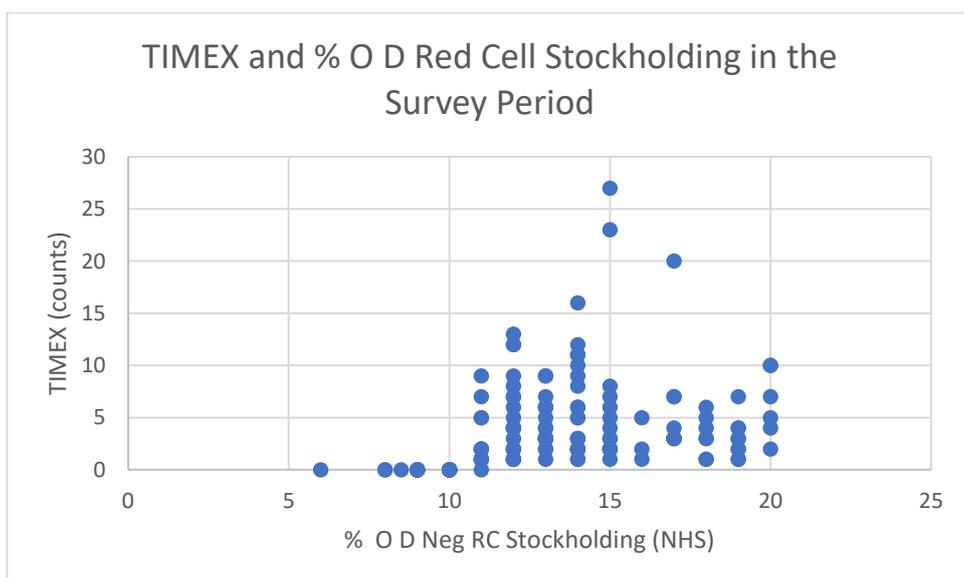
After removal of an outlying result there was no evidence of a correlation between the total number of units fated by an organisation during the survey period and the number of units wasted due to time expiry ($r = 0.01$, $p = 0.88$). (Fig 5).

Fig 5 – Total units fated vs wasted due to time expiry



Hospitals transfuse O D red cells to non O D negative red cell recipients in order to avoid wastage due to time expiry. There was a weak correlation between the amount of O D negative red cells held as stock and the number of units transfused to avoid time expiry ($r = 0.265$, $P = 0.034$) (Fig 6).

Figure 6 – Transfused to avoid wastage (TIMEX) and % O D negative red cell stockholding



There was a similar finding in the 2010 survey of O D negative red cell use.

Table indicates stockholding in organisations who share stock with other hospitals (both private and NHS)

Table 10 - % O D negative stockholding in NHS, independent and “share” sites

% O D neg stock NHS	N 145	% O D neg stock Independents	N 36	% O D neg stock Share sites	N 33
Median	13.0	Median	29.0	Median	14.0
Mode	14.0	Mode	26.0	Mode	14.0
Range	14	Range	58	Range	46
Minimum	6	Minimum	20	Minimum	8
Maximum	20	Maximum	78	Maximum	54

In 2010 the median percentage O D negative stock holding was 12.9 in NHS hospitals (IQR 11 to 15.6; range 6 to 39.9), whereas in independent hospitals the median percentage was higher than in 2018 (median 33.5; IQR 24.5% to 45.3%; range 11.2 to 59.0).

Part 2: Key findings

There was a weak positive correlation between the amount of O D negative red cells held as stock and the number of units transfused to avoid time expiry.

There was no evidence of a correlation between number of fridges and stockholding levels.

Results – Part 3: Organisational Information

141 sites submitted organisational data relating to the transfusion of O D negative red cells.

Table 11 indicates the distribution of facilities that impact on O D negative red cell use and provides comparative data from the 2010 survey apart from trauma centres, which were first established in England in 2012.

Table 11- O D negative red cells – hospital service provision

Type of Provision (N = 141 responses)	2018 Yes (%)	2010 Yes (%)
Provide services to a trauma centre	26 (18)	-
Provide services to a trauma unit	51 (36)	80 (38)
Provide services to A&E	117 (83)	182 (86)
Provide services to a maternity unit	105 (74)	172 (82)

Hospitals should have policies in place to guide O D red cell usage. Table 12 indicates policy provision according to current guidelines.

Table 12 - O D negative red cell policy provision

Type of Provision (N = 141 responses)	Yes (%)	Yes (Males) (%)	No (%)
Do you have a policy or guidance in place to provide D positive red cells to O D negative females over 50 years of age and adult males and with no detectable anti-D, if they are undergoing massive blood transfusion?	97 (69)	43 (31)	-
Do you have a policy or guidance in place to provide O D positive red cells in an emergency to unknown adult males and females over 50 years old?	69 (49)	28 (20)	44 (31)

The proportion of hospitals who have a policy to guide O D negative red cell use in specific groups of patients does seem to have increased. In the 2010 audit, 91% indicated they had a policy to guide O D negative red cell use in adult males and females aged over 50 years with no anti-D detectable. In this survey, including those whose policy is for adult males only, this has increased to 100%. However, it seems likely that in emergency circumstances, the situation seems to be unchanged. (2010 = 27% no policy vs 2018 31% no policy).

Please note that the question wording was different between these two surveys so comparisons should be interpreted with caution.

75% of Trusts provided red cells to maternity units. There was a wide variation in the number of births in these units and this may, in turn, influence stockholding (Figure 7).

Figure 7 – Births in hospitals with maternity units

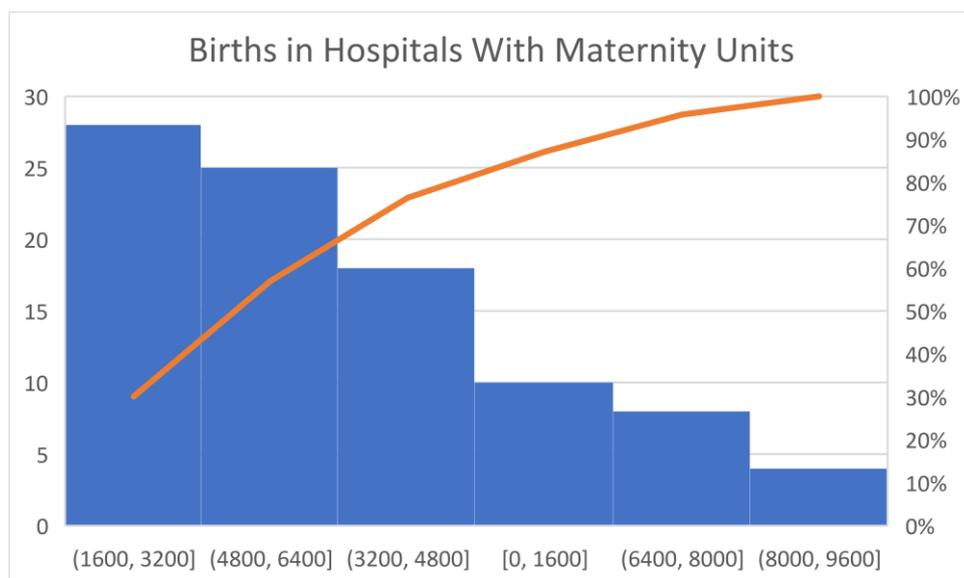


Table 13 – Provision of services to paediatric and neonatal units, and haemoglobinopathy units

Type of Provision	Yes (2018) (%)	Yes (2010) (%)
Does your laboratory provide a blood transfusion service to a hospital with an on-site paediatric/neonatal unit?	106 (76)	-
Does your laboratory provide a blood transfusion service for patients with transfusion dependent haemoglobinopathies?	72 (51)	136 (64)
Does your laboratory provide a blood transfusion service for 30 or more patients with transfusion dependent haemoglobinopathies?	10 (15)	20 (15)

Figure 8 – Number of transfusion dependent patients

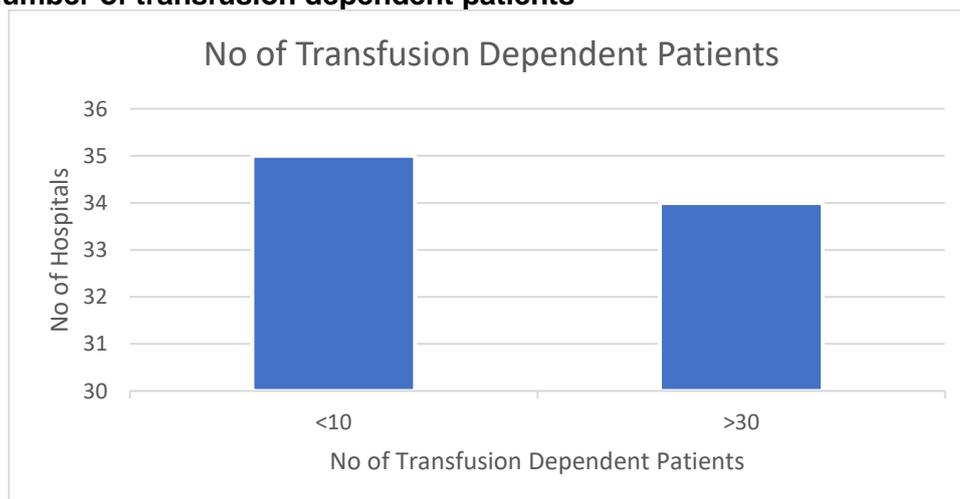


Table 14 – Distribution of O D negative blood group in hospital population (patients) by region.

With the following data we aim to support hospitals to make appropriate adjustments of stock levels taking into consideration their population (O D negative patients vs patients of all other blood groups) and activities likely to increase the need for O D negative red cells (for example maternity services, trauma centres/units, treatment of patients with haemoglobinopathies). Hospitals should regularly collect this information and make appropriate adjustments.

Reported hospital O D negative populations (%)		
RTC	2010	2018
London	5.9	5.6
North East	10	9.04
North West*	9	7.9
Yorkshire and the Humber	7.9	7.5
East of England	8.7	8.4
East Midlands	8	8
West Midlands	7.9	8
South East Coast	7.7	8
South Central	7.5	7
South West	7.9	8.1

*2010 included Wales

Part 3: Key Findings

- Number of sites where O D negative stockholding is greater than 12.5% has increased from 46% to 64% (2010 vs 2018).
- 31% of sites do not have a policy to provide O D positive red cells in an emergency to unknown females over 50 years old and unknown adult males.

Conclusions

Use of O D negative red cells has changed over the last 10 years. As a proportion, only 59% O D negative red cell units are transfused to O D negative patients. This finding is more pronounced in 'very high' and 'high' user hospitals. A regional variation was also noted. The proportion of O D negative red cells used in an emergency has increased, while a significant proportion are used as substitutions (to meet additional requirements).

A third of hospitals who participated in the audit, do not have policies to allow transfusion of O D positive red cells to O D negative adult males and females of non-childbearing potential.

Potentially avoidable transfusions

Transfusion of up to 10% of the total O D negative red cells used during the audit period could have been avoided if hospitals were able to provide O D positive red cells to adult males and women of non-childbearing potential of unknown blood group requiring blood for emergency transfusions. Transfusion of at least 5% and potentially up to 11% of O D negative red cells used during the audit period could have been avoided if Ro or O D positive blood meeting patient's special requirements were available in hospitals.

Potentially avoidable wastage

At least 5 % of units during the audit period were wasted and 12.6% were transfused to avoid wastage. These findings, correlate with hospitals size and blood usage as well as stock levels.

Recommendations:

Hospitals should review:

- Local transfusion policies and ensure they include recommendations for the use of O D positive red cells for unknown/O D negative adult male patients and female patients of non-childbearing potential in an emergency.

Hospitals should monitor:

- **Transfusion of O D negative red cells to non-O D negative patients to avoid time expiry:** A high percentage of O D negative red cells to non-O D negative individuals could indicate overstocking and stock adjustment may be required.
- **The number of days stock is held before transfusion (Issuable Stock Index - ISI):** aim for an ISI for O D negative of 3 to 4 days.
- **Use of O D negative red cells in emergencies (including (air)ambulance):** appropriate use and wastage of red cells should be audited regularly. The number of units carried in pre-hospital care boxes should be adjusted accordingly.
- **Use of O D negative red cells held in satellite fridges:** consider reducing the number of units held. O D negative red cells kept in satellite fridges must be rotated to avoid wastage.
- **Use of O D negative red cells held in remote issue fridges:** regularly review the stocks of O D negative red cells in each fridge. All stock held in remote fridges should be rotated back into stock with enough shelf life remaining to allow the units to be used appropriately before time expiry. Adequate numbers of O D positive red cells must be kept to avoid unnecessary use of O D negative as a substitution.

Hospitals should aim for:

- O D negative red cell stockholding of less than 12.5%.
- 10 to 20% of O D negative stock to be K+ to support stability of the supply chain.
- Stock sharing if possible (private hospitals, smaller NHS hospitals and between sites of the same Trust).
- O D negative wastage of less than 4%.
- Sharing of usage and wastage data at Regional Transfusion Committees (RTC).

- Provision and ordering of group specific (and if appropriate O D positive) phenotyped red cells (including those where additional specific requirements are need e.g. irradiated) where possible. Provision and ordering of group specific (and if appropriate O D positive) phenotyped red cell units (including those where additional specific requirements are need e.g. irradiated).

References

1. National Blood Transfusion Committee's audit of the use of O D negative red cells, December 2008.
<http://www.transfusionguidelines.org.uk/Index.aspx?Publication=NTC&Section=27&pageid=7544>
2. NBTC guidelines for the appropriate use of group O D negative red cells, January 2009
http://www.transfusionguidelines.org.uk/docs/pdfs/nbtc_bbt_o_neg_red_cells_recs_09_04.pdf
3. Blood Stocks Management Scheme ABO and RhD Hospital Blood Group Distribution Survey, May 2009 <http://www.bloodstocks.co.uk/pdf/ExecutiveSummary1.pdf>
4. Re-Audit of the usage of group O RhD negative red cells, 2010: Re-Audit of the usage of group O RhD negative red cells, 2010: https://www.transfusionguidelines.org/uk-transfusion-committees/regional-transfusion-committees/audits/audits/national-comparative-re-audit-of-the-use-of-group-o-rhd-negative-red-cells-sw-region-2010/download-file/rtc-sw_audit_o_neg_2010.pdf
5. The appropriate use of group O D negative red cells
<https://www.transfusionguidelines.org/document-library/documents/nbtc-appropriate-use-of-group-o-d-negative-red-cells-final-pdf>
6. O D negative red cell tool kit: <https://hospital.blood.co.uk/patient-services/patient-blood-management/o-d-negative-red-cell-toolkit/>

Appendix 1 Participating Hospitals

Addenbrooke's Hospital
Airedale General Hospital
Alder Hey Children's Hospital
Arrowe Park Hospital
Barnsley District General Hospital
Hampshire Hospitals NHS Foundation Trust
Bassetlaw District General Hospital
Bedford Hospital
Birmingham Children's Hospital
Birmingham Heartlands Hospital
Blackpool Victoria Hospital
BMI Blackheath Hospital
BMI Ealing
BMI London Independent Hospital
BMI The Priory Hospital, Birmingham
Bradford Royal Infirmary
Bristol Royal Infirmary
Broomfield Hospital
BUPA Cromwell Hospital
Burnley General Hospital
Calderdale Royal Hospital
Central Manchester Foundation Trust CMFT
Central Middlesex Hospital
Charing Cross Hospital
Chaucer Hospital
Chelsea and Westminster Hospital
Cheltenham General Hospital
Chesterfield and North Derbyshire Royal Hospital
Churchill Hospital Oxford
City Hospital Campus Nottingham University Hospital
City Hospital, Birmingham
Conquest Hospital
Countess of Chester Hospital
Cumberland Infirmary, Carlisle
Darwent Valley Hospital
Darlington Memorial Hospital
Derriford Hospital
Dewsbury and District Hospital
Diana Princess of Wales Hospital, Grimsby
Doncaster Royal Infirmary
Dorset County Hospital NHS Foundation Trust
Ealing Hospital
East Surrey Hospital
Eastbourne Hospital
Epsom Hospital
Fairfield General Hospital



Freeman Hospital, Newcastle
Frimley Park Hospital
Furness General Hospital
Gloucester Royal Hospital
Good Hope Hospital, Birmingham
Grantham and District Hospital
Great Ormond Street Hospital for Children
Great Western Hospital, Swindon
Guy's Hospital
Halton General Hospital
Hammersmith Hospital
Harrogate District Hospital
HCA Laboratories
Hillingdon Hospital
Hinchingsbrooke Hospital
Homerton Hospital
Horton Hospital, Banbury
Huddersfield Royal Infirmary
Hull Royal Infirmary
Ipswich Hospital
James Cook University Hospital, Middlesbrough
James Paget Hospital
Kent and Canterbury Hospital
Kettering General Hospital
King George Hospital
Kings College Hospital
Kings Mill Hospital, Mansfield
Leeds General Infirmary
Leighton Hospital
Lewisham Hospital
Lincoln County Hospital
Lister Hospital, Stevenage
Luton and Dunstable Hospital
Maidstone Hospital
Medway Hospital
Milton Keynes Hospital NHS Foundation Trust
Musgrove Park Hospital
New Cross Hospital, Wolverhampton
Norfolk and Norwich University Hospital
North Devon District Hospital, Barnstaple
North Manchester General Hospital
North Middlesex Hospital
Northampton General Hospital
Northern General Hospital
Northumbria Specialist Emergency Care Hospital
Northwick Park Hospital
Nuffield Health Leeds Hospital
Nuffield Health The Manor Hospital Oxford Hospital
Ormskirk and District General Hospital
Peterborough City Hospital



Pinderfields Hospital
Poole Hospital NHS Foundation Trust
Princess Alexandra Hospital, Harlow
Princess Royal Haywards Heath Hospital
QEQM Margate Hospital
Queen Alexandra Hospital, Portsmouth
Queen Elizabeth Hospital, Gateshead
Queen Elizabeth Hospital, Kings Lynn
Queen Elizabeth Woolwich Hospital
Queens Hospital Romford
Queens Hospital, Burton
Queen's Medical Centre Campus, Nottingham University Hospital
Ramsay Priory Hospital
Rivers Hospital
Rotherham District General Hospital
Royal Albert Edward Infirmary, Wigan
Royal Blackburn Hospital
Royal Bolton Hospital NHS Foundation Trust
Royal Cornwall Hospital, Truro
Royal Derby Hospital
Royal Free Hospital
Royal Hallamshire Hospital
Royal Hampshire County Hospital, Winchester
Royal Lancaster Infirmary
Royal London Hospital
Royal Marsden Hospital, Fulham
Royal Marsden Hospital, Sutton
Royal Oldham Hospital
Royal Preston Hospital
Royal Shrewsbury Hospital
Royal Stoke University Hospital
Royal Sussex County Hospital, Brighton
Royal Victoria Infirmary, Newcastle
Russell's Hall Hospital
Salisbury Hospital NHS Foundation Trust
Sandwell District General Hospital, Birmingham
Scarborough Hospital
Scunthorpe General Hospital
Sheffield Children's Hospital
Solihull Hospital
South Tyneside District Hospital
Southampton General Hospital



Appendix 2 – Other “Fate” Reasons

Other Reasons Given for "Fate" of O D Negative Unit
Air Ambulance
Bag punctured on ward
Blood recycling with Airedale
Burst on arrival
Canulae issued
Time expiry - Crossmatched for cover on three different patients before expiry
Damaged on ward
DAT positive unit
Out of temperature control - Did not pass cold chain on return to stock
Flying squad units
Out of temperature control Fridge failure
Time expiry - Issued as emergency O neg 'flying squad' units. Never allocated to any patient.
Issued as part of trial. Box opened, therefore unable to confirm validity of unit
Likely to be returned to stock. Currently in quarantine in Addenbrookes - awaiting temperature chart
Major Haemorrhage call.
Medically ordered not used
No pilot tube left - unable to electronic issue at present
O-, IRR needed for Op cover, unused so given to another Pt needing IRR
Part of RePhill trial
Patient died
Patients own ABO group not available - no special requirements
Removed for use in massive but left out of temperature control
Sent to private hospital as a flying squad unit, private hospital wasted unit out of temp control
SLA agreement with local NHS trust, blood units attempted to swap when nearing expiry to min. wastage
Time expiry - Stock - Time Expired
Temperature excursion of satellite fridge holding flying squad unit
Transferred to other hospital with patient and wasted at the other hospital
Transfused to B neg pt as no stock B neg
Unit issued as part of trial. One unit used and as box opened, the other unit had to be discarded
Unit opened on ward and then not transfused
Unit transfused as patient required an urgent operation, 3 units were requested but we only keep 2
Used by HEMS team
Used for satellite fridge 'emergency O negs'
Out of temperature control Wasted at other hospital as out of temperature control
Wasted by ward
Wasted out of Lab
Time expiry - X-matched for O Pos patient but not used before expiry