National Survey Red Cell Use

NHS Blood and Transplant

Anonymous

INTRODUCTION

Rationale for study

This study was undertaken to:

- Identify the clinical scenarios in which red cells are currently, in order that Patient Blood Management initiatives can be directed appropriately
- Understand the continued decline in red cell usage
- Assist hospitals, and NHS Blood and Transplant (NHSBT), in planning future demand for red cells.

Previous studies

The "Where does blood go?" (WDBG) study (ref 1) performed in the North of England in 1999-2000 showed for the first time that, for the study population, medical use was higher than surgical use. Since then, several UK-wide and international studies have shown similar results. The WDBG study itself has been repeated in the same North of England geographical area in 2004 and 2009 and has shown an absolute fall in red cell use per head of population, in line with national and international trends. In that study population, surgical use fell more rapidly than medical use.

METHODOLOGY

Data collection

All sites supplied with blood components by NHSBT were invited to take part. Participating sites provided data on every red cell unit transfused between 00:01 on Monday 24th February and 24:00 on Sunday 2nd March, 2014 (cycle 1) and between 00:01 on Monday 12th May and 24:00 on Sunday 18th May 2014 (cycle 2). Data were entered online using Lightmaker or entered into a spreadsheet.

The data collection form, based on the original fifty-two categories used in the 1999-2000 WDBG study has now been expanded. For example, congenital anaemia is subdivided to include thalassaemia and sickle cell disease. A new category of extra-corporeal membrane oxygenation (ECMO) has been added. A copy of the revised form is provided in the **Appendix.**

The focus of this survey was to determine the total number of red cells used for each indication, irrespective of the number of patients transfused, so hospitals were asked to report red cell usage for each transfusion episode. Consequently, it is not possible to determine the number of patients transfused, the number of transfusions given, or the number of units per transfusion.

Analysis

National results are presented in this report as percentages for categorical data and as medians and interquartile ranges (IQR) for numerical data.

To facilitate benchmarking, individual site results are shown alongside the national results. Some of the site results are based on small numbers of transfusions and sites need to take this into account when interpreting their own results. Histograms for the national data and data at your site may not be drawn on the same scale so care must be taken when comparing your site with the national data.

For each data entry, the patient's year of birth was reported and the patient's age, in years, was estimated as the difference between the year of the data collection (2014) and their year of birth. The median age of patients transfused was calculated as a median age across all data entries so the ages of patients whose data were reported over more than one data entry are included multiple times.

Across both cycles the transfusion indications for 3,278 data entries (representing 6,912 red cell units) were provided as an 'Other' sub-category within a specialty with supplementary free text. The free text was reviewed by a clinician and assigned to the specialties and their sub-categories named on the questionnaire where possible. Of these entries, the reviewer was able to assign 1,370 (2,753 red cell units) to a named sub-category and the remaining 1,908 entries (4,159 red cell units) remained under the appropriate 'Other' sub-category for the speciality.

Unless otherwise stated, all information presented is for both cycles combined. Data were analysed using SAS Enterprise Guide version 5.1, SAS institute Inc., Cary, NC, USA.

RESULTS

This survey collected data on 73% and 75% of all red cells issued by NHSBT during the respective weeks of study, (based on NHSBT issue figures and Blood Stocks Management Scheme (BSMS) wastage rates). Some sites only provided data for one cycle.

A total of 46,111 units of red cells were reported across both cycles and data completeness was good although in some cases not all the information requested was provided. Gender was missing for 201 red cell units, the patient's age was missing for 90 units, the specialty (and sub-category) was missing for 20 units, and just the sub-category was missing for a further 5 units.

NUMBERS: National and your site

The total number of red cell units transfused nationally and at Anonymous for each cycle is given in **Table 1.** The specialty where the red cell units were used is given in **Table 2.** Nationally, there is little difference between the two cycles in the distributions of red cell units across the specialties.

Table 1 Number of red cell units transfused, by cycle

	National	Anonymous
Cycle 1	21683	452
Cycle 2	24428	405
Total Units	**46111**	**857**

Table 2 Number (%) of red cell units transfused, by cycle and specialty

Specialty	National				Anonymous			
	Cycle 1		Cycle 2		Cycle 1		Cycle 2	
	N	%	N	%	N	%	N	%
Cardiothoracic Surgery	1352	(6.2)	1404	(5.7)	12	(2.7)	9	(2.2)
ENT	98	(0.5)	96	(0.4)	.	.	1	(0.2)
Gastrointestinal Surgery	839	(3.9)	925	(3.8)	9	(2.0)	12	(3.0)
Neurosurgery including head injury	126	(0.6)	153	(0.6)	12	(2.7)	7	(1.7)
Trauma	1046	(4.8)	1147	(4.7)	22	(4.9)	26	(6.4)
Urology	454	(2.1)	488	(2.0)	11	(2.4)	.	.
Solid Organ Transplant	220	(1.0)	266	(1.1)	9	(2.0)	5	(1.2)
Vascular Surgery	533	(2.5)	558	(2.3)	24	(5.3)	4	(1.0)
Orthopaedics	975	(4.5)	836	(3.4)	47	(10.4)	25	(6.2)
Plastic Surgery	103	(0.5)	104	(0.4)	9	(2.0)	2	(0.5)
Other Surgery	245	(1.1)	350	(1.4)	2	(0.4)	5	(1.2)
Obs & Gynae	1294	(6.0)	1396	(5.7)	19	(4.2)	6	(1.5)
Neonatal/Fetal	247	(1.1)	307	(1.3)	8	(1.8)	2	(0.5)
GI Bleed	2769	(12.8)	2608	(10.7)	60	(13.3)	34	(8.4)
Non-haematological anaemia	5607	(25.9)	7029	(28.8)	89	(19.7)	157	(38.8)
Haematological	5769	(26.6)	6747	(27.6)	119	(26.3)	110	(27.2)
Not reported	6	(0.0)	14	(0.1)	.	.	.	.
TOTAL units	**21683**	**(100.0)**	**24428**	**(100.0)**	**452**	**(100.0)**	**405**	**(100.0)**

AGE AND GENDER: National and your site

The median age of patients transfused averaged across all data entries is summarised nationally and for Anonymous in **Table 3.** Also included in this table is the number and percentage of red cell units transfused to male and female patients.

Table 3 Demographic summary

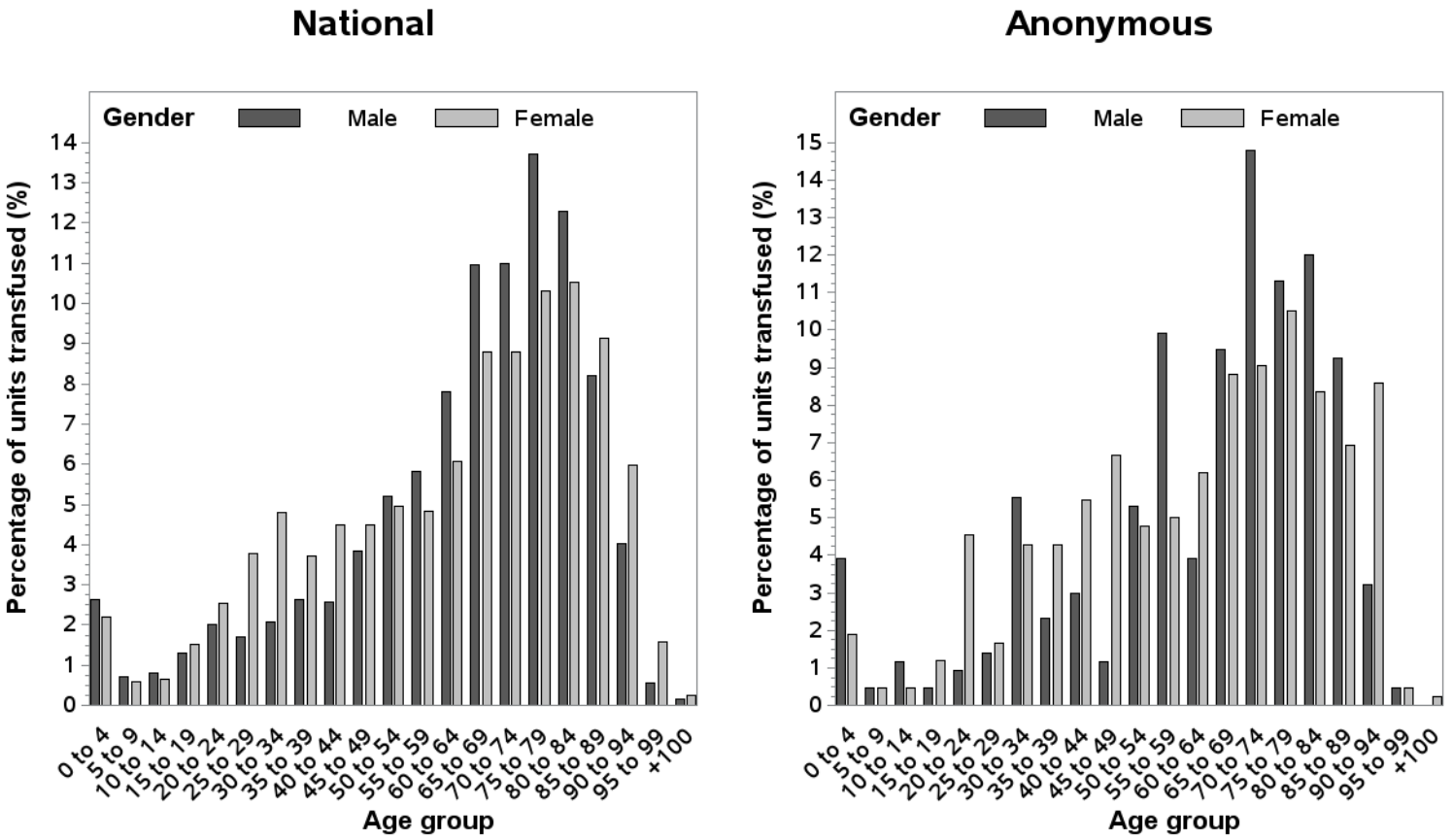
	National	Anonymous
Median age*, in years (IQR)	69 (51-80)	68 (48-80)
Number (%) of units transfused to:		
Males	23938 (51.9%)	435 (50.8%)
Females	21972 (47.7%)	422 (49.2%)
Gender not specified	201 (0.4%)	.
Total	**46111 (100.0%)**	**857 (100.0%)**

* Estimated as 2014 minus year of birth

The distribution of red cell units transfused to males and to females, by age group, is given nationally and for Anonymous in **Figure 1.**

As in previous national and international surveys, there is initially high use in the age group 0 to 4, which further examination of the data shows is due to transfusions to infants/neonates under one year of age. Usage is low in children under 18, then gradually rises, with an increase in usage for females of childbearing age compared with males of the same age. Usage then rises in older age groups until it declines from around 80 to 90 years.

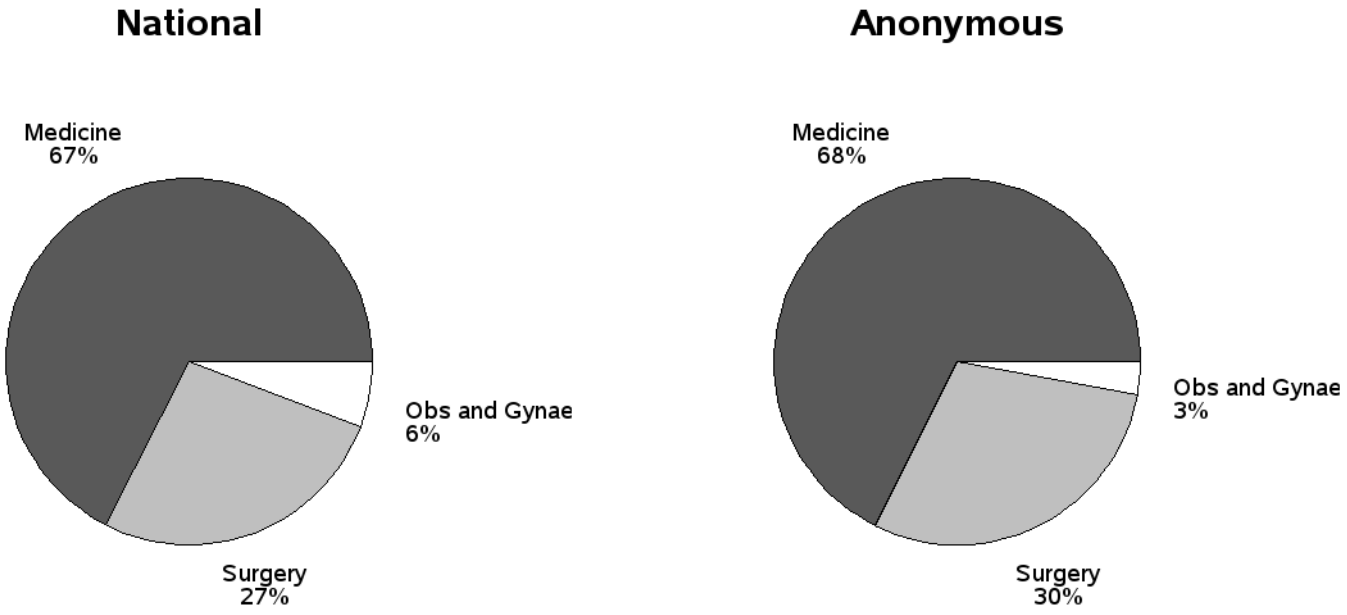
Figure 1 Red cell units transfused by age group and gender, nationally and for your site



USAGE BY BROAD CATEGORY: National and your site

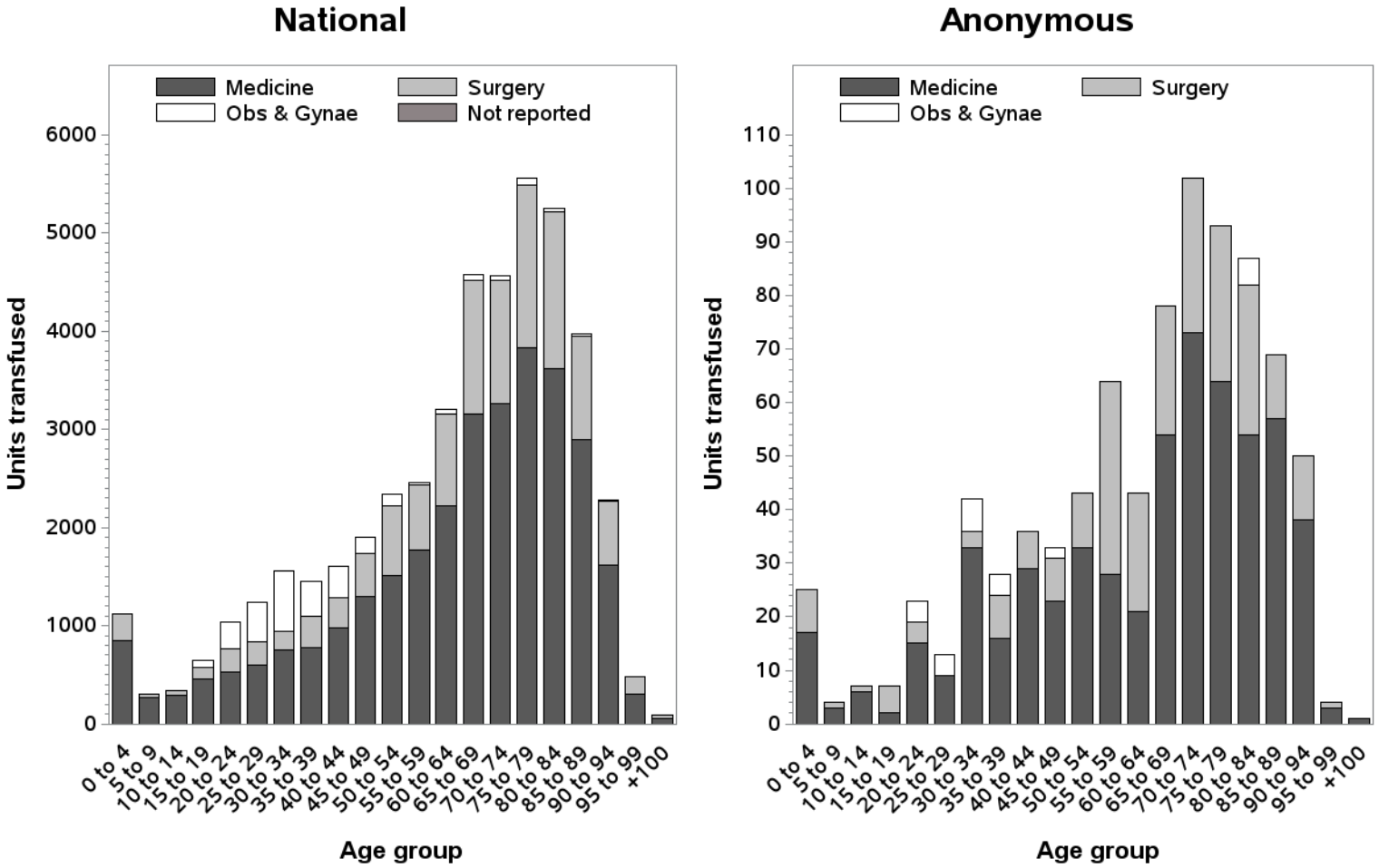
The specialty where the red cell units were used was categorised into three broad groups: Medical, Surgical, and Obstetrics and Gynaecology. The percentage of units that were used in each broad group is shown in **Figure 2.** Nationally the broad group was unspecified for 20 (0.04%) red cell units and none at Anonymous.

Figure 2 Broad group of indications for red cells transfused



The numbers of red cell units transfused for each broad group is shown in **Figure 3** by age group.

Figure 3 Broad group of indications for red cells transfused, by age group



Nationally, the pattern of high initial use in the 0 to 4 age group, low usage in children under 18, increasing use through the older age groups and a decline from the 80 to 90 age groups is reflected in the medicine and the surgery broad groups.

MEDICAL USAGE: National and your site

The number of red cell units used for a medical indication nationally and at Anonymous is given in **Table 4.** Liver disease was not initially identified as a non-haematological anaemia category although it often appeared in the free text under the Other anaemia sub-category. Nationally this accounted for 242 units used (0.5% of all units used nationally) and 1 (0.1%) at Anonymous. These could be an under-estimate as liver disease was not specifically mentioned on the data collection form. It is likely that liver disease will also account for cases of upper gastrointestinal haemorrhage.

Table 4 Number of red cell units transfused for a medical indication

		National		Your site	
Medicine specialty	**Sub-category**	**N**	**%**	**N**	**%**
Neonatal/fetal	Top up	479	(1.0)	5	(0.6)
	Exchange	9	(0.0)	2	(0.2)
	Large volume transfusion	24	(0.1)	.	.
	Intrauterine transfusion	2	(0.0)	.	.
	Other neonatal	40	(0.1)	3	(0.4)
	Total neonatal	**554**	**(1.2)**	**10**	**(1.2)**
GI bleed	Upper acute	2195	(4.8)	35	(4.1)
	Lower acute	1237	(2.7)	18	(2.1)
	Upper chronic	337	(0.7)	3	(0.4)
	Lower chronic	537	(1.2)	23	(2.7)
	Site of bleeding unknown	1071	(2.3)	15	(1.8)
	Total GI bleed	**5377**	**(11.7)**	**94**	**(11.0)**
Non-haematological anaemia	Renal failure	2257	(4.9)	52	(6.1)
	Cancer non haem	4549	(9.9)	72	(8.4)
	Iron deficiency	1260	(2.7)	4	(0.5)
	B12/folate def	104	(0.2)	2	(0.2)
	Chronic disorders	1319	(2.9)	72	(8.4)
	Critical care	1663	(3.6)	43	(5.0)
	Other anaemia	1484	(3.2)	1	(0.1)
	Total non-haematological anaemia	**12636**	**(27.4)**	**246**	**(28.7)**
Haematological	MDS	2890	(6.3)	48	(5.6)
	AML including APML	1983	(4.3)	40	(4.7)
	ALL	537	(1.2)	12	(1.4)
	Myeloma	1083	(2.3)	24	(2.8)
	Hodgkins/NHL/CLL	1876	(4.1)	58	(6.8)
	Acquired Haemolytic Anaemia	238	(0.5)	4	(0.5)
	Thalassaemia	722	(1.6)	12	(1.4)
	Sickle cell disease	1350	(2.9)	12	(1.4)
	Other inherited anaemia	202	(0.4)	2	(0.2)
	Myeloprolerative disease	575	(1.2)	11	(1.3)
	CML	218	(0.5)	1	(0.1)
	Aplastic anaemia	323	(0.7)	2	(0.2)
	Other haematological	519	(1.1)	3	(0.4)
	Total haematological	**12516**	**(27.1)**	**229**	**(26.7)**
TOTAL Medicine (%)		**31083**	**(67.4)**	**579**	**(67.6)**

% Percentage of 46111 units nationally and 857 units at Anonymous

The highest-using medical categories are: non-haematological cancer, 9.9%, and myelodysplasia, 6.3%. Renal failure, acute upper GI bleed and acute myeloid leukaemia are also high users within the broad category of medicine, at 4.9%, 4.8% and 4.3%, respectively. Medical anaemia, excluding haematological indications, accounted for 40.7% of all medical use, not very different than haematological use, 40.3%. Sickle cell disease is now amongst the top ten indications for using red cells within medicine, at 4.3% of medical use, 2.9% of total use.

SURGICAL USAGE: National and your site

The number of red cell units used for a surgical indication nationally and at Anonymous is given in **Table 5.**

Table 5 Number of red cell units transfused for a surgical indication

		National		Your site	
Surgery specialty	**Sub-category**	**N**	**%**	**N**	**%**
Cardiothoracic surgery	CABG First	678	(1.5)	9	(1.1)
	CABG Redo	124	(0.3)	8	(0.9)
	Valve replacement +/- CABG	803	(1.7)	2	(0.2)
	ECMO	318	(0.7)	.	.
	Congenital Heart Disease	272	(0.6)	.	.
	Other cardiothoracic surgery	561	(1.2)	2	(0.2)
	Total cardiothoracic surgery	**2756**	**(6.0)**	**21**	**(2.5)**
ENT	**Total ENT**	**194**	**(0.4)**	**1**	**(0.1)**
Gastrointestinal surgery	Oesophageal	71	(0.2)	.	.
	Gastric	331	(0.7)	6	(0.7)
	Pancreatic	164	(0.4)	1	(0.1)
	Colorectal	816	(1.8)	9	(1.1)
	Liver	199	(0.4)	5	(0.6)
	Other gastrointestinal surgery	183	(0.4)	.	.
	Total gastrointestinal surgery	**1764**	**(3.8)**	**21**	**(2.5)**
Neurosurgery including head injury	**Total neurosurgery**	**279**	**(0.6)**	**19**	**(2.2)**
Trauma	Blunt	225	(0.5)	16	(1.9)
	Penetrating	54	(0.1)	2	(0.2)
	Fractured femur	1297	(2.8)	17	(2.0)
	Fractured pelvis	108	(0.2)	3	(0.4)
	Other fracture	257	(0.6)	.	.
	Other trauma	252	(0.5)	10	(1.2)
	Total trauma	**2193**	**(4.8)**	**48**	**(5.6)**
Urology	**Total urology**	**942**	**(2.0)**	**11**	**(1.3)**
Solid organ transplant	**Total solid organ transplant**	**486**	**(1.1)**	**14**	**(1.6)**
Vascular surgery	Emergency AAA repair	379	(0.8)	24	(2.8)
	Elective open AAA repair	222	(0.5)	4	(0.5)
	Other vascular surgery	490	(1.1)	.	.
	Total vascular surgery	**1091**	**(2.4)**	**28**	**(3.3)**
Orthopaedics	THR first	751	(1.6)	28	(3.3)
	THR redo	291	(0.6)	20	(2.3)
	TKR first	261	(0.6)	4	(0.5)
	TKR redo	76	(0.2)	4	(0.5)
	Other orthopaedics	432	(0.9)	16	(1.9)
	Total orthopaedics	**1811**	**(3.9)**	**72**	**(8.4)**
Plastic surgery	Maxillo Facial	56	(0.1)	4	(0.5)
	Other including burns	151	(0.3)	7	(0.8)
	Total plastic surgery	**207**	**(0.4)**	**11**	**(1.3)**
Other surgery	**Total other Surgery**	**595**	**(1.3)**	**7**	**(0.8)**
TOTAL Surgery (%)		**12318**	**(26.7)**	**253**	**(29.5)**

% Percentage of 46111 units nationally and 857 units at Anonymous

Amputation was not identified separately as a surgical indication however it arose frequently in the free text associated with the trauma, vascular surgery and orthopaedics specialties. Nationally this accounted for 175 units (0.4% of all units used) and 8 (0.9%) at Anonymous. These could be under-estimates as amputation was not specifically mentioned on the data collection form.

The highest surgical user is cardiac surgery at 6.0% of total usage. The second highest user is trauma, at 4.8%, of which the most common indication was fractured femur. Transfusion associated with planned orthopaedic procedures accounts for 3.9% of usage, with first hip replacement being the most common indication. Gastrointestinal surgery accounts for 3.8% of total usage, of which colorectal surgery is the most common indication.

OBSTETRICS AND GYNAECOLOGY USAGE: National and your site

The number of red cell units used for an obstetrics and gynaecology indication is given in **Table 6** nationally and at Anonymous. Nationally one data entry reported the use of 74 units of red cells for an obstetric haemorrhage and it has not been possible to verify or disprove this.

Table 6 Number of red cell units transfused for obstetrics and gynaecology

	National		Your site	
Obs and Gynae specialty	**N**	**%**	**N**	**%**
Gynae non malignant	819	(1.8)	9	(1.1)
Gynae oncology	259	(0.6)	.	.
Obstetric anaemia	308	(0.7)	4	(0.5)
Obstetric haemorrhage	1299	(2.8)	11	(1.3)
Not reported	5	(0.0)	1	(0.1)
TOTAL Obs & Gynae (%)	**2690**	**(5.8)**	**25**	**(2.9)**

% Percentage of 46111 units nationally and 857 units at Anonymous

The most common indication for transfusion is obstetric haemorrhage (2.8% of all units, 48% of units used for obstetric/gynae indications).

DISCUSSION

Results of the current study

This latest survey indicates that the red cell transfusion rate per head of population has fallen to 31.5 units per 1000 population, compared with 43 per 1000 in 1999-2000.

Medical usage now accounts for 67.4% of red cell units used. Sickle cell disease is now amongst the top ten indications for using red cells within medicine, at 4.3% of medical usage and 2.9% total usage. Gastrointestinal (GI) bleeding accounts for 11.7% of total usage, similar to 1999-2000. This will undoubtedly be the focus of patient blood management initiatives in the future, as there is evidence for the benefits of restrictive transfusion practice in non-major GI bleeding (ref 2).

Cardiac surgery is the highest surgical user at 6.0% of all units used nationally. In the original North of England study, cardiac surgery also accounted for 6% of all red cell use, but the total number of units has now has fallen in real terms. Transfusion associated with planned orthopaedic procedures, which accounted for 14% of all red cell use in the North of England in 1999/2000, now accounts for 3.9% of usage in the national survey. A number of initiatives towards appropriate usage, including the use of haemostatic agents, implementation of cell salvage, and more restrictive transfusion practices, will have contributed to this impressive reduction.

Obstetric and gynaecological use has remained stable at around 6% of all red cell usage in the three northern studies and this current survey. The use of tranexamic acid is being assessed in obstetric haemorrhage and other patient blood management initiatives, including restrictive transfusion practice and the use of cell salvage, have the potential to reduce obstetric transfusion rates.

How this information can be used

Demand planning

Data on trends in usage assist NHSBT and other blood services to plan future collection strategy. As an example, the 2009 study of red cell usage in the North of England showed that the fall in units transfused between 1999-2000 and 2009 was largely due to a reduction in transfusion for elective surgical cases. Sites that have contributed to this study may be able to extrapolate from national figures to determine how their red cell use may change in the future.

Whilst a reduction in red cell transfusions can be predicted for most clinical categories, there is one clinical area in which usage may increase, both as a percentage and in real terms. Sickle cell anaemia is now a major indication for red cell use, and usage may increase, as a result of the recent study indicating that regular transfusions can reduce the risk of silent cerebral infarcts in children. It is difficult to predict how red cell use in trauma, which currently accounts for 4.8% of use, may alter in the future. Initiatives, such as “blood on board” (helicopters) and better recognition of massive haemorrhage may lead to a rise, but this may be balanced by optimum use of plasma components and haemostatic agents.

Patient blood management initiatives

In addition to the measures that have resulted in a fall in red cell use in elective surgery, it is likely that patient blood management measures such as pre-operative haemoglobin optimisation will have a further effect.

Attention is now also being drawn to medical anaemia, where it has been estimated that 10-20% of transfusions are inappropriate (ref 3). The optimum transfusion strategy for chronic bone marrow failure syndromes is not yet known. This survey has demonstrated that 2.7% of units nationally were given to patients with iron deficiency, clearly a treatable anaemia. Other anaemias of unknown cause identified in our survey may respond to appropriate treatment.

Ease of data collection

Collection of the data was a major undertaking for participating sites, particularly larger sites that could be recording data on over five hundred transfusions in a week. Some sites were able to generate data via electronic requesting. Forthcoming BCSH guidelines on the use of IT in transfusion departments are likely to stress the importance of collecting coded information on the clinical requirements for transfusion and it is likely that future studies would employ such methods.

Quality of the data

This study had the advantage of being prospective; data input being by members of hospital transfusion teams, rather than being dependent on retrospective completion by coding staff. Nevertheless, those tasked with entering the data had to rely on the quality of information provided, so that a small number of units (20, 0.04 %) could not have clinical usage assigned. Data collection was undertaken over two separate weeks, and the similarity of results suggests that this survey of the fate of 46,500 units reflects transfusion practice in participating sites.

ACKNOWLEDGEMENTS

We wish to thank all those who have participated in this National Survey. We recognise that many people have given up their valuable time and that this will inevitably have been on top of a heavy workload. This survey would clearly not have been possible without your support. We are equally grateful to many colleagues for their valuable and constructive comments.

REFERENCES

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2. Villanova C, Colomo A, Bosch A, Concepcion M, Hernandez-gea et al (2013) Transfusion strategies for acute upper gastrointestinal bleeding NEJM, **368,** 11-21

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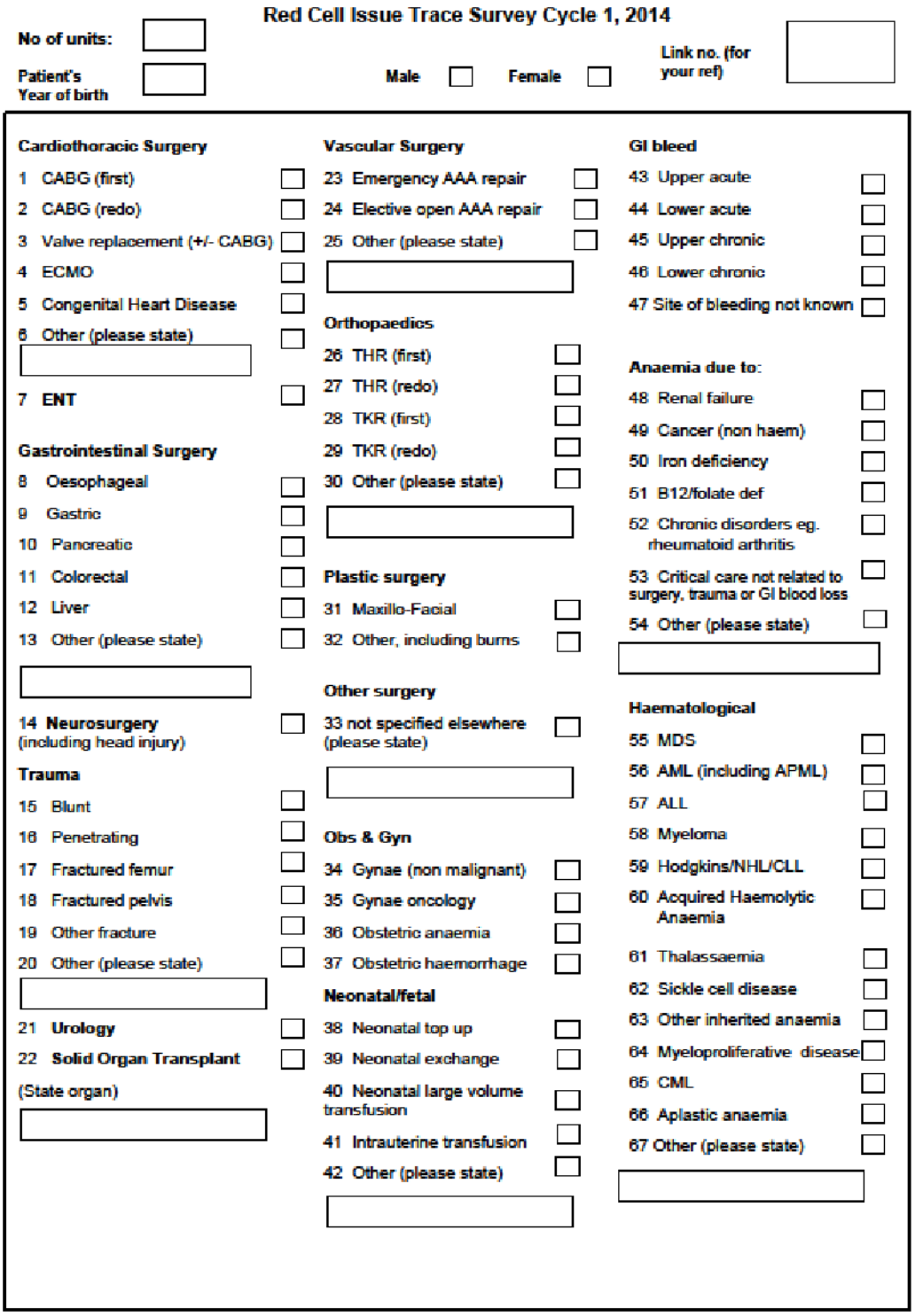
APPENDIX



Red Cell Issue Trace Survey Cycle 1, 2014

No of units: ☐

Patient's Year of birth ☐

Male ☐ **Female** ☐

Link no. (for your ref) ☐

Cardiothoracic Surgery
1 CABG (first) ☐
2 CABG (redo) ☐
3 Valve replacement (+/- CABG) ☐
4 ECMO ☐
5 Congenital Heart Disease ☐
6 Other (please state) ☐
☐
7 **ENT** ☐

Gastrointestinal Surgery
8 Oesophageal ☐
9 Gastric ☐
10 Pancreatic ☐
11 Colorectal ☐
12 Liver ☐
13 Other (please state) ☐
☐
14 **Neurosurgery** (including head injury) ☐

Trauma
15 Blunt ☐
16 Penetrating ☐
17 Fractured femur ☐
18 Fractured pelvis ☐
19 Other fracture ☐
20 Other (please state) ☐
☐
21 **Urology** ☐
22 **Solid Organ Transplant** ☐
(State organ)
☐

Vascular Surgery
23 Emergency AAA repair ☐
24 Elective open AAA repair ☐
25 Other (please state) ☐
☐

Orthopaedics
26 THR (first) ☐
27 THR (redo) ☐
28 TKR (first) ☐
29 TKR (redo) ☐
30 Other (please state) ☐
☐

Plastic surgery
31 Maxillo-Facial ☐
32 Other, including burns ☐

Other surgery
33 not specified elsewhere (please state) ☐
☐

Obs & Gyn
34 Gynae (non malignant) ☐
35 Gynae oncology ☐
36 Obstetric anaemia ☐
37 Obstetric haemorrhage ☐

Neonatal/fetal
38 Neonatal top up ☐
39 Neonatal exchange ☐
40 Neonatal large volume transfusion ☐
41 Intrauterine transfusion ☐
42 Other (please state) ☐
☐

GI bleed
43 Upper acute ☐
44 Lower acute ☐
45 Upper chronic ☐
46 Lower chronic ☐
47 Site of bleeding not known ☐

Anaemia due to:
48 Renal failure ☐
49 Cancer (non haem) ☐
50 Iron deficiency ☐
51 B12/folate def ☐
52 Chronic disorders eg. rheumatoid arthritis ☐
53 Critical care not related to surgery, trauma or GI blood loss ☐
54 Other (please state) ☐
☐

Haematological
55 MDS ☐
56 AML (including APML) ☐
57 ALL ☐
58 Myeloma ☐
59 Hodgkins/NHL/CLL ☐
60 Acquired Haemolytic Anaemia ☐
61 Thalassaemia ☐
62 Sickle cell disease ☐
63 Other inherited anaemia ☐
64 Myeloproliferative disease ☐
65 CML ☐
66 Aplastic anaemia ☐
67 Other (please state) ☐
☐