



**National Comparative Audit
Of Blood Transfusion**

NHS
Blood and Transplant



National Comparative Audit of Blood Transfusion

**2011 Audit of Use of Blood in Adult Medical
Patients – Part Two**

July 2013

ACKNOWLEDGEMENTS

We wish to thank all those who have participated in the 2011 Audit of Use of Blood in Adult Medical Patients. We recognise that those giving up their valuable time have been many and that this will inevitably have been on top of a heavy workload. This audit would clearly not be possible without their support. We are equally grateful to many colleagues for their valuable and constructive comments.

HOSPITALS THAT AGREED TO PILOT PART ONE OF THE AUDIT

Doncaster & Bassetlaw Hospitals NHS Foundation Trust, Hull Royal Infirmary, James Paget University Hospital, Kettering General Hospital, Manchester Royal Infirmary, Northampton General Hospital NHS Trust, North Bristol NHS Trust, Taunton & Somerset NHS Foundation Trust, The Ipswich Hospital NHS Trust, The John Radcliffe Hospital, The Rotherham NHS Foundation Trust, The Royal Berkshire NHS Foundation Trust, The Royal Free Hampstead NHS Trust, Torbay Hospital, University Hospitals of Leicester NHS Trust, Wythenshawe Hospital & Ysbyty Glan Clywd.

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FOREWORD

In 2011/12 the Royal College of Physicians collaborated with NHS Blood and Transplant to produce the largest ever study within the UK of how physicians use red blood cells when managing patients. Apart from collecting information on the characteristics of patients receiving red cell transfusion and the investigations that informed management, the audit went further by engaging physicians in a review of a sample of patients who were transfused, challenging the transfusion decision.

This report sets out the findings of Part One of the audit, which was distributed to hospitals earlier this year, and describes in detail what happened when nearly 1600 cases were reviewed by hospital physicians. The results should make us pause for thought.

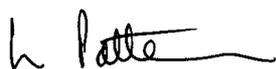
747 patients who had a potentially reversible cause of anaemia were reviewed and physicians agreed with the auditors that for 187 of those patients, transfusion could have been avoided if the anaemia had been managed differently.

The Steering Group who designed the audit used national guidelines when deciding what could be termed as an inappropriate transfusion. They decided, by consensus, to set transfusion thresholds, and for 808 patients reviewed, physicians agreed that 220 of them were probably inappropriately transfused. Overtransfusion was also explored, defined as transfusing to a haemoglobin level of 20g/L above the transfusion thresholds set by the Steering Group. The audit found there is a significant correlation between body weights and haemoglobin increments, raising the possibility that low-weight patients are being transfused too many red cells.

NHS Blood and Transplant sets out in the Action Plan ten initiatives it intends to promote in an attempt to improve physicians' use of blood, and the Royal College of Physicians will be pleased to support these in whatever way it can.

But the Blood Service and this College can only go so far: it is up to each physician to ensure that anaemia is thoroughly investigated in a timely fashion, that alternatives to transfusion are explored, and that red blood cells are only used when clinically appropriate and only in the quantity necessary to restore health.

Blood is a scarce and costly resource which carries risks when transfused. There is growing evidence that a more restrictive approach to transfusion is neutral or beneficial compared to a liberal approach in many clinical circumstances, and the audit demonstrates that a restrictive approach is not currently applied to the majority of medical patients. Improving the way physicians use blood will not only make the best use of that resource, but will also help to ensure that transfusions help to save and improve patients' lives.



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EXECUTIVE SUMMARY

Introduction

Part One of this audit analysed data from 9126 medical patients who were transfused to assess the appropriateness of red cell transfusion in medical patients in the UK. The data indicated that 4818 patients (53%) had a transfusion outside the standards set. Of the patients who received potentially avoidable transfusions:-

- 20% had anaemia possibly treatable by means other than red cell transfusion
- 29% were transfused above the threshold set according to diagnosis, age and comorbidities
- 33% were transfused to more than 20g/L above the agreed audit standard threshold

Aims

The aims of Part Two of the audit were to review the information from the case records in a random selection of patients identified in Part One of the audit as having potentially avoidable transfusion. This was to better understand the factors influencing decision making about transfusion and to assess whether the transfusion was appropriate.

The specific aims were to review information about:-

- Anaemia recognition, investigation and management in patients with potentially reversible anaemia in the 6 months leading up to the audited transfusion episode
- The documented reason for transfusion including symptoms and signs of anaemia in patients transfused above the threshold set by the audit steering group
- Body weight in patients transfused to more than 20g/L above threshold.

An additional aim of the audit is to inform and update the existing guidance for physicians on the use of red cell transfusion in medical patients and provide tools for the better investigation and management of patients with anaemia.

Methods

3138 patients were randomly selected from the 4818 medical patients who received a red cell transfusion outside the standards set for Part One, up to a maximum of 20 per hospital. The audit tools were sent to the audit lead in each hospital in May 2012 with instructions to ask the nominated Foundation Doctor / primary auditor to identify the patients and retrieve the case notes in order to collect the additional information required, and each Foundation Doctor / primary auditor was asked to discuss the anonymised patients with the consultant supervisor in order to conclude whether the transfusion could have been avoided or whether the transfusion was appropriate.

Results

The Part Two audit was completed on 1592 of the 3138 cases identified (51%).

Possible reversible anaemia

There were 747 patients with possible reversible anaemia in Part Two. Of these, 527 (71%) had a documented reason for transfusion in the case notes. The consultant auditors concluded that transfusion could have been avoided in 187 (25%) of the patients transfused. Of these patients who received avoidable transfusion, 18% were not investigated to determine the cause of the anaemia and in 60% the anaemia was not adequately treated. Of the 552 patients with possible iron deficiency, 372 were documented as having definite iron deficiency. Of the 372, only 73% were prescribed iron therapy (252 oral and 20 parenteral). 37 (15%) of the 252 patients were intolerant of oral iron and of these, only 8 (22%) were given parenteral iron.

Transfusion above threshold defined by the audit algorithm

There were 808 patients transfused above the threshold for transfusion defined by the audit algorithm. Of these, 438 (54%) had a documented reason for transfusion in the case notes, 338

(42%) did not have a documented reason. Following review of each case, consultant supervisors concluded that of the 808 patients, transfusion was not appropriate in 220 (27%).

Transfusion to more than 20g/L above threshold

There were 439 patients transfused to more than 20g/L above threshold. There was a significant correlation between body weight and Hb increment with a correlation coefficient of -0.32 $p < 0.001$ (Spearman's rho 2 tailed) i.e.: the lower the body weight the larger the Hb increment/unit.

Discussion

In Part Two of the National Comparative Audit of the Use of Blood in Medical Patients, consultant reviewers concluded that 25% of a selection of cases considered to have had potentially avoidable transfusion in Part One of the audit had inappropriate transfusion. Extrapolating the data from Part Two to Part One, 5% of patients with reversible anaemia and 8% of patients transfused above Hb threshold were considered to be inappropriately transfused i.e. 13% of the transfused patients.

Why were patients with potentially reversible anaemia being transfused? The main reasons identified in the audit were:-

- Inadequate recognition, investigation and treatment of anaemia
- Significant symptoms / signs of anaemia according to the consultant reviewers. But are fatigue and shortness of breath on exertion sufficient to justify a transfusion in a patient with reversible anaemia?

Why were patients being transfused above the thresholds set in the audit? The main reasons identified in the audit were:

- Significant symptoms / signs of anaemia according to the consultant reviewers

Why were patients being 'overtransfused'?

- The main reason was the use of a 'standard' prescription of 2 units in many cases which led to a higher increment than required particularly in patients of lower body weight.

Although other reasons for transfusion were not specifically audited, the logistics of emergency patient care and the pressure on inpatient beds may mean that transfusion is selected as a matter of expediency. Unnecessary and overtransfusion may result in patient harm and is a waste of a precious resource.

There is growing evidence that a more restrictive approach to transfusion is neutral or beneficial compared to a liberal approach in many clinical circumstances, and the audit demonstrates that a restrictive approach is not currently applied to the majority of medical patients.

There will be opportunities to link the recommendations of this audit to other national initiatives:

- The implementation of Patient Blood Management (PBM), which is a multi-disciplinary, evidence-based approach to optimising the care of individual patients who might need blood transfusion. This initiative is being led by National Blood Transfusion Committee (NBTC) and NHSBT.
- The Education Working group of the NBTC has identified a number of opportunities to strengthen training and education in transfusion medicine, including anaemia management, for undergraduates, Foundation doctors and in postgraduate medical curricula.
- NICE has commissioned Transfusion Guidelines which will also make recommendations on the appropriate use of blood (including Hb triggers and targets) and transfusion alternatives.
- SaBTO has recommended that patients should give valid consent to receive a transfusion which includes having the risks and benefits of transfusion explained and being offered alternatives to transfusion where relevant.

Conclusions

There is evidence of inappropriate use of red cell transfusion in medical patients in the UK due to inadequate recognition, investigation and management of anaemia, transfusion at higher Hb thresholds than recommended in guidelines and transfusion to a higher Hb than necessary. There are opportunities to work with several national initiatives to improve practice.

Next steps

Results of the audit will be used to raise awareness of the recommendations for transfusion management of patients under the care of physicians. Tools will be developed to support the recognition, investigation and management of anaemia and to develop simple guidelines to support transfusion decision-making. The output will be linked to other national initiatives such as: implementation of PBM, the work plan of the Education Working group of the NBTC and the NICE Transfusion Guidelines.

Recommendations

Recommendation 1

Patients with medical conditions for example with low grade chronic bleeding, malabsorption syndromes, and chronic renal impairment should be checked for anaemia.

Recommendation 2

Anaemia should be investigated for an underlying cause.

Recommendation 3

Patients should receive appropriate and timely treatment for anaemia to avoid unnecessary transfusion. For example, parenteral iron should be considered for treatment of iron deficiency anaemia if it is not possible to use oral iron

Recommendation 4

Patients should give valid consent to receive a transfusion which includes having the risks and benefits of transfusion explained and being offered alternatives to transfusion where relevant

Recommendation 5

The decision to transfuse must take into account the laboratory findings, the patient's symptoms and signs and the underlying cause for the anaemia. The decision must be fully documented in the patient notes with the justification for the use of transfusion rather than alternatives and the expected outcome of the transfusion.

Recommendation 6

Clinicians must be made aware that the expected increment following transfusion of a unit of red cells is dependent upon the patient's weight. In medical patients with anaemia, there should be clinical reassessment after each unit transfused and a re-check of the blood count.

Recommendation 7

Further research is required to provide the evidence for appropriate transfusion decision making in medical patients with anaemia

ACTIONS

Action	Responsibility	Timescale
Raise awareness of audit Results of audit should be widely distributed to all trusts and healthcare professionals	National Comparative Audit team NBTC and Regional Transfusion Committees Royal College of Physicians NHSBT	July 2013
The investigation and management of anaemia should be part of the training of healthcare professionals making the decision to transfuse	NBTC Education Working Group	December 2013
Develop tools to support the recognition, investigation and effective treatment of anaemia; A pathway for the investigation and management of anaemia should be developed and made available to all healthcare professionals	NBTC PBM Working Group (anaemia toolkit)	December 2013
Promote development of anaemia management services to provide a resource for effective and timely anaemia management (which may help to avoid emergency admission and unnecessary transfusion) and education and training for staff in both primary and secondary care	NBTC PBM working group	December 2013
Develop tools to guide appropriate transfusion decisions for physicians Red cell transfusion guidelines should be updated and built in to transfusion requesting pathways (including definition of over transfusion and use of single unit transfusion where possible)	NBTC PBM working group NICE transfusion group	July 2015
Ensure reason for transfusion is documented in the notes; the patient should be consented and given the option of alternatives to transfusion if indicated, e.g. IV iron if oral iron fails	Hospital Transfusion Teams	July 2013
Prospective monitoring of use of blood in medical patients – development of key performance indicators and audit mechanisms	NBTC PBM working group	December 2013

INTRODUCTION

National red cell demand has fallen by nearly 20% over the last 10 years. Regional surveys show that this is due to a marked reduction in surgical use of blood but that use in adult medical patients over this period has remained static¹. 'Medical' is broadly defined to include medical specialities as well as oncology and haematology. Part 1 of the 2011 National Comparative Audit of Use of Blood in Adult Medical Patients² appeared to show high levels of inappropriate or excessive blood transfusion, and wide variation between hospitals. These results have to be interpreted with some caution because the audit standards were based on a simple algorithm which only took into account haemoglobin level, age, and recorded diagnoses and investigations. In clinical practice the decision to transfuse red cells requires more subtle judgements of quality of life, symptom control, and evaluation of alternative approaches to treatment. Part 2 of the audit took 1592 of the cases in which the decision to transfuse seemed questionable and subjected them to more detailed scrutiny. More detailed clinical information was collected and then consultant physician auditors from each site reviewed the decision making to transfuse. While Part 1 of the audit gives a maximum estimate of theoretically avoidable transfusions, Part 2 gives a more realistic estimate of how many transfusions are potentially avoidable within current practice.

Overview of Part 1 of the audit

The aims of Part 1 of this audit were as follows:

1. To capture the indications for, recipient demographics and co-morbidities of medical patients receiving red cell transfusion;
2. Collect data on pre and post haemoglobin measurements, number of units transfused, place of transfusion and who makes the decision to transfuse;
3. Collect information about prior investigation of anaemia in patients receiving red cell transfusions to identify those with a potentially reversible cause in whom transfusion might have been avoided, e.g. iron deficiency anaemia.

Participating sites were asked to audit all adult patients (unless on the Intensive Care Unit or in the Emergency Department) under the care of a physician in one week of their choice during each of the months September, October and November 2011. 135/156 (87%) NHS Trusts (182 sites) and 15 Independent hospitals in the UK contributed data on 9126 red cell transfusions. The median age of recipients was 73 years and the median number of units per transfusion episode was 2 units. The primary reason for transfusion was anaemia in 78% of cases, blood loss in 20% and prophylaxis prior to procedure in 2%. Much of transfusion practice was appropriate and reflected the high quality of care given. 4 standards were set:

- | | |
|------------|--|
| Standard 1 | A pre-transfusion haemoglobin (Hb) is taken in 100% of cases within 3 days of transfusion (and preferably the same day).
<i>93% compliance</i> |
| Standard 2 | No non-radiotherapy patient should have a pre transfusion Hb > 100g/L
<i>96.4% compliance</i> |
| Standard 3 | A post-transfusion Hb is taken in 100% of cases within 3 days following transfusion (and preferably the same day).
<i>Within 3 days 84%, same day 12%</i> |
| Standard 4 | No non-radiotherapy patient should have a post transfusion Hb > 120 g/L
<i>94.1% compliance</i> |

The median (IQR) pre transfusion Hb was 78 (71-85) g/L and median (IQR) post transfusion Hb was 99 (90-107) g/L.

Using the algorithms and definitions developed by the audit steering group (Figure 1) based on BCSH guidelines³ and other sources^{4,5}, 4818 (53% of 9126 cases) cases of potentially avoidable transfusion were identified as follows:

- 1791/9126 cases (20%) had a possible potentially reversible anaemia (Site variation IQR: 13-26%)
- 2533/8820 cases (29%) were transfused above the haemoglobin threshold defined by the audit algorithm (Site variation IQR: 22-36%)
- 2451/7437 cases (33%) were transfused to more than 20g/L above the agreed audit standard (Site variation IQR: 25-43%)

There was wide variation between sites. Part 1 was reported in December 2012 in the form of a report with individualised site results and a regional slideshow, comparing sites within each region.

In order to understand in more detail the process by which transfusion decisions are made in medical patients, Part 2 of the audit was undertaken.

AIMS & OBJECTIVES OF PART 2 OF THE AUDIT

To review the information from the case records in a random selection of patients identified in Part 1 of the audit as having potentially avoidable transfusion in order to better understand the factors influencing decision making and to assess whether the transfusion was appropriate. The process of selecting patients was carried out by the National Comparative Audit Project Manager. Sites with 20 or fewer cases that could be re-audited were asked to audit all of them. For sites with more than 20 potentially re-auditable cases, then cases were chosen by systematically selecting every 7th case. If this process had not returned 20 cases, then cases were randomly selected in a non-systematic way. No other case information was available during selection, and this aided the selection towards a representative sample.

- In patients with potentially reversible anaemia to review information about anaemia recognition, investigation and management in the 6 months leading up to the audited transfusion episode
- In patients transfused above the threshold set by the audit steering group to review information about the documented reason for transfusion including documented symptoms and signs of anaemia
- In patients transfused to more than 20g/L above threshold to review information about body weight.

The ultimate aim of the audit is to produce new guidance on the use of red cell transfusion in medical patients and tools for the better investigation and management of patients with anaemia.

METHODS

The Part 2 audit tool (Appendix 1) was developed in paper format following a pilot process. The tool was divided into three sections:

- Section 1: patients who received a transfusion with a potentially reversible cause of anaemia
- Section 2: patients transfused above the threshold set by the audit algorithm based on diagnosis, age and comorbidity
- Section 3: patients transfused to more than 20g/L above the threshold set by the audit steering group

The criteria for defining possible reversible anaemia, transfusion above threshold and overtransfusion were developed for Part 1 of the audit and are outlined in Figure 1 below:

Definition of possible potentially reversible anaemia

Iron deficiency = Ferritin ≤ 15 mcg/l (female) or ≤ 20 mcg/l (male) **or if there was no Ferritin result then** Iron studies suggestive of TSAT ≤ 20 **or if there was also no TSAT result then** TIBC ≥ 85 micromol/l **or if there was also no TIBC result then** MCV ≤ 78 fl

B12 deficiency = B12 ≤ 150 ng/l (pg/ml)

Folate deficiency = Serum folate ≤ 2 mcg/l (ng/ml) **or if there was no serum folate result then** Red cell folate ≤ 80 mcg/l (ng/ml)

Autoimmune haemolytic anaemia =Direct Antiglobulin Test (DAT) 'Positive' or grade 1 and above

Renal Anaemia (definition 1) calculated eGFR of ≤ 44 (Chronic Kidney Disease stage 3b to 5) but excluding patients with 'acute renal failure', 'blood loss' and unknown age or gender.

Renal Anaemia (definition 2) calculated eGFR of ≤ 30 (Chronic Kidney Disease stage 4 to 5)and chronic renal failure as ONLY diagnosis 'ticked'

Definition of possible unnecessary transfusion above pre-transfusion Hb trigger

The categories below are stepped in that anaemia patients at one level are those remaining after patients belonging to all earlier levels have been excluded. For example level 2 patients with thalassaemia are selected from the whole group of anaemia patients after excluding the level 1 patients with radiotherapy.

1. Radiotherapy **and** pre-Hb >110 g/L
2. Thalassaemia **and** pre-Hb >100 g/L
3. Age > 65 with bone marrow failure^A **and** pre-Hb >90 g/L
4. Age > 65 with chemotherapy **and** pre-Hb >90 g/L
5. Age >65 without bone marrow failure^A or chemotherapy or comorbidity^B **and** pre-Hb >80 g/L
6. Any age with comorbidity^B **and** pre-Hb >80 g/L
7. Age ≤ 65 with bone marrow failure^A **and** pre-Hb >80 g/L
8. Age ≤ 65 with chemotherapy **and** pre-Hb >80 g/L
9. Age ≤ 65 without bone marrow failure^A or chemotherapy or comorbidity^B **and** pre-Hb >70 g/L

A: Aplastic anaemia, Acute myeloid leukaemia, Acute lymphoblastic leukaemia, Myelodysplasia, Myeloproliferative disease (myelofibrosis), Chronic leukaemia any type, Myeloma, Non-haematological malignant infiltration (Q6B1 thru Q6B9)

B: Cardiac, respiratory or vascular disease (Q13) or on any of the drugs (Q13b)

In patients with acute blood loss, a threshold of 100g/L has been set

Over transfusion

1. Transfusion to more than 20g/L above Hb threshold set for that patient group
2. In patients with possible potentially reversible anaemia, transfusion to more than 20g/L above pre-transfusion Hb

Figure 1: Definitions for possible reversible anaemia, transfusion above threshold and overtransfusion (from Part 1 of the audit).

3138 cases were randomly selected, using the process described earlier, from the three groups, providing up to a maximum of 20 cases per site. For each case, a front sheet was produced which provided the auditor with the original audit ID number, data provided for that case in the Part 1 audit, the reason for inclusion in the Part 2 audit and an indication of which of the three sections of the audit tool required completion.

There was a particular problem with the criterion for identifying patients with anaemia caused by renal failure in whom treatment with drugs such as Erythropoetin analogues might avoid the need for red cell transfusion. The criterion for possible renal anaemia originally chosen when the audit was planned was : cases with calculated eGFR < 44 (excluding those with acute renal failure or blood loss (Definition 1 in Figure 1) . Prior to the analysis of the Part 1, data it was recognised that this broad definition identified a very large number of patients in whom specific treatments for renal anaemia would not be usual practice. The definition was changed post hoc to any patient with eGFR < 30 and chronic renal failure as the only diagnosis ticked (Definition 2 in Figure 1). It was felt that using a much narrower definition would make it more likely that patients identified in Part 1 would genuinely have anaemia caused purely by renal failure.

The audit tools were sent to the audit lead in each site in May 2012 with instructions to ask the nominated foundation doctor / primary auditor to identify the cases and retrieve the case notes in order to collect the additional information required: recognition, investigation and management of anaemia in the 6 months leading up to the audited transfusion episode, documented reason for transfusion above threshold and the body weight in those over transfused.

Each Foundation Doctor / primary auditor was asked to discuss the anonymised cases with their consultant supervisor in order to conclude whether the transfusion could have been avoided or whether the transfusion was appropriate.

The audit tools were returned by FREEPOST and the data inputted into Excel by three data analysts. The data were transported into SPSS for further analysis and in order to link it with the original Part 1 dataset. The Part 2 cases have been analysed as a national cohort with no sub analysis at site or regional level.

RESULTS

Data was available for analysis in 1592 cases. This represents 51% of the 3138 cases selected for the Part 2 audit and 33% of the 4818 cases eligible for the Part 2 audit.

SECTION ONE : POSSIBLE REVERSIBLE ANAEMIA

There were 773 cases of possible reversible anaemia in Part 2 (43% of the 1791 cases eligible for Part 2). Table 1 shows the breakdown of the cause of the anaemia allocated according to the audit definitions (Figure 1):

Cause of anaemia	Number of cases
Iron deficiency	552
B12/folate deficiency	107
Autoimmune haemolytic anaemia	49
Renal anaemia (Definition 1)	65
Renal anaemia (Definition 2)	12

Table 1: Part 2 cases with possible reversible anaemia

The Part 2 audit proforma used to extract data asked specifically about the following symptoms: palpitations, shortness of breath on exertion, chest pain, postural hypotension and tachycardia. There were a significant number of symptoms that were recorded as 'other' with free text; these have been classified post hoc into three further categories: acute blood loss, collapse and lethargy. Of the 747 cases, 527 cases (71%) had a documented reason for transfusion in the case notes (see Figure 2).

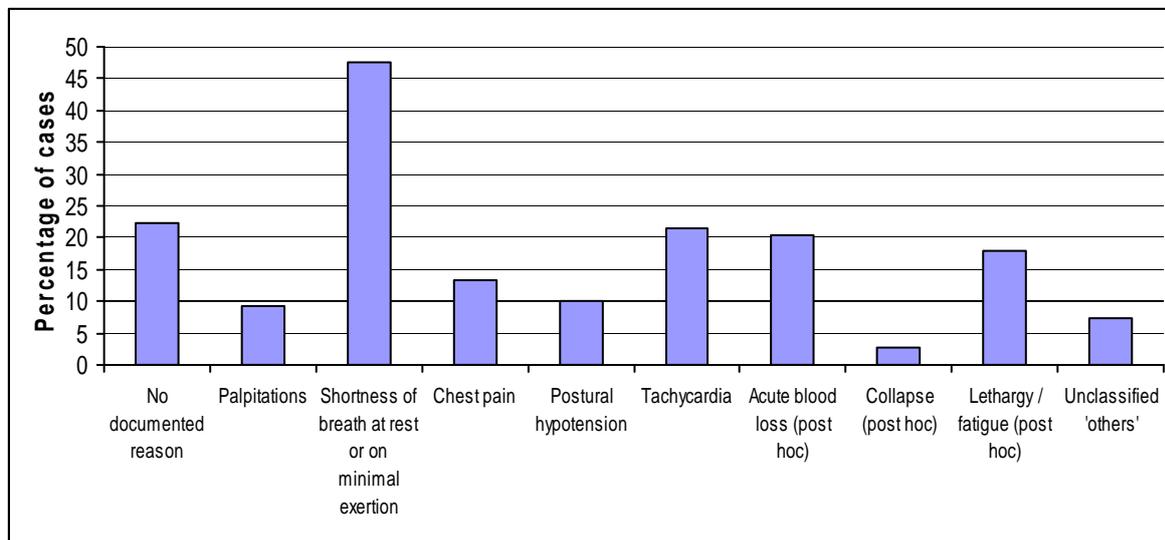


Figure 2: Documented symptoms in patients with possible reversible anaemia prior to transfusion

The consultant supervisors concluded that of the 747 cases, transfusion could have been avoided in 187 cases (25%). Figure 3 shows the reasons why transfusion could have been avoided. The largest category were patients in whom the anaemia had been previously identified and investigated but not adequately treated (105 cases). There were 35 cases where the anaemia was identified but not adequately investigated. There were 15 cases where the anaemia was not identified before admission despite patients presenting with chronic low grade bleeding (e.g. menorrhagia) or malabsorption; in these cases the Full Blood Count (FBC) was not checked or was checked but the results were not reviewed.

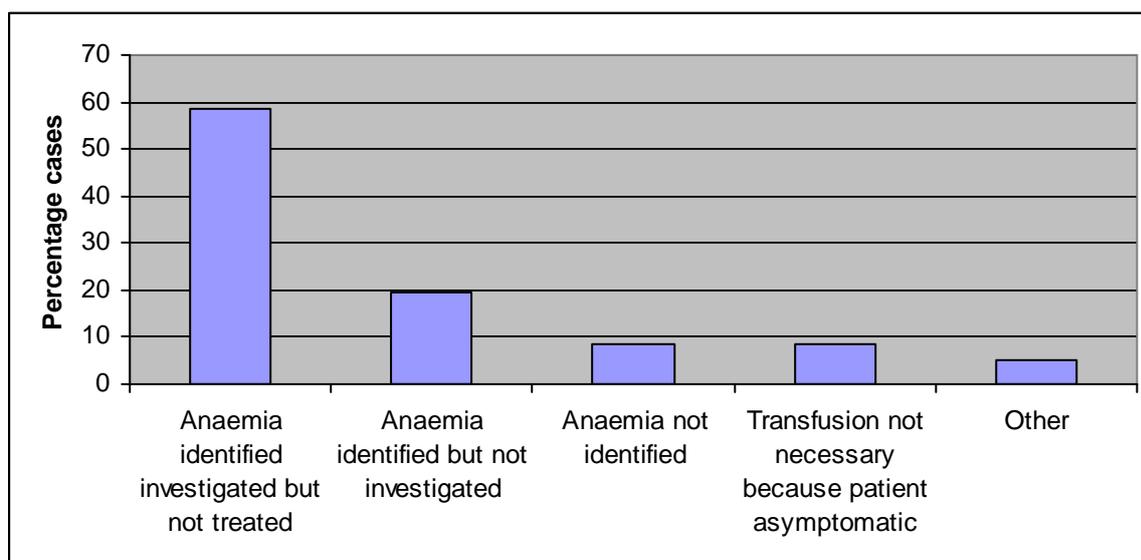


Figure 3: Reasons why transfusion could have been avoided in 187 patients with possible reversible anaemia

Analysis of investigation of anaemia

The auditors were asked to review the case notes to identify which service first noted the anaemia. (Figure 4). 246 cases were first recognised in primary care, 132 cases in Emergency Department, 94 cases in outpatients, 267 in inpatients and 1 'other' service (hospice). In 7 cases there was a blank response.

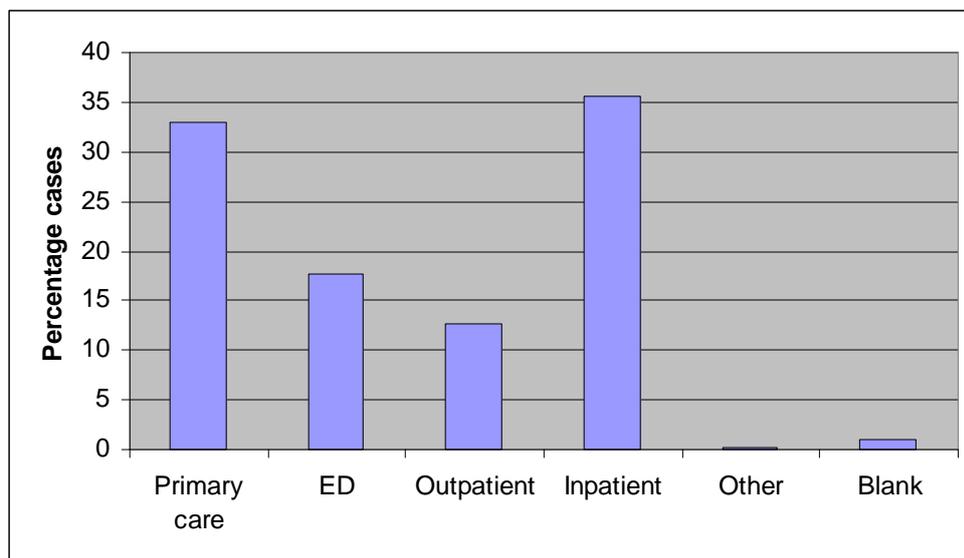


Figure 4: Which service first noted the anaemia?

The inpatient services most likely to first note the anaemia were: acute medicine, gastroenterology, haematology, care of the elderly, cardiology, renal and oncology. The outpatient specialities first noting anaemia were most likely to be gastroenterology, haematology and oncology.

The median time from the anaemia first being noted to the audited transfusion episode was 3 days (IQR 1-76 days). Figure 5 shows the distribution of cases:

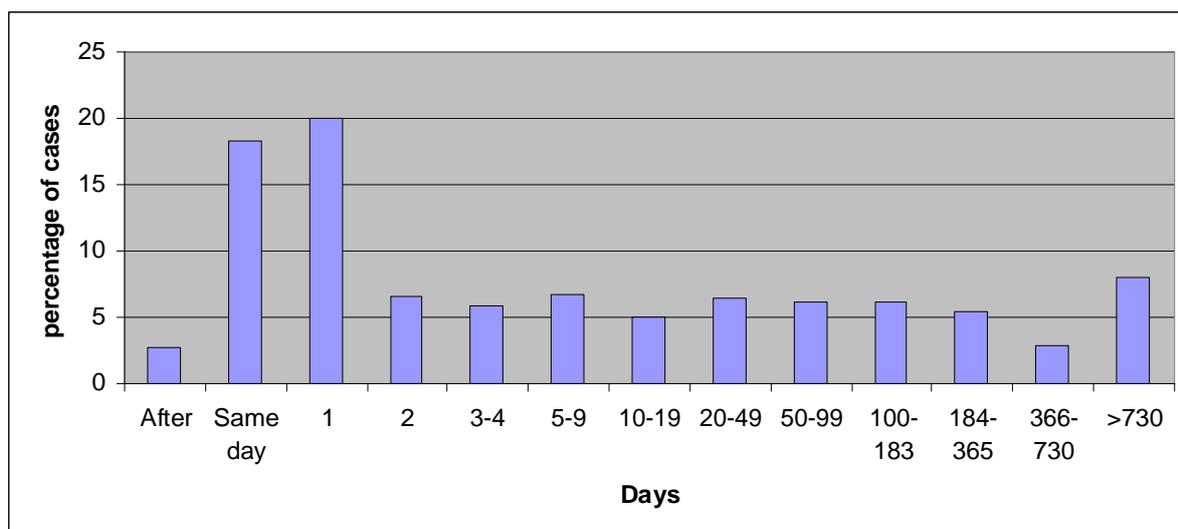


Figure 5: Time from anaemia being noted to audited transfusion episode

Of the 747 cases, investigations were undertaken to determine the cause of anaemia in 615 cases (82%).

Iron deficiency cases

There were 552 cases assessed as possible iron deficiency according to the audit group definition (see Figure 1). 288 (52%) cases were selected on the basis of a low ferritin result, 70 (13%) were selected on the basis of a transferrin saturation of <20% and no ferritin result available and 194 (35%) were selected on the basis of an MCV <78fl and no haematinics available. The frequency of haematinic investigations undertaken in the various clinical settings are shown in Table 2.

Investigation	Primary care	A&E	Outpatients	Inpatients	Haematinics not checked
Haematinics	92 (17%)	46 (8%)	52 (9%)	252 (46%)	154 (28%)

Table 2: Haematinic Investigations in patients with suspected iron deficiency anaemia (some patients had investigations checked more than once)

Coeliac serology was undertaken in 85 patients (15%), mainly in inpatients and outpatients. Gastrointestinal investigations were undertaken in 343 of the 552 cases (62%). Of the 311 women, 61 were < 55 years and of these, 26 had gynaecological investigations (43%). 250 were 55 years or more and of these, 9 had gynaecological investigations.

B12 and folate cases

There were 48 cases of B12 deficiency and 64 cases of folate deficiency according to the audit group definition as shown in Figure 1 (5 cases had both B12 and folate deficiency). The frequency and type of investigations undertaken in the various clinical settings are shown in Table 3.

Investigation	Primary care	A&E	Outpatient s	Inpatients	Setting of investigation not documented
<i>B12 deficiency</i>					
Haematinics	3 (6%)	4 (8%)	3 (6%)	30 (63%)	8 (17%)
Intrinsic factor antibody	--	--	2 (4%)	8 (17%)	
<i>Folate deficiency</i>					
Haematinics	9 (14%)	2 (3%)	9 (14%)	33 (52%)	11(17%)
Coeliac serology	1 (2%)	--	5 (8%)	3 (5%)	
Duodenal biopsy	--	--	1 (1.6%)	2 (3%)	

Table 3: Investigations in patients with suspected B12/folate deficiency

Possible AIHA cases

There were 49 cases of possible AIHA as defined by the audit group definition. The frequency and type of investigations undertaken in the various clinical settings are shown in Table 4.

Investigation	Primary care	A&E	Outpatients	Inpatients
Reticulocytes	--	1 (2%)	6 (12%)	20 (41%)
LDH	--	1 (2%)	10 (20%)	21 (43%)
LFT	4 (8%)	8 (16%)	8 (16%)	24 (49%)

Table 4: Investigations in patients with suspected AIHA

Renal anaemia

There were 65 cases of renal anaemia using definition 1, i.e. cases with eGFR < 44 and acute renal failure excluded. The frequency and type of investigations undertaken in the various clinical settings are shown in Table 5.

Investigation	Primary care	A&E	Outpatients	Inpatients
Ferritin	4 (6%)	2 (3%)	12 (18%)	27 (42%)
CRP	2 (3%)	3 (4%)	10 (15%)	29 (45%)

Table 5: Investigations in patients with suspected renal anaemia

Analysis of the treatment of anaemia

Iron deficiency anaemia

Of the 552 cases that had potential iron deficiency in Part 1, 372 cases had a primary diagnosis of iron deficiency anaemia documented in the case notes, 239 (64%) of these had a low ferritin, 37 (10%) had a transferrin saturation of <20% and 96 (26%) had a low MCV alone and no haematinic results documented. The cause of the anaemia in the remaining 180 cases was as follows:

B12/Folate	3
Anaemia of chronic disease	25
Renal anaemia	16
Bleeding	56
Haematological malignancy	12
Cancer	9
Others	18
Not documented	64

There was some multiple causes stated within the above. It is interesting to note that in 64 cases, the cause of the anaemia was not documented.

Of the 372 cases documented as iron deficiency, 280 were prescribed iron therapy (75%): 252 were on oral iron and 20 on IV iron, not known for 8. Therefore 92 cases (25%) were not treated with iron therapy pre transfusion; of these, 12 were commenced on oral iron post transfusion and 3 were given parenteral iron post transfusion. For those given oral iron pre transfusion, 37/252 (15%) were either intolerant or non-compliant with oral iron. Of these, 8 of the 37 were prescribed IV iron. 63 patients were given dietary advice. 141 of the 372 had treatment for an underlying gastrointestinal disorder. 18 female patients received treatment for menorrhagia.

B12/folate deficiency

Of the 107 cases of B12/folate deficiency according to the audit definition, 37 had B12 or folate deficiency documented in the notes. The documented cause of anaemia in the other 70 was as follows:

Iron deficiency	14
Anaemia of chronic disease	9
Renal anaemia	8
AIHA	2
Bleeding	12
Haematological malignancy	15
Cancer	6
Others	3
Not documented	18

There was some multiple causes stated within the above.

Of the 37 documented cases of B12 / folate deficiency, 25 were prescribed folic acid and 16 were prescribed B12.

Possible AIHA

Of the 49 cases of possible AIHA according to the audit definition, 17 were documented in the case notes as AIHA. The documented causes of anaemia in the other 32 cases were as follows:

Iron deficiency	4
B12/Folate deficiency	1
Anaemia of chronic disease	1
Renal anaemia	2
Bleeding	4
Haematological malignancy	13
Cancer	2
Others	1
Not documented	9

There was some multiple causes stated within the above.

Of the 17 cases of documented AIHA, 5 were treated with steroids; other treatments included azathioprine (1), chlorambucil (1), rituximab (1), R-CHOP (1) & folic acid (7).

Possible renal anaemia (Definition 1 eGFR < 44, acute renal failure excluded)

Of the 65 cases of possible renal anaemia, 43 were documented as having renal anaemia. The documented causes of anaemia in the other 22 cases were as follows:

Iron deficiency	5
B12/Folate	1
Anaemia of chronic disease	4
AIHA	1
Bleeding	2
Haematological malignancy	2
Others	1
Not documented	9

There were some multiple causes stated within the above.

8 of the 43 documented cases of renal anaemia were prescribed IV iron, 14 were prescribed ESA and 16 had been referred to a nephrologist.

SECTION TWO – TRANSFUSION ABOVE THRESHOLD DEFINED BY THE AUDIT ALGORITHM

There were 808 cases in Part 2 (32% of the 2533 cases eligible for Part 2). Of these, 438 (54%) had a documented reason for transfusion in the case notes, 338 (42%) did not have a documented reason and it was unclear in 32 cases. The reasons are shown in Figure 6.

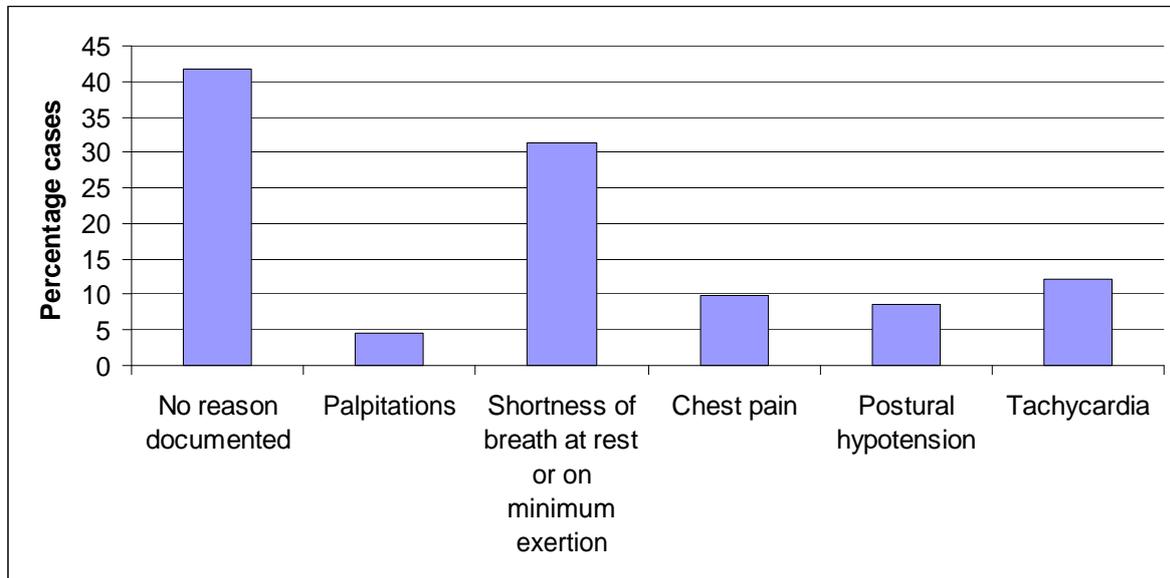


Figure 6: Documented symptoms and signs in patients transfused above the audit threshold prior to transfusion

Following review of each case, consultant supervisors concluded that of the 808 cases, transfusion was not appropriate in 220 (27%) of these. Of the 438 cases recorded as having a documented reason for transfusion, the conclusion was that 365 (83%) were appropriately transfused. Of the 338 cases who had no documented reason for transfusion, the auditors concluded that 156 (46%) were appropriately transfused.

SECTION THREE – TRANSFUSION TO MORE THAN 20g/L ABOVE THRESHOLD

There were 439 cases in Part 2 (18% of the 2451 cases eligible for Part 2)

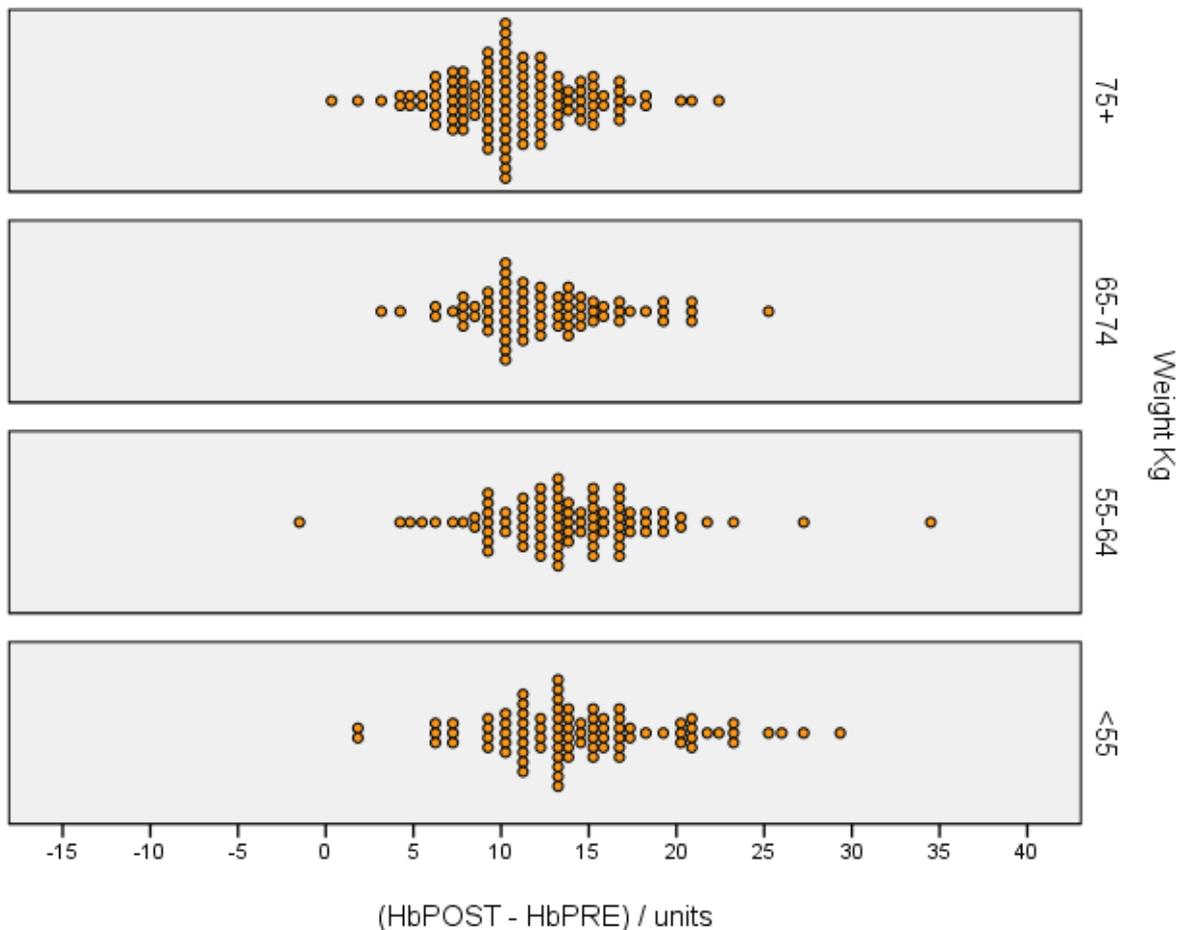
There was a significant correlation between body weight and Hb increment per unit transfused with a correlation coefficient of -0.32 $p < 0.001$ (Spearman's rho 2 tailed) ie: the lower the body weight the larger the Hb increment.

Table 6: Median (IQR) Hb Increment per unit transfused by ranges of body weight for patients transfused to more than 20g/L above threshold

Weight (kg)*	Median Hb increment/units transfused (g/L)	IQR increment	N of cases
<55	14.0	11.0-16.5	87
55-64	13.5	11.0-16.5	85
65-74	12.3	10.0-14.5	71
75-89	10.5	9.0-14.0	75
90+	10.0	7.0-12.0	39
75+	10.5	8.0-13.5	114

*Weight was known for 357 of the 439 cases

Figure 7: Pattern of Hb increments by ranges of body weights



DISCUSSION

Consultant auditors believed only a quarter of the transfusion episodes in Part 2 of the audit were inappropriate, despite all cases having been identified as potentially inappropriate in Part 1. It is not possible to say whether this reflects the inadequacy of the algorithm in Part 1, or whether it reflects a culture of over liberal transfusion practice among physicians. Members of the audit group noted that it could be difficult to be certain from case notes whether a symptom such as breathlessness was due to anaemia or another medical condition. The standards used in Part 1 of the audit were not particularly restrictive, and were based on well-established consensus guidelines³⁻⁵. Nonetheless it is fair to say that there is very little research evidence underlying these guidelines and much of that evidence is based on extrapolating from research done in rather different patient populations.^{6,7}

Transfusion in cases of possible reversible anaemia

Donated blood is a precious resource, and red cell transfusion has well established risks⁸. Red cell transfusion may be the only treatment for symptoms of anaemia in patients with conditions that cause primary bone marrow failure or infiltration, but in patients whose anaemia has a potentially reversible underlying cause, prompt diagnosis and early treatment will reduce or avoid blood transfusion. In the Part 2 audit there were 747 cases which had been identified in Part 1 as possibly having a reversible underlying cause of anaemia (the commonest being possible iron deficiency in 552 cases). Consultant auditors believed that transfusion could have been avoided in 187 (25%) of these cases of anaemia.

The 552 cases of possible iron deficiency warrant further discussion. Anaemia with microcytosis is suggestive but not diagnostic of iron deficiency. It is of concern that that 28% of the possible iron deficiency cases in the audit did not have any documentation of testing of haematinics to confirm the diagnosis. The audit group recommend serum ferritin as the most useful single test to confirm iron deficiency. It is not surprising that 64 cases of this 552 had no documentation as to the underlying diagnosis causing anaemia, given the number of patients who did not have haematinics tested. Treatment of iron deficiency was not always adequate; 92 of the 372 cases in whom a definite diagnosis of iron deficiency had been recorded in the notes had not been treated with iron therapy before transfusion and of these 15 were commenced on iron therapy post transfusion. There is likely to be scope for increased use of parenteral iron in patients who have failed oral iron therapy, as very few patients (only 11) had been offered this. Dietary advice was poorly recorded, appearing in the notes of only 63 cases.

Transfusion above the threshold set by the audit algorithm

The transfusion thresholds used as standards for Part 1 of the audit (see Figure 1) were based on consensus guidelines³⁻⁵. Although an age cut off of 65 years was used in the Part 1 audit algorithm it is important to note that age thresholds are a crude measure on which to base clinical decisions, and would have systematically distorted the results of Part 1 of the audit so that transfusion in patients younger than the cut off age was more likely to have been considered inappropriate, and transfusion in older patients more likely to be considered appropriate - even if the clinical presentation and co-morbidities are identical. BCSH red cell transfusion guidelines suggest an upper limit of Hb of 100g/L above which a red cell transfusion is generally considered inappropriate and a lower limit of Hb of 70g/L below which transfusion would usually be indicated unless an effective alternative exists³. If a patient's Hb falls between these upper and lower limits, then factors such as co-morbidities, ongoing blood loss, age, and presence of symptoms / signs of anaemia are used to guide the transfusion decision. It is in this grey area between 70-100g/L that clinical decision making becomes more difficult, particularly in the absence of clear research evidence of harm or benefit in this group.

In the Part 2 audit there were 808 cases which had been identified in Part 1 as having transfusions above threshold Hb within this grey area of 70-100g/L. The consultant auditors considered that transfusion was appropriate in 73% of these cases, although there was a documented reason in only 54% of cases. In other words consultants felt the majority of transfusions in this group were appropriate, with a significant minority which were not. This result reinforces the view that simple information on the Hb level, co-morbidity, age and diagnosis is not sufficient on its own to judge the appropriateness of red cell transfusion and that clinical judgement also plays a significant role in decision making. Some of these cases may be those where it was appropriate to keep patients at a higher Hb threshold because of the need for individualised management of patients, for example, with chronic transfusion dependent anaemia.

Overtransfusion

In patients considered to have a potentially reversible cause of anaemia, the audit defined potential over-transfusion as transfusion to more than 20g/L over the pre-transfusion Hb threshold. This was considered to be a reasonable increment sufficient to improve symptoms. This may be at variance with the clinical approach adopted by many physicians who may choose a target haemoglobin to aim for post transfusion, for example 100g/L. In other situations the audit defined potential overtransfusion as transfusion to more than 20g/L over the appropriate threshold for transfusion. Possible over-transfusion occurred in 33% of patients in Part 1 of the audit (2451/7437). Analysis of a proportion of these cases (n= 439) in Part 2 suggests a significant negative correlation between body weight and Hb increment. Table 6 will be useful to help clinicians estimate the likely increment in Hb per unit of blood transfused. In many patients (especially those with a lower body weight) it may be possible to achieve alleviation of symptoms and signs of anaemia with a single unit transfusion. There are some cases where a larger increment may be appropriate such as in chronic transfusion dependent patients in whom giving a larger dose of blood will reduce the frequency of attendance for top-up transfusion.

In Part 2 of the National Comparative Audit of the Use of Blood in Medical Patients, consultant reviewers concluded that 25% of a selection of cases considered to have had potentially avoidable transfusion from Part 1 of the audit had inappropriate transfusion. Extrapolating the data from Part 2 to Part 1, 5% of patients with reversible anaemia and 8% of patients transfused above Hb threshold were considered to be inappropriately transfused i.e. 13% of the transfused patients. It must be remembered that this audit did not include all haematology cases, but this estimate is similar to other regional audits (London RTC 2007 15.5%, North West RTC 2009 17%, East Midlands 12%, and Northern Ireland 2008 6%). The audit in Northern Ireland also demonstrated that 25% of transfusions could have been avoided in patients with anaemia⁵.

The large difference between Part 1 and Part 2 suggests that there is a gap between clinical practice and transfusion guidelines. This may be because the Hb thresholds in transfusion guidelines have traditionally been based on consensus rather than evidence. The purpose of transfusion is to improve tissue oxygen delivery and reduce morbidity, but this is not something that can be measured directly in normal circumstances. Decisions on red cell transfusion need to take into account the broader impact on an individual's symptoms and outcome, rather than using arbitrary Hb triggers, but there is a dearth of information on how to make good patient-centred decisions. There is growing evidence that a more restrictive approach to transfusion is neutral or beneficial compared to a liberal approach in many clinical circumstances^{7,9} and the audit demonstrates that a restrictive approach is not currently applied to the majority of medical patients. Although other reasons for transfusion were not specifically audited, the logistics of emergency patient care and the pressure on inpatient beds may mean that transfusion is selected as a matter of expediency.

As in many previous transfusion audits, the reason for transfusion was not always documented in the notes (in Part 2, the reason was not documented in 29% of cases of patients with potentially reversible anaemia and 46% patient of cases transfused above threshold). The documentation of the reason for transfusion should form part of the documentation of consent for blood transfusion.

There will be opportunities to link the recommendations of this audit to other national initiatives:

- The implementation of Patient Blood Management (PBM), which is a multi-disciplinary, evidence-based approach to optimising the care of individual patients who might need blood transfusion.
- The Education Working group of the National Blood Transfusion Committee (NBTC) has identified a number of opportunities to strengthen training and education in transfusion medicine, including anaemia management, for undergraduates, Foundation doctors and in postgraduate medical curricula.
- NICE has commissioned Transfusion Guidelines which will also make recommendations on transfusion alternatives.
- SaBTO has recommended that patients should give valid consent to receive a transfusion which includes having the risks and benefits of transfusion explained and being offered alternatives to transfusion where relevant¹⁰.

Limitations of the audit

The Part 1 audit used the Hb concentration as the key indicator of appropriate transfusion, together with information provided on age, comorbidity and diagnosis. However, in practice, many other features need to be taken into account including chronicity of anaemia, the patient's symptoms and signs, the rate and volume of blood loss and the reversibility of the anaemia. The audit steering group decided whether or not the transfusion was appropriate according to the application of strict criteria developed from consensus guidelines. In practice, the nuances of transfusion decision making means that it is difficult to be black and white in these situations. In fact, many transfusion decisions are likely to fall in the 'uncertain' category. This is reflected in the Part 2 audit results where consultant auditors disagreed with the Part 1 decision in 75% of cases transfused for reversible anaemia and 73% of cases transfused above threshold.

The definition of reversible anaemia was based on surrogate information provided in the Part 1 audit as not all patients had been fully investigated prior to transfusion. With regards to haematinic measurements in cases of possible iron deficiency, these were only available in 74% of the cases; the use of MCV as surrogate marker for iron deficiency is not perfect as the cut-off of 78fl chosen may also include some anaemia of chronic disorder and thalassaemia trait cases. Cases of potential B12 and folate deficiency may have been missed and macrocytosis was not used as a surrogate marker in view of the multiple different causes of macrocytosis. The selection of a standardised cut off level to diagnose haematinic deficiency was hampered by the fact that there is not only a wide variation in normal ranges of haematinic assays in UK laboratories depending on the techniques and reagents used, but also well recognised grey areas where a result is indeterminate. Some cases where the levels were lower than the cut off chosen by the audit group may have been in the normal range in a few laboratories. The use of a one-off eGFR reading is not the sole indicator of whether a patient has a renal anaemia that is potentially treatable with IV iron and EPO. The eGFR calculation did not take ethnicity into account as this information was not available: race can have a significant impact on the eGFR result. The definition of renal anaemia was changed after the Part 2 cases had already been selected. The original definition of eGFR < 44 plus acute renal failure excluded was felt to be too broad a definition, and this was tightened to cases with eGFR < 30 and Chronic renal failure as only diagnosis ticked – in Part 2, there were only 12 cases that fulfilled this tighter definition and therefore analysis of Part 2 cases has looked at those with the broader definition (65 cases).

The definition of reversible anaemia used in Part 1 of the audit, as expected, included some patients with genuine irreversible causes of anaemia as well. There were also many cases where the cause of anaemia was 'not documented', 'not diagnosed' or left blank reflecting inadequate or uncertain investigation and diagnosis of the cause of the anaemia prior to transfusion.

The trigger thresholds for transfusion used in this audit are based on relatively restrictive practice as reflected by a number of current consensus guidelines,^(11,12) but this does not take into account patients with chronic transfusion dependent anaemia (e.g. those with myelodysplasia) where transfusion to a higher individualised Hb threshold may be required to subjectively improve quality of life.

The definition of overtransfusion of > 20g/L increase in Hb and or 20g/L above the threshold set for that patient is derived from consensus opinion rather than evidence base. There is a paucity of evidence on clinical outcomes following transfusion. The audit has not attempted to define undertransfusion. This may also be a significant problem that has not been analysed here.

CONCLUSIONS

There is growing evidence that a more restrictive approach to transfusion is neutral or beneficial compared to a liberal approach in many clinical circumstances, and this audit demonstrates that a restrictive approach is not currently applied to the majority of medical patients in the UK. The audit shows evidence of inappropriate use of blood in medical patients due to transfusion of patients with reversible anaemia, transfusion at a higher threshold than required and over-transfusion. Unnecessary transfusion could be avoided by:

- Recognising anaemia earlier and instituting appropriate investigation and management;
- Ensuring that the patient's symptoms and signs and the Hb level are taken into account and that this is documented in the notes;
- Introduction of more cautious use of multi-unit transfusion especially in those with low body-weight. Clinical re-assessment and laboratory checks after each unit in smaller patients in particular would help to prevent over-transfusion;
- An individualised approach to chronic transfusion-dependent patients.

NEXT STEPS

Results of the audit will be used to raise awareness of the recommendations for transfusion management of patients under the care of physicians. Tools will be developed to support the recognition, investigation and management of anaemia and to develop simple guidelines to support transfusion decision-making. The output will be linked to other national initiatives such as: implementation of PBM, the work plan of the Education Working group of the NBTC and the NICE Transfusion Guidelines.

RECOMMENDATIONS

Recommendation 1

Patients with medical conditions for example with low grade chronic bleeding, malabsorption syndromes, and chronic renal impairment should be checked for anaemia.

Recommendation 2

Anaemia should be investigated for an underlying cause.

Recommendation 3

Patients should receive appropriate and timely treatment for anaemia to avoid unnecessary transfusion. For example, parenteral iron should be considered for treatment of iron deficiency anaemia if it is not possible to use oral iron

Recommendation 4

Patients should give valid consent to receive a transfusion which includes having the risks and benefits of transfusion explained and being offered alternatives to transfusion where relevant

Recommendation 5

The decision to transfuse must take into account the laboratory findings, the patient's symptoms and signs and the underlying cause for the anaemia. The decision must be fully documented in the patient notes with the justification for the use of transfusion rather than alternatives and the expected outcome of the transfusion.

Recommendation 6

Clinicians must be made aware that the expected increment following transfusion of a unit of red cells is dependent upon the patient's weight. In medical patients with anaemia, there should be clinical reassessment after each unit transfused and a re-check of the blood count.

Recommendation 7

Further research is required to provide the evidence for appropriate transfusion decision making in medical patients with anaemia

ACTIONS

Action	Responsibility	Timescale
Raise awareness of audit Results of audit should be widely distributed to all trusts and healthcare professionals	National Comparative Audit team NBTC and Regional Transfusion Committees Royal College of Physicians NHSBT	July 2013
The investigation and management of anaemia should be part of the training of healthcare professionals making the decision to transfuse	NBTC Education Working Group	December 2013
Develop tools to support the recognition, investigation and effective treatment of anaemia; A pathway for the investigation and management of anaemia should be developed and made available to all healthcare professionals	NBTC PBM Working Group (anaemia toolkit)	December 2013
Promote development of anaemia management services to provide a resource for effective and timely anaemia management (which may help to avoid emergency admission and unnecessary transfusion) and education and training for staff in both primary and secondary care	NBTC PBM working group	December 2013
Develop tools to guide appropriate transfusion decisions for physicians Red cell transfusion guidelines should be updated and built in to transfusion requesting pathways (including definition of over transfusion and use of single unit transfusion where possible)	NBTC PBM working group NICE transfusion group	July 2015
Ensure reason for transfusion is documented in the notes; the patient should be consented and given the option of alternatives to transfusion if indicated, e.g. IV iron if oral iron fails	Hospital Transfusion Teams	July 2013
Prospective monitoring of use of blood in medical patients – development of key performance indicators and audit mechanisms	NBTC PBM working group	December 2013

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HOSPITALS PARTICIPATING IN THE PART 2 AUDIT

Addenbrooke's Hospital	Oxford Radcliffe Hospitals NHS Trust
Airedale NHS Foundation Trust	Papworth Hospital NHS Foundation Trust
Altnagelvin Area Hospital	Peterborough City Hospital
Antrim Area Hospital	Pilgrim Hospital
Barnet and Chase Farm Hospitals NHS Trust	Poole Hospital NHS Foundation Trust
Barnsley Hospital	Prince Charles Hospital
Basildon and Thurrock University Hospitals NHS Foundation Trust	Princess Alexandra Hospital
Basingstoke and North Hampshire NHS Foundation Trust	Princess of Wales Hospital
Bedford Hospital NHS Trust	Queen Alexandra Hospital
Betsi Cadwaladr University Health Board	Queen Elizabeth Hospital Birmingham
Birmingham City Hospital	Queen Elizabeth The Queen Mother Hospital
Birmingham Heartlands Hospital	Queen's Hospital Romford
Blackpool Teaching Hospitals NHS Foundation Trust	Rochdale Infirmary
BMI The Priory Hospital	Royal Alexandra Hospital
BMI The Saxon Clinic	Royal Bolton Hospital
Borders General Hospital	Royal Cornwall Hospitals NHS Trust
Bradford Teaching Hospitals NHS Foundation Trust	Royal Devon and Exeter Hospital
Brighton and Sussex University Hospitals NHS Trust	Royal Free Hospital
Buckinghamshire Healthcare NHS Trust	Royal Glamorgan Hospital
Burton Hospitals NHS Foundation Trust	Royal Gwent Hospital
Calderdale and Huddersfield NHS Foundation Trust	Royal Marsden Hospital Chelsea
Causeway Hospital	Royal Marsden Hospital Sutton
Chelsea and Westminster Hospital NHS Foundation Trust	Royal Oldham Hospital
Chesterfield Royal Hospital NHS Foundation Trust	Royal Surrey County Hospital NHS Foundation Trust
City Hospitals Sunderland NHS Foundation Trust	Royal United Hospital
Clatterbridge Centre for Oncology NHS Foundation Trust	Salford Royal NHS Foundation Trust
Colchester Hospital University NHS Foundation Trust	Salisbury NHS Foundation Trust
Conquest Hospital	Sandwell General Hospital
Countess of Chester Hospital NHS Foundation Trust	Singleton Hospital
Craigavon Area Hospital	Solihull Hospital
Croydon Health Services NHS Trust	South London Healthcare NHS Trust
Cumberland Infirmary	South Tyneside NHS Foundation Trust
Darlington Memorial Hospital	South Warwickshire NHS Foundation Trust
Dartford and Gravesham NHS Trust	Southend University Hospital NHS Foundation Trust
Derby Hospitals NHS Foundation Trust	Southport and Ormskirk Hospital NHS Trust
Dumfries and Galloway Royal Infirmary	Spire Hull and East Riding Hospital
Ealing Hospital NHS Trust	Spire Dunedin Hospital
East Cheshire NHS Trust	Spire Leeds Hospital
East Lancashire Hospitals NHS Trust	Spire Little Aston Hospital
Erne Hospital	Spire Parkway Hospital
Fairfield General Hospital	Spire Southampton Hospital
Frimley Park Hospital NHS Foundation Trust	Spire Tunbridge Wells Hospital
Gartnavel General Hospital	St Anthony's Hospital
Gateshead Health NHS Foundation Trust	St. George's Healthcare NHS Trust
George Eliot Hospital NHS Trust	St. Mary's Hospital Paddington
Glasgow Royal Infirmary	St. Peter's Hospital
Gloucestershire Hospitals NHS Foundation Trust	Stepping Hill Hospital
Good Hope Hospital	Surrey and Sussex Healthcare NHS Trust
Great Western Hospitals NHS Foundation Trust	Taunton and Somerset Hospital

Guys and St Thomas' NHS Foundation Trust
 Hammersmith Hospital
 Harrogate and District NHS Foundation Trust
 Heatherwood and Wexham Park Hospitals NHS Foundation Trust
 Hexham General Hospital
 Hinchingsbrooke Health Care NHS Trust
 Homerton University Hospital NHS Foundation Trust
 Hull and East Yorkshire Hospitals NHS Trust
 Inverclyde Royal Hospital
 James Paget University Hospitals NHS Foundation Trust
 Kent and Canterbury Hospital
 Kettering General Hospital
 King Edward VII's Hospital Sister Agnes
 King's College Hospital NHS Foundation Trust
 King's Mill Hospital
 Kingston Hospital Surrey
 Lancashire Teaching Hospitals NHS Foundation Trust
 Lincoln County Hospital
 Lister Hospital
 Liverpool Heart and Chest Hospital
 London Bridge Hospital
 Luton and Dunstable Hospital
 Manchester Royal Infirmary
 Marie Curie Hospice
 Medway NHS Foundation Trust
 Mid Cheshire Hospitals NHS Foundation Trust
 Mid Essex Hospital Services NHS Trust
 Mid Staffordshire NHS Foundation Trust
 Milton Keynes NHS Foundation Trust
 Monklands Hospital
 Morriston Hospital
 Neath Port Talbot Hospital
 Nevill Hall Hospital
 NHS Fife
 NHS Lothian
 NHS Western Isles
 Noble's Hospital
 Norfolk and Norwich University Hospital
 North Bristol NHS Trust
 North Manchester General Hospital
 North Middlesex University Hospital
 North Middlesex University Hospital London
 North Tees and Hartlepool NHS Foundation Trust
 North Tyneside General Hospital North Shields
 Northampton General Hospital NHS Trust
 Northern Devon Healthcare NHS Trust
 Northern General Hospital
 Northern Lincolnshire and Goole Hospitals NHS Foundation Trust
 Nottingham University Hospitals NHS Trust
 The Christie NHS Foundation Trust
 The Dudley Group of Hospitals NHS Foundation Trust
 The Harley Street Clinic
 The Hillingdon Hospitals NHS Foundation Trust
 The Ipswich Hospital NHS Trust
 The James Cook University Hospital
 The Leeds Teaching Hospitals NHS Trust
 The Mid Yorkshire Hospitals NHS Trust
 The Newcastle upon Tyne Hospitals NHS Foundation Trust
 The North West London Hospitals NHS Trust
 The Princess Grace Hospital
 The Queen Elizabeth Hospital Kings Lynn NHS Foundation Trust
 The Queen Elizabeth II Hospital
 The Rotherham NHS Foundation Trust
 The Royal Bournemouth & Christchurch Hospitals NHS Foundation Trust
 The Royal Hallamshire Hospital
 The Royal Liverpool University Hospital
 The Royal Wolverhampton Hospitals NHS Trust
 The Shrewsbury and Telford Hospital NHS Trust
 The Wellington Hospital
 The Whittington Hospital NHS Trust
 Trafford Healthcare NHS Trust
 University College London Hospitals NHS Foundation Trust
 University Hospital Aintree
 University Hospital of North Durham
 University Hospital of North Staffordshire NHS Trust
 University Hospital of South Manchester NHS Foundation Trust
 University Hospital Southampton NHS Foundation Trust
 University Hospitals Bristol NHS Foundation Trust
 University Hospitals of Leicester NHS Trust
 University Hospitals of Morecambe Bay NHS Foundation Trust
 Vale of Leven District General Hospital
 Walsall Healthcare NHS Trust
 Wansbeck General Hospital
 Warrington and Halton Hospitals NHS Foundation Trust
 West Hertfordshire Hospitals NHS Trust
 West Middlesex University Hospital NHS Trust
 West Suffolk Hospital
 Western Sussex Hospitals NHS Trust
 Weston General Hospital
 William Harvey Hospital
 Winchester and Eastleigh Healthcare NHS Trust
 Wishaw General Hospital
 Witherby General Hospital
 Worcestershire Acute Hospitals NHS Trust
 Wrightington, Wigan and Leigh NHS Foundation Trust
 Wye Valley NHS Trust
 Yeovil District Hospital NHS Foundation Trust
 York Teaching Hospital NHS Foundation Trust

Appendix 1: The Part 2 audit tool



**National Comparative Audit
of Blood Transfusion**



2011 National Comparative Audit of the Medical Use of Red Cells

PART 2 - PATIENT AUDIT TOOL

Section One – Patients who have received a transfusion and who have a potentially reversible cause of anaemia

1. On what date was this patient's anaemia first noted?

D	D	M	M	Y	Y
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2. Which clinical service first noted the anaemia?

- Primary Care
- A&E
- Outpatient (state specialty)
- Inpatient (state specialty)
- Other, please state

2a. Were investigations undertaken to find the cause of the anaemia? Yes No

If yes, complete questions 3 to 6 as appropriate. If no, go to question 7.

3. Which investigation for iron deficiency was undertaken and by which clinical service? (Tick as many as apply, and indicate which clinical service(s) undertook the test, with the specialty, if done. If this information is not available, leave blank and move on to question 3a)

Iron deficiency	Primary Care (tick)	A & E (tick)	Outpatient (State specialty)	Inpatient - State specialty	Other clinical service – please state
Not investigated					
Patient declined investigation					
Haematinics					
Haemoglobinopathy screen (to look for thalassaemia trait)					
CRP					
Coeliac serology (TTG/antiendomysial antibodies)					

3a) If gastrointestinal investigations were carried out, please state which (otherwise, leave blank and go on to question 3b):

3b) If gynaecological investigations were carried out, please state which (otherwise, leave blank and go on to question 3c):

3c) If other investigations were carried out, please state which (otherwise, leave blank and go on to question 4):

4. Which investigation for B12 / Folate deficiency was undertaken and by which clinical service? (Tick as many as apply, and indicate which clinical service(s) undertook the test, with the specialty, if done. If this information is not available, leave blank and move on to question 4a)

B12 / Folate deficiency	Primary Care (tick)	A & E (tick)	Outpatient (State specialty)	Inpatient - State specialty	Other clinical service – please state
Not investigated					
Patient declined investigation					
Haematinics					
Coeliac serology (TTG/antiendomysial antibodies)					
Schilling test					
Intrinsic factor antibody					
Duodenal biopsy					

4a) If other gastrointestinal investigations were carried out, please state which (otherwise, leave blank and go to Q4b):

4b) If other investigations were carried out, please state which (otherwise, leave blank and go to Q5):

5. Which investigation for Autoimmune Haemolytic Anaemia (AIHA) was undertaken and by which clinical service? (Tick as many as apply, and indicate which clinical service(s) undertook the test, with the specialty, if done. If this information is not available, leave blank and move on to question 5a)

AIHA	Primary Care (tick)	A & E (tick)	Outpatient (State specialty)	Inpatient - State specialty	Other clinical service – please state
Reticulocytes					
Blood film					
DAT (DCT)					
LDH					
LFTs					

5a. If other investigations were carried out, please state which (otherwise, leave blank and go to Q6):

6. Which investigation for Renal anaemia was undertaken and by which clinical service? (Tick as many as apply, and indicate which clinical service(s) undertook the test, with the specialty, if done. IF NONE, leave blank and move on to question 6a)

Renal anaemia	Primary Care (tick)	A & E (tick)	Outpatient (State specialty)	Inpatient – State specialty	Other clinical service – please state
Not investigated					
Patient declined investigation					
Ferritin (or other iron studies)					
eGFR					
CRP					

6a. If other investigations were carried out, please state which (otherwise, leave blank):

Now please go to Q7

Summary of the diagnosis

7. What was the documented cause of anaemia? (Tick as many as apply)

- 7a. Iron deficiency
- 7b. B12 and/or folate deficiency
- 7c. Anaemia of chronic disease
- 7d. Renal anaemia
- 7e. Autoimmune Haemolytic Anaemia
- 7f. Other cause of anaemia (state which)
- 7g. Cause not documented
- 7h. Not diagnosed because not investigated
- 7i. Not diagnosed because results of investigations were not reviewed
- 7j. Not diagnosed because investigations were inconclusive

If anaemia was diagnosed, what treatment was prescribed? (If anaemia was not diagnosed, leave blank and move to Q15)

8. For iron deficiency:

8a. Iron Therapy Yes No

8b. If yes, was it: Oral IV

8c. If oral, was the patient intolerant or non-compliant with treatment? Yes No

8d. If yes, was the patient offered IV iron? Yes No

9. For B12/Folate deficiency

9a. Was B12 prescribed? Yes No

9b. Was folic acid prescribed? Yes No

10. For AIHA

10a. Were steroids prescribed? Yes No

10b. Was any other treatment prescribed? Yes No

10c. If yes, please give details:

11. For renal anaemia

11a. Was IV iron prescribed? Yes No

11b. Was EPO prescribed? Yes No

What treatment was given for the underlying cause of the anaemia?

12. For iron deficiency

12a. Dietary advice Yes No

12b. Treatment of GI disorder Yes No

12c. If yes, please give details:

12d. Treatment of menorrhagia Yes No

12e. If yes, please give details:

12f. Other, please state:

13. For B12 / Folate deficiency

13a. Dietary advice Yes No

13b. Treatment of GI disorder Yes No

13c. If yes, please give details:

13d. Other, please state:

14. For renal anaemia

14a. Was the patient referred to a nephrologist for further management of the anaemia and chronic kidney disease? Yes No

According to the data supplied to us in Part 1 of this audit, it is our opinion that this patient was transfused with red cells in order to treat a potentially reversible cause of anaemia.

15. Is there a documented reason for transfusion in the case notes? Yes No

16. Are any of the following symptoms documented:

16a. Palpitations?

Yes

No

16b. Breathlessness at rest / on minimal exertion?

Yes

No

16c. Chest pain?

Yes

No

16d. Postural hypotension?

Yes

No

16e. Tachycardia?

Yes

No

16f. Acute blood loss?

Yes

No

16g. Please give details of any other symptoms documented:

17. In your opinion, could this transfusion have been avoided?
(discuss with your consultant supervisor)

Yes No

If yes, explain how the transfusion could have been avoided (tick one option)

- Anaemia not identified prior to transfusion (no blood tests performed or performed but results not received) despite risk of anaemia from e.g. low grade bleeding, dietary issues or previous history)
- Anaemia identified but not investigated for treatable cause
- Anaemia identified and investigated but not adequately treated (e.g. failure to move to IV iron if oral iron not effective; failure to treat underlying cause)
- Other, please state:

18. Following transfusion, which of these, if any, definitive treatments for the anaemia were started? (Tick as many as apply or leave blank if treatment was not started)

Oral iron IV iron B12 Folate EPO Steroids

Other, please state:

SECTION TWO

This patient was, in our opinion, transfused above the threshold set.

19 . Is there a documented reason for this in the case notes? Yes No

Are any of the following symptoms documented:

19a. Palpitations? Yes No

19b. Breathlessness at rest / on minimal exertion? Yes No

19c. Chest pain? Yes No

19d. Postural hypotension? Yes No

19e. Tachycardia? Yes No

20. In your opinion, was this an appropriate transfusion?
(discuss with your consultant supervisor) Yes No

SECTION THREE

This patient was, in our opinion, overtransfused.

21. What was the weight of this patient, in Kg?