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# Medical management of anaemia

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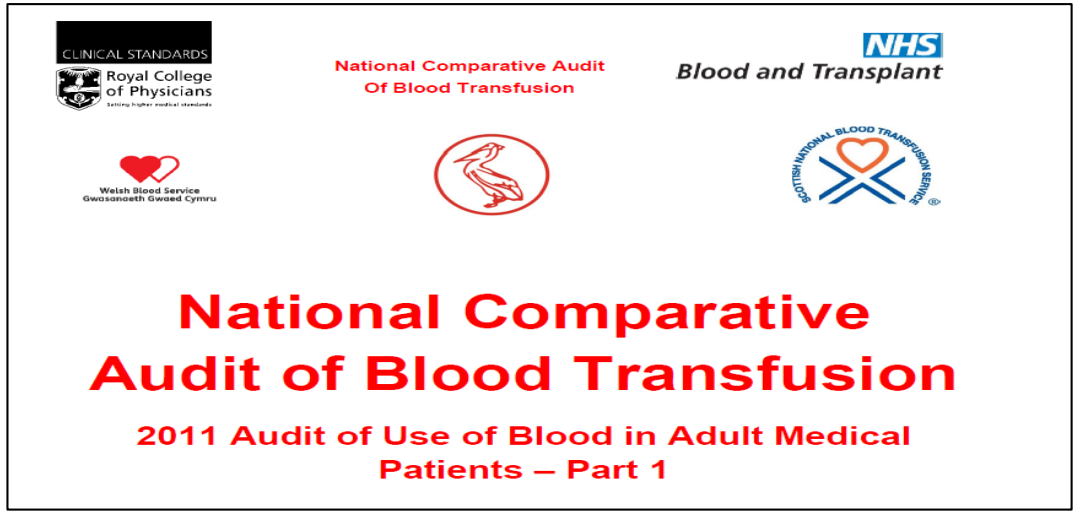


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- All medical RCC transfusions (but only 1 in 3 haematology or oncology cases) in 3 x one week periods

- Medical specialties include:
  *haematology, oncology, acute medicine, general medicine, care of the elderly, cardiology, gastro-intestinal medicine, endocrinology, renal medicine, neurology, rheumatology, respiratory medicine*

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# Audit standards

1. Pre-transfusion haemoglobin (Hb) taken within 3 days of transfusion (and preferably the same day)

2. No non-radiotherapy patient should have a pre-transfusion Hb >10g/dl

3. Post-transfusion Hb taken within 3 days of transfusion (and preferably the same day)

4. No non-radiotherapy patient should have a post-transfusion Hb >12 g/dl

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# Other parameters developed for the audit:

**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 ≤ 78fl

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

**Folate deficiency** = Serum folate ≤ 2mcg/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 '

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## 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

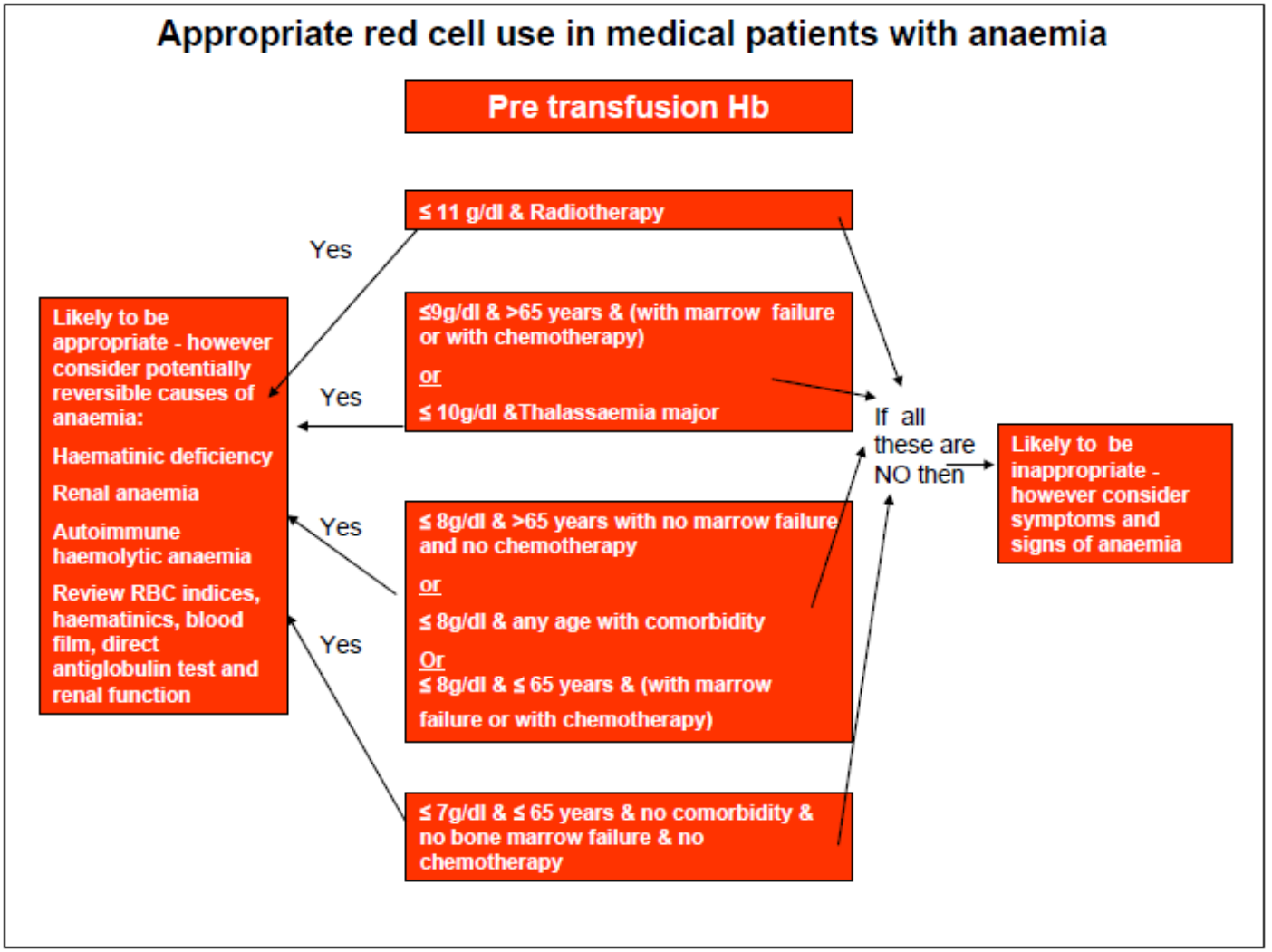
*A: Aplastic anaemia, Acute myeloid leukaemia, Acute lymphoblastic leukaemia, Myelodysplasia, Myeloproliferative disease (myelofibrosis), Chronic leukaemia any type, Myeloma, Non-haematological malignant infiltration (Q6B1 thru Q6B9)*

*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



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# Results

- 9126 cases
- Primary reason for transfusion:
  - 78% - anaemia (n=7128)
  - 19% - blood loss (n=1773)
  - 2% - prophylaxis pre-procedure
- Median age was 73 yrs → → → →
- 53% M / 47% F
- 32% were haematology cases → → →

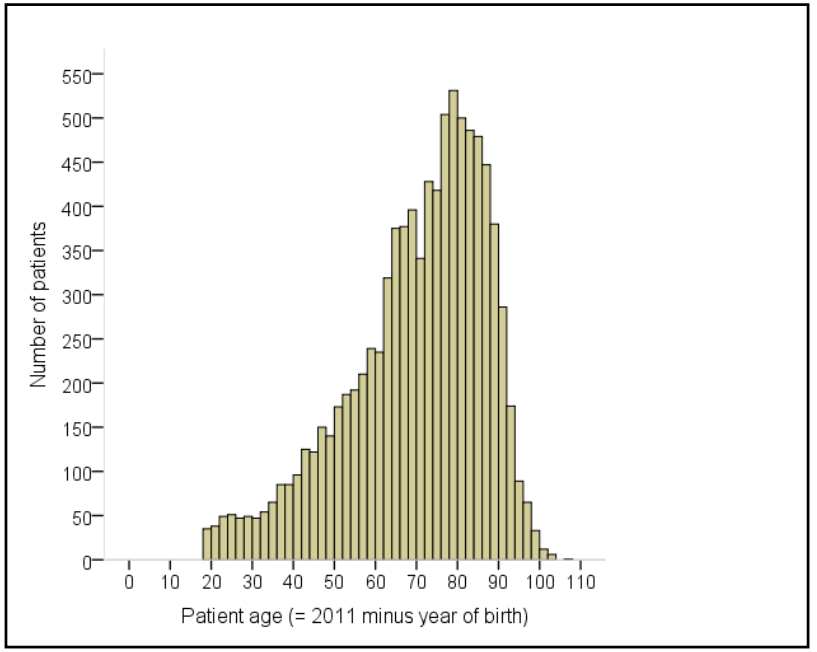


**Table 4 - Clinical presentation**

| | National (9126) % | N |
|---|---|---|
| A. Anaemia under investigation | 20 | 1848 |
| B. Gastro-intestinal | 21 | 1954 |
| C. Haematology | 10 | 946 |
| D. Bone marrow failure | 22 | 2039 |
| E. Nephrology | 10 | 875 |
| F. Oncology | 19 | 1719 |
| G. Other bleeding | 8 | 755 |

*Multiple selections were possible as appropriate*

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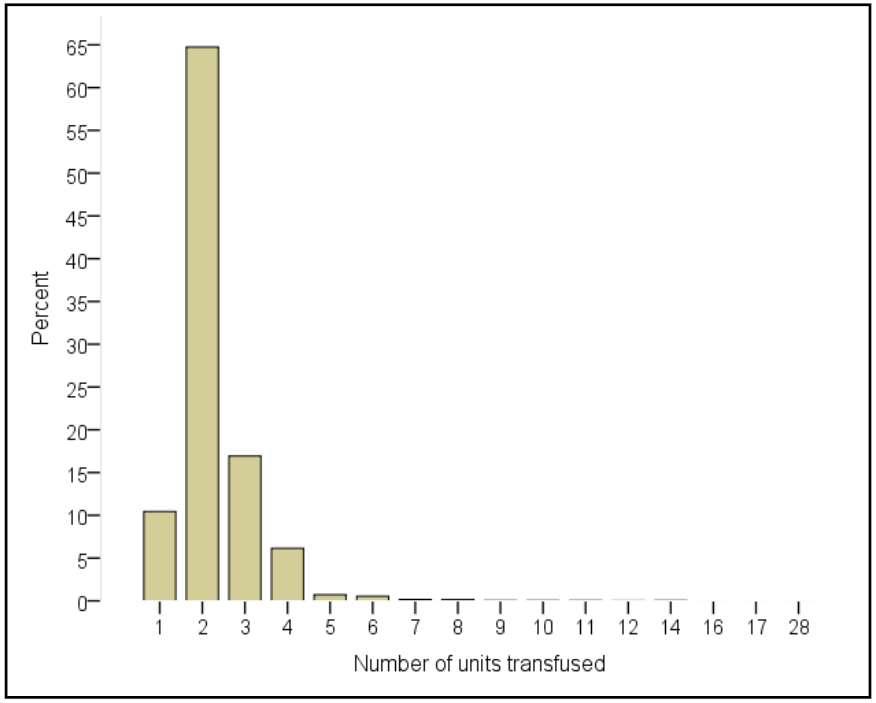
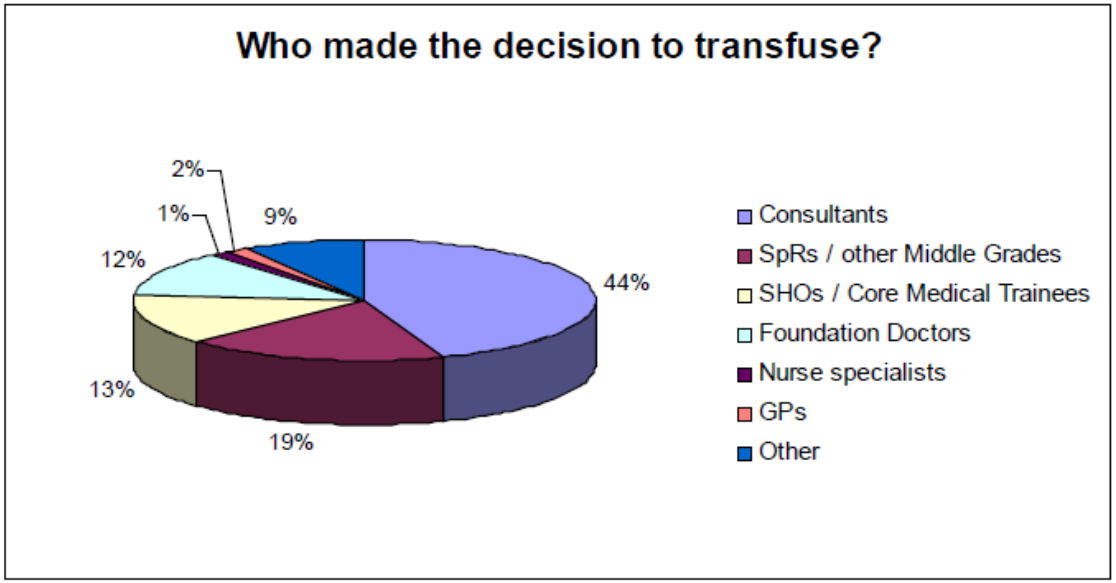



← RCC units transfused per case

↓

**Table 10 - Number of units transfused for patients with anaemia**

| | National (7128) | |
|---|---|---|
| | % | N |
| 1 unit | 11 | 775 |
| 2 units | 67 | 4778 |
| 3 units | 17 | 1190 |
| 4 units | 5 | 324 |
| 5-10 units | 0.7 | 53 |
| 11-28 units | <0.1 | 1 |
| Not known | 0.1 | 7 |



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# Results - audit standards

1. Pre-transfusion haemoglobin (Hb) taken within 3 days of transfusion (and preferably the same day)
   *93% compliance*

2. No non-radiotherapy patient should have a pre-transfusion Hb >10g/dl
   *96.4% compliance*

3. Post-transfusion Hb taken in within 3 days of transfusion (and preferably the same day)
   *Within 3 days 84%, same day 12%*

4. No non-radiotherapy patient should have a post-transfusion Hb >12 g/dl
   *94.1% compliance*

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# Potentially avoidable transfusions

- 53% (4818/9126) of transfusions were considered potentially avoidable:

  1. 20% (1791/9126) had a possible potentially reversible anaemia

  2. 29% (2533/8820) were above the pre-transfusion Hb trigger(s)

  3. 33% (2451/7437) were transfused to more than 2g/dl over the Hb threshold(s)

- 5% (403/8820) of cases fell in to both 1. & 2. above

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# Possible reversible anaemia

Out of the 1791 identified as possible potentially reversible anaemia :

- 13% (n=1201) was possible iron deficiency
  - 16% of F cases , 11% of M cases
- 3% was B12/folate deficiency
- 1.5% had positive direct antiglobulin test
  [possible autoimmune haemolytic anaemia]
- 3.2 % was eGFR ≤30
  [possible renal anaemia]

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# Transfusion above Hb trigger

- 34% of pt.s with anaemia →

| | Pre-transfusion Hb threshold | % above threshold | Number above threshold |
|---|---|---|---|
| [A] All Patients with anaemia[1] | | 34 | 2427/7071 |
| 1. Radiotherapy | 11.0 | 7 | 7/102 |
| 2. Thalassaemia | 10 | 39 | 40/103 |
| 3. Age > 65 with bone marrow failure | 9.0 | 18 | 231/1295 |
| 4. Age > 65 with chemotherapy | 9.0 | 24 | 59/245 |
| 5. Age >65 without bone marrow failure or chemotherapy or comorbidity[1] | 8.0 | 32 | 160/502 |
| 6. Any age with comorbidity[2] | 8.0 | 34 | 1224/3633 |
| 7. Age ≤65 with bone marrow failure | 8.0 | 46 | 185/400 |
| 8. Age ≤65 with chemotherapy | 8.0 | 74 | 138/186 |
| 9. Age ≤65 without bone marrow failure or chemotherapy or comorbidity[1] | 7.0 | 63 | 383/605 |

- 10% (n=106) of pt.s with blood loss [10g/dl]

# Transfusion to >2g/dl above Hb trigger

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- 40% of patients with anaemia →

| | | |
|---|---|---|
| **[A] All anaemia patients with post Hb** | | 5773 |
| Transfused to >2g/dl above the pre-transfusion threshold trigger | | **40% (2335/5773)** |
| | Trigger | |
| 1. Radiotherapy | 13.0 | 11% (10/89) |
| 2. Thalassaemia | 12.0 | 13% (6/46) |
| 3. Age > 65 with bone marrow failure | 11.0 | 13% (115/882) |
| 4. Age > 65 with chemotherapy | 11.0 | 34% (66/192) |
| 5. Age >65 without bone marrow failure or chemotherapy or comorbidity[1] | 10.0 | 45% (183/406) |
| 6. Any age with comorbidity[1] | 10.0 | 44% (1384/3152) |
| 7. Age ≤65 with bone marrow failure | 10.0 | 36% (127/355) |
| 8. Age ≤65 with chemotherapy | 10.0 | 65% (95/147) |
| 9. Age ≤65 without bone marrow failure or chemotherapy or comorbidity[1] | 9.0 | 69% (349/504) |

- 7% (n=116) of patients with blood loss [12g/dl]

# National Comparative Audit of Blood Transfusion

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

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- 3138 of the 4818 potentially avoidable transfusions were then randomly selected for further investigation
- Hospital based auditors asked to review patient notes to collect additional information, and conclude if the transfusion could have been avoided, or whether it was appropriate
- Further data was actually submitted on 1592 cases (51%)

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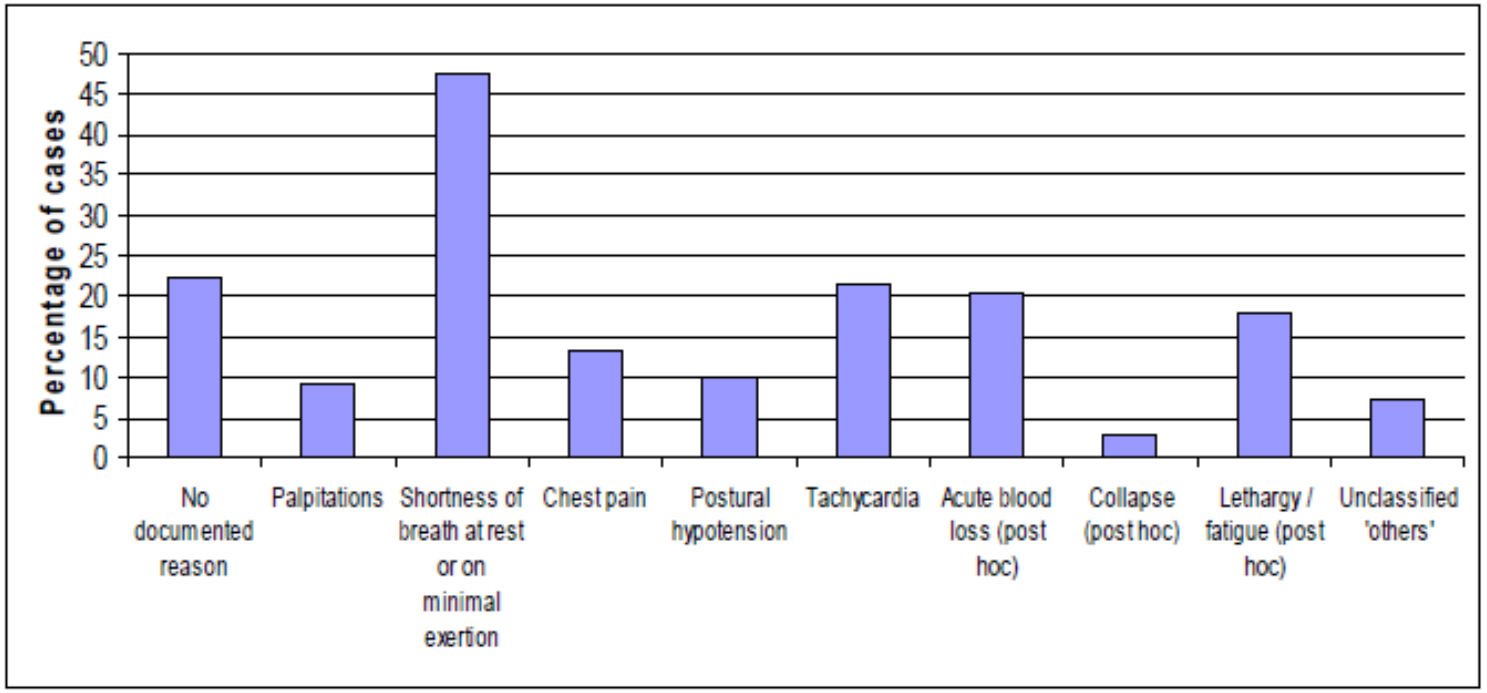
# Possible reversible anaemia

- 747 cases (out of the 1592 cases reported for part 2)

- 71% (n=527) had a documented reason for transfusion in the case notes:



# Possible reversible anaemia

- 25% (n=187) transfusion could have been avoided:

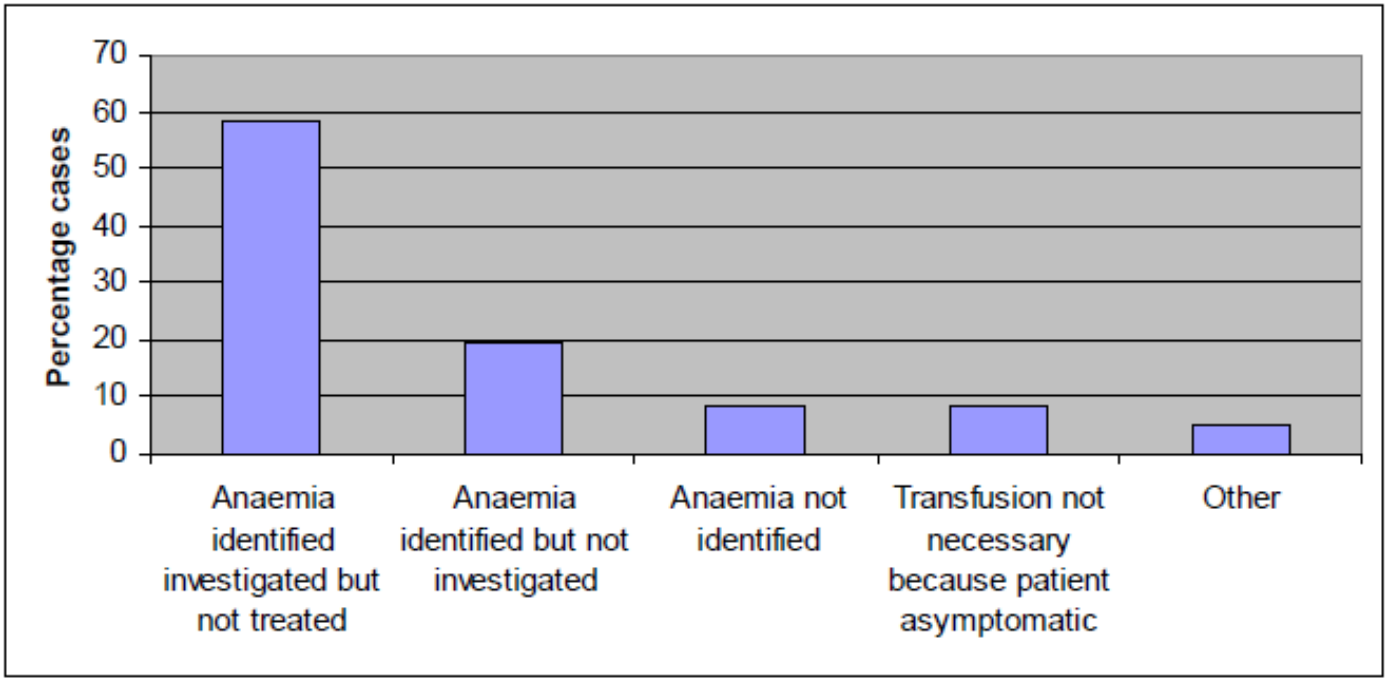



*Figure 3: Reasons why transfusion could have been avoided in 187 patients with possible reversible anaemia*

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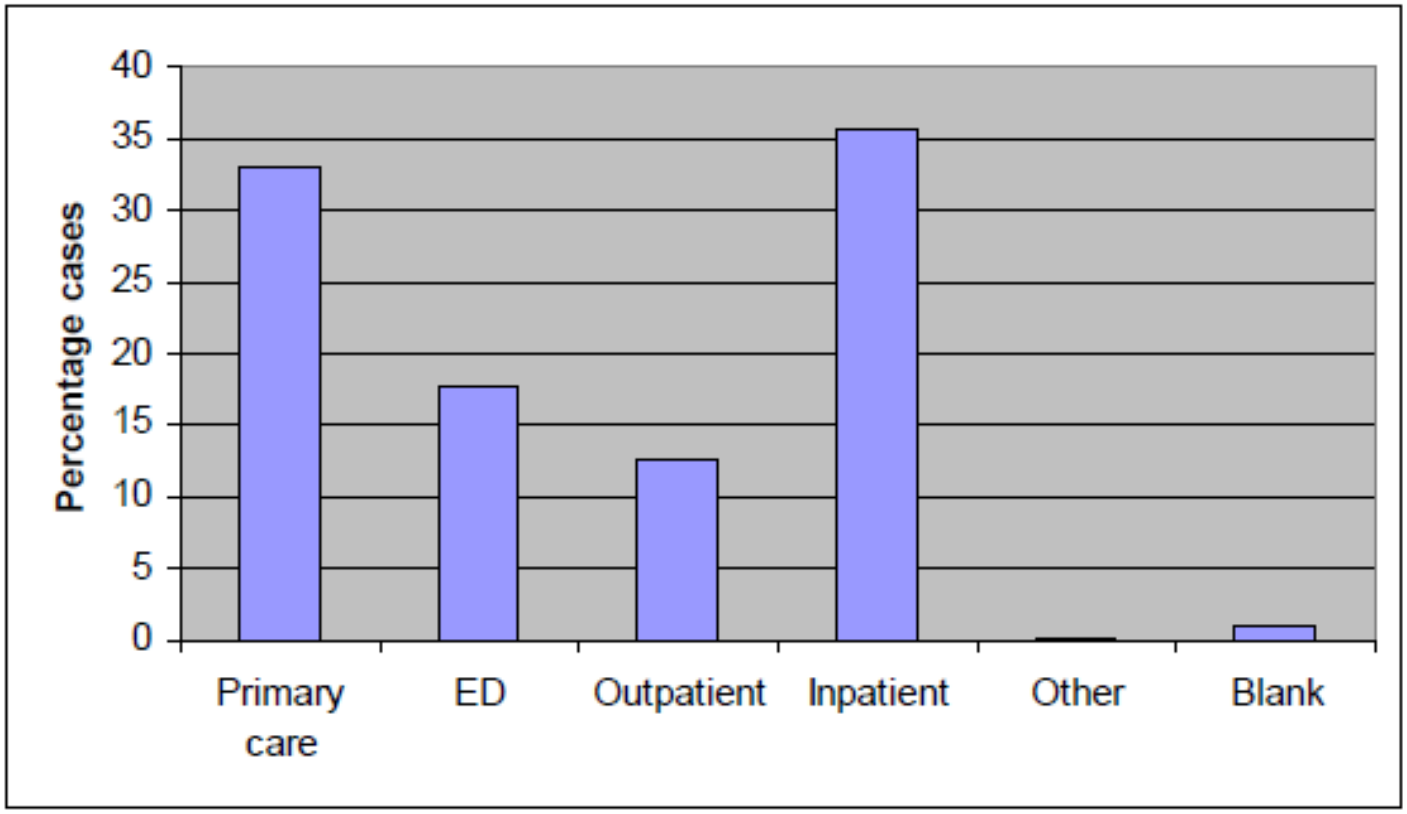
# Possible reversible anaemia

- Which service first noted the anaemia:



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# Possible reversible anaemia

- 372 patients had definite iron deficiency anaemia (out of the 552 'possible' cases identified in part 1)
  - 239 (64%) had a low ferritin
  - 37 (10%) had a transferrin saturation of <20%
  - 96 (26%) had a low MCV alone and no haematinic results
- Treatment of iron deficiency anaemia
  - 75% prescribed iron therapy (252 oral / 20 parenteral / 8 NK)
  - 37 (15%) of the 252 were intolerant to oral iron, but only 8 (22%) of these were given parenteral iron
- Also:
  - 63 patients were given dietary advice
  - 141 patient had treatment for an underlying GI disorder
  - 18 female patients received treatment for menorrhagia

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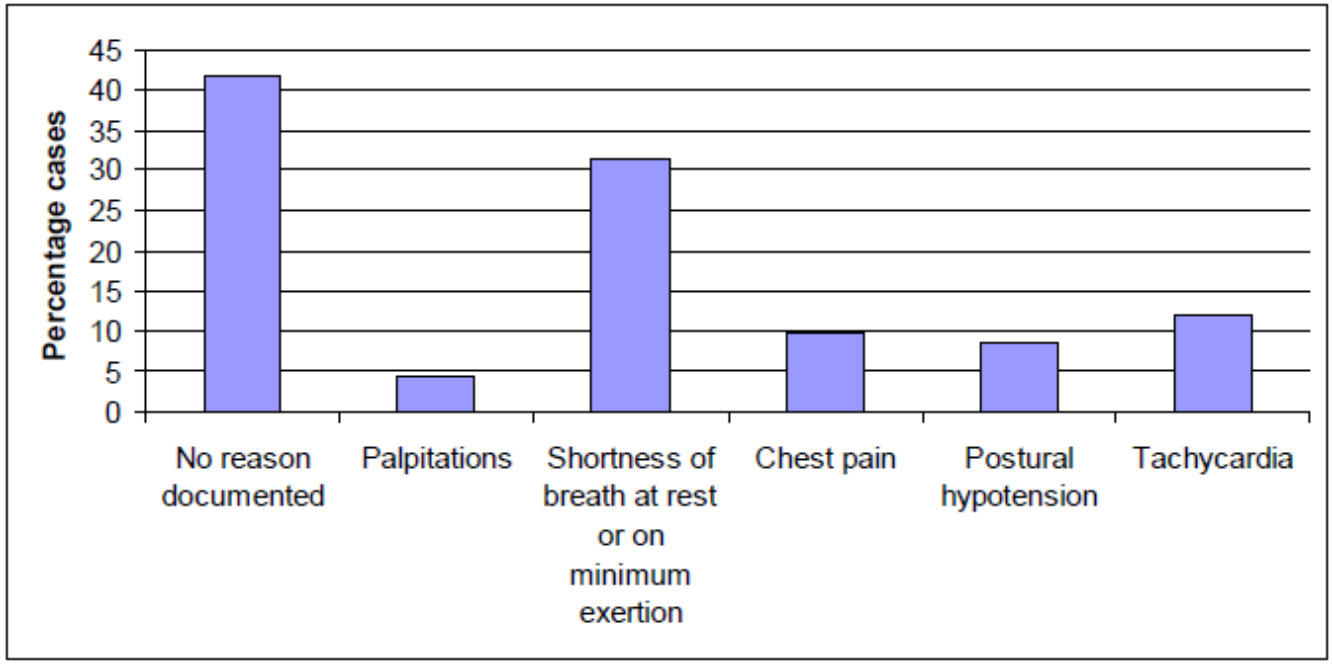
# Transfusion above Hb trigger

- 808 cases (32% of the 2533 cases identified in part 1)
- 438 (54%) had a documented reason for transfusion in the case notes and 338 (42%) did not [it was unclear in 32 cases]:



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# Transfusion above Hb trigger

- Transfusion was not appropriate in 220 (27%) of cases:
  - Of the 438 cases with a documented reason for transfusion, 365 (83%) were appropriately transfused
  - Of the 338 cases with no documented reason for transfusion, 156 (46%) were appropriately transfused

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# Transfused to more than 2g/dl over Hb threshold

- 439 cases (18% of the 2451 cases identified in part 1)
- Significant correlation between body weight and Hb increment per unit transfused was found: the lower the body weight the larger the Hb increment

*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

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# Conclusion [part 2]

- There is evidence of inappropriate use of blood in medical patients due to transfusion of patients with reversible anaemia, transfusion at a higher trigger 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 bodyweight; 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

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# Recommendations [part 2]

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

2. Anaemia should be investigated for an underlying cause.

3. Patients should receive appropriate and timely treatment for anaemia to avoid unnecessary transfusion, e.g. parenteral iron for treatment of iron deficiency anaemia if it is not possible to use oral iron.

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.

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# Recommendations [part 2]

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.

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.

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

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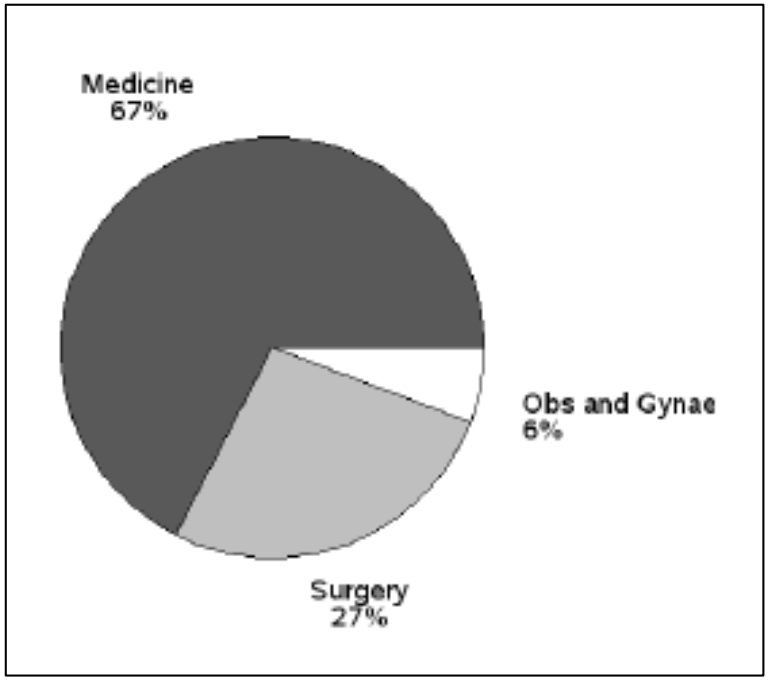
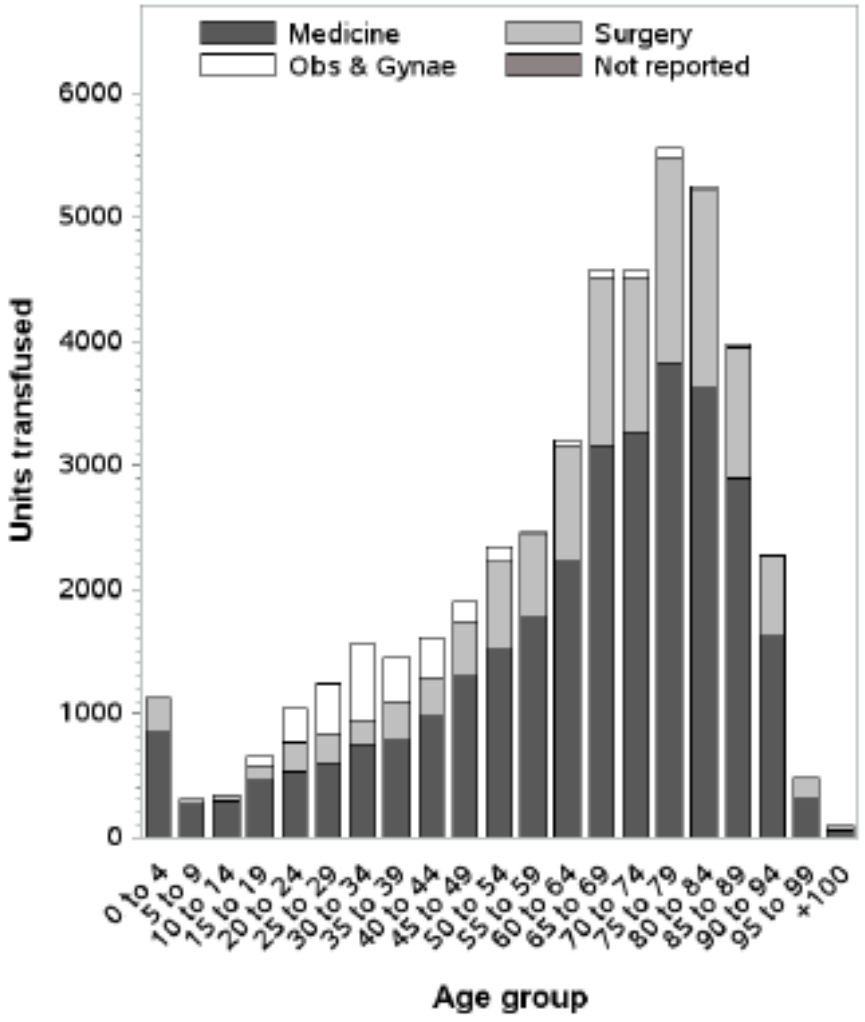
# National Survey Red Cell Use 2014

Table 1 Number of red cell units transfused, by cycle

| | National |
|---|---|
| Cycle 1 | 21683 |
| Cycle 2 | 24428 |
| Total Units | 46111 |



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# National Survey Red Cell Use 2014

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

| Medicine specialty | Sub-category | National N | National % |
|---|---|---|---|
| Neonatal/fetal | Top up | 479 | (1.0) |
| | Exchange | 9 | (0.0) |
| | Large volume transfusion | 24 | (0.1) |
| | Intrauterine transfusion | 2 | (0.0) |
| | Other neonatal | 40 | (0.1) |
| | **Total neonatal** | **554** | **(1.2)** |
| GI bleed | Upper acute | 2195 | (4.8) |
| | Lower acute | 1237 | (2.7) |
| | Upper chronic | 337 | (0.7) |
| | Lower chronic | 537 | (1.2) |
| | Site of bleeding unknown | 1071 | (2.3) |
| | **Total GI bleed** | **5377** | **(11.7)** |
| Non-haematological anaemia | Renal failure | 2257 | (4.9) |
| | Cancer non haem | 4549 | (9.9) |
| | Iron deficiency | 1260 | (2.7) |
| | B12/folate def | 104 | (0.2) |
| | Chronic disorders | 1319 | (2.9) |
| | Critical care | 1663 | (3.6) |
| | Other anaemia | 1484 | (3.2) |
| | **Total non-haematological anaemia** | **12636** | **(27.4)** |
| Haematological | MDS | 2890 | (6.3) |
| | AML including APML | 1983 | (4.3) |
| | ALL | 537 | (1.2) |
| | Myeloma | 1083 | (2.3) |
| | Hodgkins/NHL/CLL | 1876 | (4.1) |
| | Acquired Haemolytic Anaemia | 238 | (0.5) |
| | Thalassaemia | 722 | (1.6) |
| | Sickle cell disease | 1350 | (2.9) |
| | Other inherited anaemia | 202 | (0.4) |
| | Myeloprolerative disease | 575 | (1.2) |
| | CML | 218 | (0.5) |
| | Aplastic anaemia | 323 | (0.7) |
| | Other haematological | 519 | (1.1) |
| | **Total haematological** | **12516** | **(27.1)** |
| **TOTAL Medicine (%)** | | **31083** | **(67.4)** |

% Percentage of 46111 units nationally and 857 units at Anonymous

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# Clinical scenarios

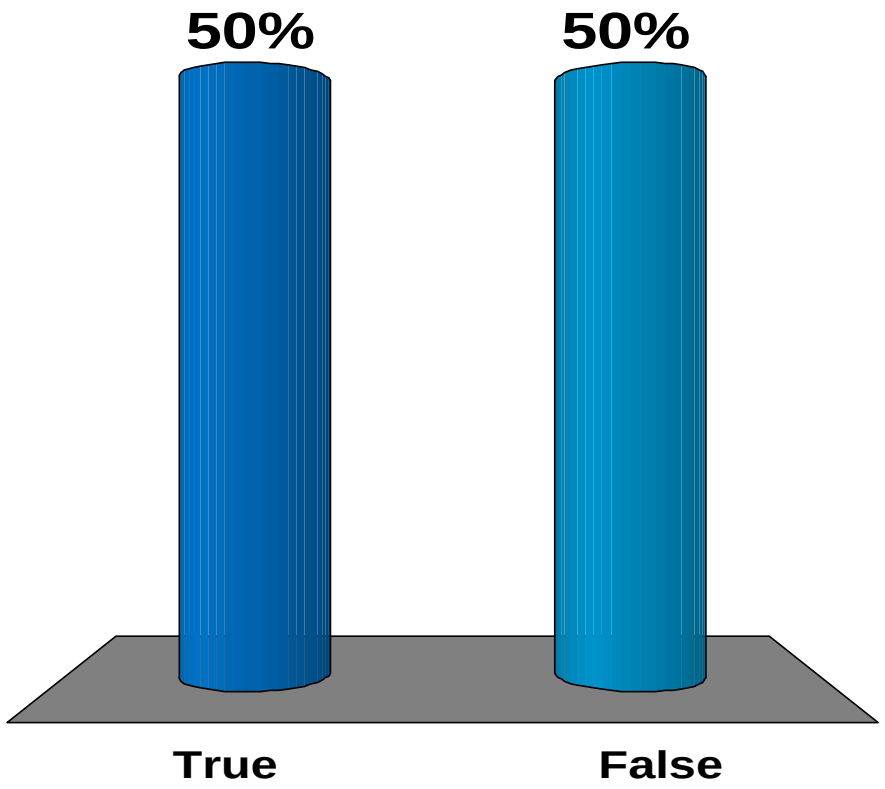
# TRUE OR FALSE?

A GP refers in an asymptomatic 30 year old female with a history of menorrhagia and a Hb 44g/L.

Initial treatment should include  a 2 unit transfusion of red cells.

A. True

B. False

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# TRUE OR FALSE?

A GP refers in an asymptomatic 30 year old female with a history of menorrhagia and a Hb 44g/L.
Initial treatment should include a 2 unit transfusion of red cells.

FALSE

In chronic anaemia transfusion is based on symptoms, not Hb. Iron deficiency anaemia secondary to menorrhagia is easily treated with oral iron supplements. Hb should increase by approximately 15g/L per week.

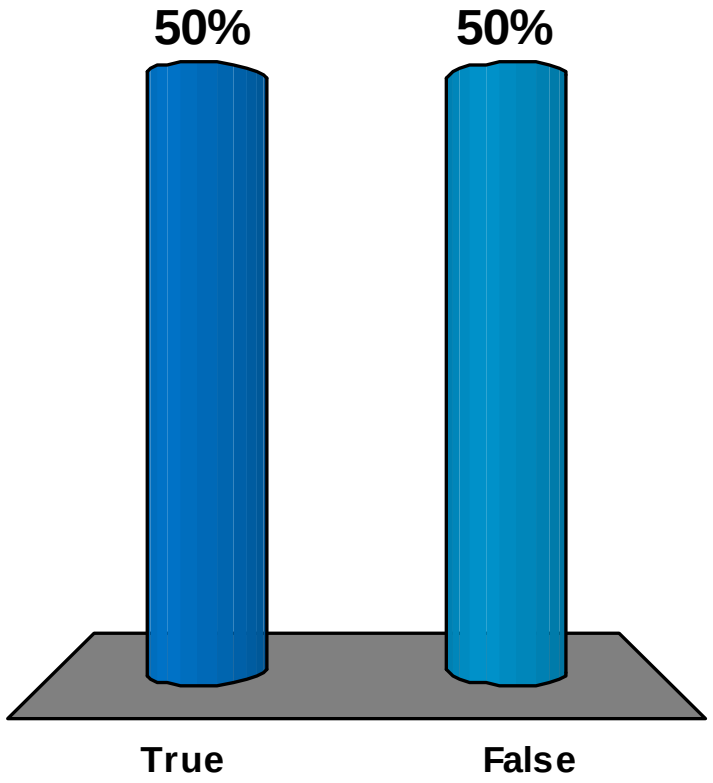
# TRUE OR FALSE?

An 82 year old male with known diabetes and hypertension has a repeat Hb of 101g/L following admission for recurrent chest pain.

It is appropriate to transfuse him red cells.

A. True

B. False



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# TRUE OR FALSE?

An 82 year old male with known diabetes and hypertension has a repeat Hb of 101g/L following admission for recurrent chest pain. It is appropriate to transfuse him red cells.

FALSE

There is no evidence to support transfusing patients with an Hb>100g/L.

In acute blood loss transfusion is indicated after 30-40% loss of blood volume (>1500-2000mls in adult).

Peri-operative transfusion may be indicated if Hb<70g/L or <80g/L in elderly patients with known cardiovascular disease, although a full clinical assessment must first be made.

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# Case studies

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# 1.

- A 78 year old man felt unwell and had a Hb 58g/L. He was otherwise asymptomatic and was known to have iron deficiency anaemia.
- The attending doctor authorised a 3 unit red cell transfusion.
- The post transfusion Hb was 76g/L.

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# Appropriate or inappropriate transfusion?

A. Appropriate – pt. unwell (but also should be started on iron)

B. Inappropriate – number of units for the pt.’s age

C. Appropriate – pt. had Hb >20g/l below transfusion ‘trigger’

D. Inappropriate – pt. asymptomatic of anaemia

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# Inappropriate transfusion of red cells to an asymptomatic iron deficient patient

- A 78 year old man felt unwell and had a Hb 58g/L. He was otherwise asymptomatic and was known to have iron deficiency anaemia.
- The attending doctor authorised a 3 unit red cell transfusion.
- The post transfusion Hb was 76g/L.

*from the SHOT 2013 report*

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# 2.

- A patient weighing 35.1kg with small bowel angiodysplasia and anaemia received 6 red cell transfusions over a 3 month period.

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# What are the clinical issues here?

Multiple transfusions over short time period

Low patient body weight

RCC transfusion not indicated for this condition

Oral iron is first line treatment

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# A patient of low body weight repeatedly over-transfused

- A patient weighing 35.1kg with small bowel angiodysplasia and anaemia received 6 red cell transfusions over a 3 month period.
- A fall precipitated her admission and her Hb was then found to be 222 g/L and she was generally deteriorating. She was dyspnoeic with a tachycardia and had symptoms consistent with polycythaemia.
- A haematology specialist registrar noted the patient was plethoric and she then required repeated venesection. She developed renal impairment with long term morbidity.

*from the SHOT 2012 report*

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# 3.

- A 78 year old female, weight 63.3kg, with a possible allergic transfusion reaction.
- On assessment, there was no evidence of an allergic reaction and a diagnosis of TACO was made. The patient had been admitted to the emergency department (ED) unwell and feeling faint. All vital signs were within normal limits, Hb 59g/L with a microcytic blood picture, likely cause chronic iron deficiency.
- Two units of red cells were ordered by the ED doctor. The first unit was begun at 14:12 and she was transferred to the AMU. During a consultant led ward round, 2 more red cell units were prescribed.

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# What do you think was the outcome?

Required a further 2 RCC units 24 hours later

Reviewed again – tx. withheld in favour of iron therapy

Continued with management plan – with poor outcome

Good Hb increment with first 2 units – other 2 withheld

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# Fatal TACO following red cell transfusion for probable chronic iron deficiency anaemia

- A 78 year old female, weight 63.3kg, was brought to the attention of a transfusion practitioner as a possible allergic transfusion reaction.
- On assessment, there was no evidence of an allergic reaction and a diagnosis of TACO was made. The patient had been admitted to the emergency department (ED) unwell and feeling faint. All vital signs were within normal limits, Hb 59g/L with a microcytic blood picture, likely cause chronic iron deficiency.
- Two units of red cells were ordered by the ED doctor. The first unit was begun at 14:12 and she was transferred to the AMU. During a consultant led ward round, 2 more red cell units were prescribed. She received 3 red cell units and approximately 290mL of the fourth unit when she developed massive pulmonary oedema and left ventricular failure. Her pulse and blood pressure at baseline and at the time of the reaction were 98 and 82bpm and 120/75mmHg and 152/111 respectively. An electrocardiograph showed atrial fibrillation and T wave changes.
- She was admitted to ITU where she received continuous positive airway pressure (CPAP) and a furosemide infusion, however she subsequently died.

*from the SHOT 2013 report*

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# 4.

- A middle-aged woman with known alcoholic liver disease presented with haematemesis estimated to be more than 500 mL and was urgently transfused 7 units of red cells without monitoring of the Hb.
- The Hb on the previous day was 11.3 g/dL.
- The patient was not reviewed regularly during transfusion.

Appropriate to transfuse?

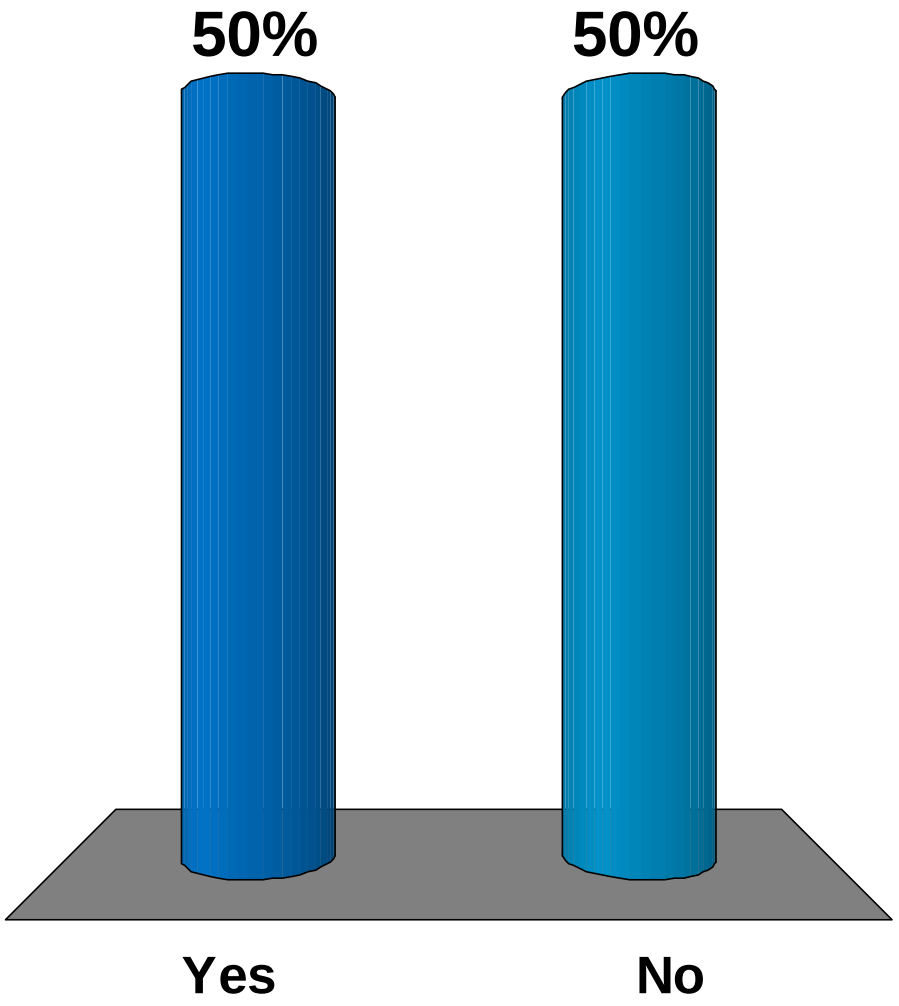
YES

NO

# Appropriate to transfuse?

A. Yes

B. No

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How would you ‘dose’ RCCs?

Against initial Hb

Against initial Hb and estimated blood loss (ongoing)

Against regular Hbs and symptoms

Against regular Hbs check

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# Haematemesis with excessive transfusion and TACO

- A middle-aged woman with known alcoholic liver disease presented with haematemesis estimated to be more than 500 mL and was urgently transfused 7 units of red cells without monitoring of the Hb.
- The Hb on the previous day was 11.3 g/dL.
- The patient was not reviewed regularly during transfusion.
- Her Hb rose to 16.4 g/dL post-transfusion requiring venesection of 2 units and admission to high dependency unit (HDU) for ventilation because of pulmonary oedema.
- She later died of multi-organ failure. It was felt that death was related to the excessive transfusion.

*from the SHOT 2011 report*

NHS Blood and Transplant

# Summary of transfusion of adult medical patients

- Anaemia was the primary reason for transfusion in 78% of cases.
- Most commonly 2 units of red cells were given (67% of cases).
- Transfusion at above Hb trigger (29%) and to >2g.dl above Hb trigger (33%)
- 20% of transfusions had a possible potentially reversible anaemia

  - 13% of were possible iron deficiency

- Patients should receive appropriate and timely treatment for anaemia to avoid unnecessary transfusion

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# End

Thank you

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