



**National Comparative  
Audit of the use of blood in  
Primary, Elective, Unilateral Total  
Hip Replacement  
for**

**St. Elsewhere's Hospital**

**July 2007**

## **Acknowledgements**

We wish to thank all those who have participated in the National Comparative Audit of the use of blood in Primary, Elective, Unilateral Total Hip Replacement. 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.

We are also indebted to the following hospitals that agreed to pilot the audit:

The South West London Elective Orthopaedic Centre	
Derby City General Hospital	Wythenshawe Hospital
Derriford Hospital	Barnet Hospital
Leighton Hospital	Russells Hall Hospital
BMI The Chiltern Hospital	Whiston Hospital
University Hospital of North Staffordshire	BUPA Hospital Bristol
North Devon District Hospital	The Yorkshire Clinic
Queen's Medical Centre	The London Clinic
Royal United Hospital	Morrison Hospital
Taunton & Somerset Hospital	The Barlborough NHS Treatment Centre
Torbay District General Hospital	Wrexham Maelor Hospital
Altnagelvin Area Hospital	

## **Report prepared by the National Comparative Audit of Blood Transfusion Use of blood in Primary, Elective, Unilateral Total Hip Replacement Project Group:**

**Dr Hari Boralessa**, Consultant Haematologist, NHS Blood & Transplant; **Mr. Keith Tucker**, Consultant Orthopaedic Surgeon & President, British Hip Society; **Dr. Sandy Kidd**, Consultant Anaesthetist, South West London Elective Orthopaedic Centre; **Karen Madgwick**, Transfusion Practitioner, North Middlesex University Hospital; **Derek Lowe**, Medical Statistician, Royal College of Physicians; **David Dalton**, Project Officer, National Comparative Audit; **John Grant-Casey**, Project Manager, National Comparative Audit.

## **Members of the National Comparative Audit of Blood Transfusion Steering Group**

Prof. Mike Murphy (Chair), NHS Blood and Transplant; Dr Ann Benton, Lead Consultant for Better Blood Transfusion in Wales; Dr Hari Boralessa, NHS Blood and Transplant; Dr Hannah Cohen, British Society for Haematology; John Grant-Casey, NHS Blood and Transplant; Sandra Gray, Scottish National Blood Transfusion Service; Mike Hayward, Royal College of Nursing; Catherine Howell, NHS Blood and Transplant; Joan Jones, Welsh Blood Service and Institute of Biomedical Science; Jonathon Lloyd, Birmingham and Black Country Strategic Health Authority; Derek Lowe, Royal College of Physicians; Prof. John Lumley, Royal College of Surgeons; Dr Kieran Morris, Northern Ireland Blood Transfusion Service; Dr AJ Mortimer, Royal College of Anaesthetists; Dr Denise O'Shaughnessy, Department of Health; Elaine Parris, NHS Blood and Transplant; Dr Hafiz Qureshi, University Hospitals of Leicester & NHS Blood and Transplant; Joan Russell, National Patient Safety Agency; Tanya Hawkins, Transfusion Practitioner; Dr Craig Taylor, NHS Blood and Transplant; Mr John Thompson, Royal College of Surgeons; Dr Gill Turner, Norfolk and Norwich University Hospital; Adrian Coplestone, National Blood Transfusion Committee; Jonathan Potter, Royal College of Physicians, Dr. Clare Taylor, SHOT.

## **For correspondence, please contact:**

John Grant-Casey, Project Manager, National Comparative Audit of Blood Transfusion, FREEPOST (SCE 14677), BIRMINGHAM, B2 4BR  
Email [john.grant-casey@nbs.nhs.uk](mailto:john.grant-casey@nbs.nhs.uk) Tel: +44 (0)1865 440046

<b>Contents</b>	<b>Page</b>
<b>How to use this report</b>	4
<b>Executive summary</b>	5
<b>Recommendations</b>	7
<b>Introduction</b>	8
Why is this audit necessary?	
What does this audit do?	
What does this audit aim to achieve?	
The principal stakeholders	
<b>Method</b>	9
Recruiting NHS Trusts and Independent hospitals	
Nature and size of the audit case sample	
The data collection method	
Pilot	
Presentation of results	
Standards and Criteria	
<b>RESULTS</b>	
<b>Section 1. Principal Findings</b>	11
<b>Section 2. Supplementary Findings</b>	19
<b>Section 3. Supporting Comparative Statistics</b>	21
Table 1 – Co-morbidity	21
Table 2 – ASA Grade	21
Table 3 – Hospital Transfusion Committee	21
Table 4 –Total blood loss	22
Table 5 – Duration of surgery	22
Table 6 – Patient age	22
Table 7 – Gender	22
Table 8 – Ordering blood	23
Table 9 – Hip replacements performed in past year	23
Table 10 – Grades of surgeon performing the operation	23
Table 11 – Grade of anaesthetist	24
Table 12 – Type of anaesthesia	24
Table 13 – Use of low molecular weight heparin	24
Table 14 – Audits of blood use in last year	24
<b>Section 4. Supporting National Statistics</b>	
Table 15 – Transfusion by ASA grade	25
Table 16 – Transfusion by co-morbidity	25
Table 17 – Combinations of anaesthesia	25
Table 18 – Patients ventilated if receiving general anaesthetic	26
Table 19 – Aprotinin and Tranexamic Acid	26
Table 20 – Pre-operative antiplatelet use & blood loss	26
Table 21 – Low molecular weight heparin & blood loss	27
Table 22 – Long term anticoagulation & blood loss	27
Table 23 – Transfusion by use of heparin	27
Table 24 – Transfusion by length of surgery	27
Table 25 – Comparison of organizational factors – NHS v Independent	28
<b>References</b>	29
<b>Communication plan</b>	30
<b>Appendices</b>	
A. Data Items included in the Organizational Audit	31
B. Data Items included in the Episode Audit	32

## How to use this report

The information shown in this report has been arranged to present the data in the most clinically relevant fashion. The report is in 4 sections.

**Section 1** measures practice against 2 Key Performance Indicators (see pages 11 & 12) and 4 Standards for Best Practice (page 13 onwards).

**Section 2** contains supplementary findings, again arranged in order of clinical relevance. The results are of interest, but are not necessarily such important indicators of practice as those discussed in Section 1.

**Section 3** presents supporting comparative statistics and is useful when you wish to inquire about possible reasons why your practice may differ from other participating hospitals, should this be the case. It can be argued, for example, that the patients' state of health, the duration of their surgery, or their age could be factors that influence the decision to transfuse or the amount of blood transfused. If you want to compare your sample of patients for these factors against the national picture, refer to the following tables in this section:

- *To compare your patient's co-morbidity* – **See Table 1**
- *To compare your patient's health as measured by ASA Grade* – **See Table 2**
- *To compare length of surgery* – **See Table 5**
- *To compare patient's ages* – **See table 6**

You may consider that organizational factors, such as orthopaedic surgeon attendance at the Hospital Transfusion Committee, may be an important influence on your hospital's practice. To use this information – **See Table 3**

**Section 4** presents supporting national statistics which are relevant to the audit and of some general interest, but which are not so clinically significant as to have an immediate impact on the quality of care. For example, the relationship between long-term anticoagulation and blood loss is shown in **Table 22**.

References are provided enabling the reader to go to the main sources of evidence for the audit.

As with all audits in the programme, hospitals are welcome to receive their raw data on which this report is based. To obtain this, please contact the Project Manager whose details appear on page 2.

## Executive summary

Practice was measured against 2 performance indicators and 4 practice standards.

### **Key Performance Indicator 1 - % of patients transfused**

Nationally, 7465 patients were audited. Of these, 1823 (25%) were transfused, representing a reduction of about 50% in the numbers being transfused in the year 2000. For your hospital **3 (8%)** were transfused.

### **Key Performance Indicator 2 – average number of units of blood transfused**

Two-thirds of the patients who were transfused received two units of blood. About one-quarter (27%) received three or more units. See your hospital's results on page 12.

It is important that patients are properly assessed and prepared for surgery so that they are not put at risk of unnecessary transfusion or risk of bleeding.

### **STANDARD STATEMENT 1**

*Hospitals have effective means of assessing a patient's anaemia prior to surgery and take appropriate corrective action when necessary.*

**Findings:** *Virtually all hospitals state that they have a mechanism for identifying and correcting anaemia pre-operatively.*

### **STANDARD STATEMENT 2**

*Patients assessed in the pre-assessment clinic have their anaemia managed effectively.*

**Findings:** *A significant number of patients are going for surgery without having had a pre-operative Hb level performed during the four weeks preceding surgery. This means hospitals may not have known if the patients were anaemic prior to surgery. Nationally, the figure was 29% (2177/7414), and for your hospital this was 8% (3/40).*

*15% (795/5237) of patients are admitted for surgery with a haemoglobin of less than 12 g/dl which increases the likelihood of receiving donor blood threefold. In your hospital this figure was 14% (5/37)*

It is important not to transfuse patients unnecessarily. Transfusing only those who need blood will minimize risk of transfusion reactions and hazards associated with invasive procedures, and reduce costs.

### **STANDARD STATEMENT 3**

*Postoperatively, all patients who are asymptomatic are not transfused unless their pre-transfusion Hb concentration is <8 g/dl.*

**Findings:** *47% (91/195) of hospitals had a policy that a decision to transfuse a stable post-operative patient should be consistently based on the patient's Hb level. Your hospital **DID NOT** have a policy.*

*There were 1330 patients transfused during days 1 to 14 after surgery. Of these, 88% (1167) had a postoperative pre-transfusion Hb tested. **In your hospital the figure was 100% (2/2).***

*To meet the standard, the postoperative, pre-transfusion Hb result should be less than 8 g/dl. 52% (604/1167) of Hb values were less than 8 g/dl. **In your hospital the figure was 50% (1/2).***

*In the period 24 hours to 14 days after surgery the haemoglobin concentration is more likely to be the trigger for transfusion. Therefore we excluded patients who were transfused during surgery and on the same day as surgery. 48% of patients transfused had a pre-transfusion haemoglobin greater than 8 g/dl and in some of these patients transfusion could have been avoided.*

### **STANDARD STATEMENT 4**

*Patients who are transfused 2 or more units of blood and whose post-transfusion Hb is above 10 g/dl, may have been transfused excessively.*

**Findings:** *The number of units transfused was known for 1314 of 1330 patients transfused during days 1 to 14 after surgery. 17% (229) received one unit, 70% (922) received two units and 12% (163) received three or more units.*

*Of those given 2 or more units, 65% (609/944) had a post-transfusion Hb level of 10 g/dl or more. The post-transfusion Hb was unknown for 141 cases.*

***In your hospital 0% (0/1)** of patients who received 2 or more units of red cells had a post-transfusion Hb level of 10 g/dl or more.*

**Comment:** *The majority of patients who have received 2 or more units of blood may have been unnecessarily over-transfused.*

## **Recommendations**

- **In order to minimize the likelihood of a patient receiving a donor blood transfusion, pre-operative anaemia should be corrected as far as possible.**
- **Hospitals should have a written policy for identification and management of anaemia in pre-assessment clinics.**
- **Surgeons seeing patients at initial consultation must ensure that patients have a full blood count, and that anaemic patients are investigated and steps taken to correct the anaemia before surgery.**
- **General Practitioners referring patients for surgery should take measures to optimize the haemoglobin.**
- **Every hospital should have a transfusion policy to guide transfusion in the peri- / post-operative period, based upon one or more of the following:**
  - **Symptoms**
  - **Haemoglobin concentration**
  - **Estimated blood loss**
- **Trusts should ensure that their prescribers are aware that it is not necessary to transfuse patients who are asymptomatic, not bleeding and have a haemoglobin of  $\geq 8\text{g/dl}$ .**
- **In order to avoid over-transfusion, single-unit transfusions may be appropriate. Hospitals should review the number of units transfused against their patients' post-transfusion Hb at regular intervals.**
- **Nationally, orthopaedic representation at Hospital Transfusion Committees needs to be improved and more consistent attendance encouraged.**

## Introduction

### Why is this audit necessary?

Orthopaedic surgery accounts for 10% of red cells used in hospital <sup>(1)</sup>. Studies have demonstrated wide variation in practice in the use of red cells for the same elective orthopaedic procedure such as total knee replacement and total hip replacement surgery <sup>(2)(3)</sup>.

Despite the availability of national guidelines for red cell transfusion, several audits have shown that a significant amount (10 – 15%) of red cell transfusions could be avoided in the perioperative period <sup>(4)</sup>. In view of the recognised risks of transfusion and the decreasing availability of donor blood, every effort should be made to minimise inappropriate transfusions.

Health Service Circular 2002/009(BBT2) <sup>(5)</sup> sets out a programme of action for Chief Executives of NHS Trusts to avoid unnecessary use of red cells in clinical practice.

### What does this audit do?

- Assesses variation in practice for performance indicators such as % of patients transfused and number of units of red cells transfused per procedure
- Look at the effect of preoperative haemoglobin, pre-transfusion haemoglobin, ASA score, and the use of autologous cell salvage on performance indicators.
- Audits orthopaedic transfusion practice against standards derived from British Orthopaedic Association, Association of Anaesthetists of Great Britain and Ireland, Better Blood Transfusion 2 circular from the Chief Medical Officer of Health, and British Committee for Standards in Haematology guidelines
- Presents benchmark data and audit findings to participating hospitals for comparative purposes
- Presents data to other stakeholder organisations

### What does this audit aim to achieve?

- The collection of sufficient credible data from a large and representative sample of hospitals
- The production of a report that is widely disseminated to those stakeholders who have the ability to influence and improve the practice of using blood for this procedure
- The commencement of a dialogue which will lead to meaningful multidisciplinary discussion on the appropriateness of blood transfusions in patients undergoing this procedure
- A reduction in the inappropriate use of red blood cells in patients undergoing this procedure

### Who are the principal stakeholders?

British Hip Society	The British Orthopaedic Association
The Royal College of Surgeons	The Royal College of Anaesthetists
NHS Trusts	Independent Hospitals
NHS Blood and Transplant	

## Method

### Recruiting NHS Trusts and independent hospitals

All NHS Trusts in England were invited to participate in the audit, as were all independent hospitals. Trusts and hospitals in Wales, Northern Ireland and Scotland were invited to participate via nominated contacts within the blood services in those countries. There was no lower eligibility limit on the number of procedures normally performed.

A letter about the audit was sent from the Clinical Audit Lead to the Chief Executive, Medical Director and Clinical Audit Manager in each English NHS Trust. Electronic copies of this letter were sent via email to Trust Transfusion Laboratory Managers, Transfusion Practitioners, and Consultant Haematologists with responsibility for blood transfusion. A similar letter was sent to managers of independent hospitals.

Non-responders were sent a reminder letter on August 28<sup>th</sup> 2006 and the audit clinical lead telephoned the Medical Directors of Trusts who did not respond to the follow up letter.

### Participation rates

	Invited n	Participated n (%)
English NHS Trusts	167	139 (83%)
English Independent	177	98 (55%)
Welsh NHS	12	8 (67%)
Welsh Independent	5	2 (40%)
Scottish Independent	5	2 (40%)
Northern Ireland NHS	4	2 (50%)

**Your Trust contributed organizational data**

**Your hospital contributed data on 40 cases**

### Nature and size of the audit case sample

The target sample was 40 consecutive patients undergoing the procedure prospectively or on a recent retrospective basis depending on their operational preferences always provided the cases were, as far as possible, consecutive, so as to eliminate selection bias. In all 223 hospitals submitted audit data for 7465 cases, median 40 cases per hospital, inter-quartile range 28-40 cases. 14 other cases were excluded from analysis due to the surgery date not being known and 73 (from 53 sites) because duplicate records had been submitted.

All patients in the consecutive sample were to be audited even if they had not received a blood transfusion. Included were patients undergoing a primary procedure as opposed to a revision operation, and on an elective basis. Excluded were patients admitted for other causes, such as a fractured neck of femur, and patients undergoing bilateral hip replacement. Data on transfusion and full blood count was collected for the period 28 days pre-operatively to 14 days post-operatively, which was thought to be an appropriate period around the procedure.

86% of the 7465 audit cases submitted had operations performed from June to December 2006, as shown in the table overleaf:

Month of surgery	Cases	Month of surgery	Cases	Month of surgery	Cases
January 2006	66	June 2006	450	November 2006	1492
February 2006	69	July 2006	534	December 2006	581
March 2006	145	August 2006	741	January 2007	279
April 2006	161	September 2006	812	February 2007	17
May 2006	248	October 2006	1844	March 2007	26

### The data collection method

Data entry was directly onto the audit tool webpage designed for the purpose (see appendix A and B for items included). This was the second transfusion audit to use web entry and the data checking facilities were not as advanced as they will be for future audits. There was also a considerable delay of 3 months in exporting the transfusion data due to IT problems. Some data cleaning was necessary, particularly to do with date sequences, to gain consistency between different scales of measurement e.g. blood loss and in identifying duplicate cases and data outliers.

### Pilot

The audit tool was piloted on paper in March 2006 by 22 hospitals representing a mix of District General Hospitals and large University hospitals. A short technical pilot of electronic data capture was undertaken in August 2006. The main audit began in October 2006.

### Presentation of results

Wherever possible the audit question numbers have been added within tables of results to facilitate reference to the actual questions in the audit tool in Appendix A.

National results are presented as percentages for categorical data and as median and inter-quartile range (IQR) for numerical data. Missing data are reflected by variation in patient denominators.

Individual hospital results are shown alongside the national results, to facilitate benchmarking. Some of the 'Your site' results are based on small numbers of patients and hospitals need to take account of this when interpreting their own results.

### Standards and Criteria

Standards and criteria were created by the Project Group and are based on published guidelines or papers where possible. Each standard is accompanied by a rationale statement which is referenced. References are shown at the end of this report. Where published evidence is unavailable, standards and criteria are based on the Project Group's consensus on best practice.

## Section 1 - PRINCIPAL FINDINGS

- a) Key performance indicators
- b) Performance against standards

### a) Key performance indicators

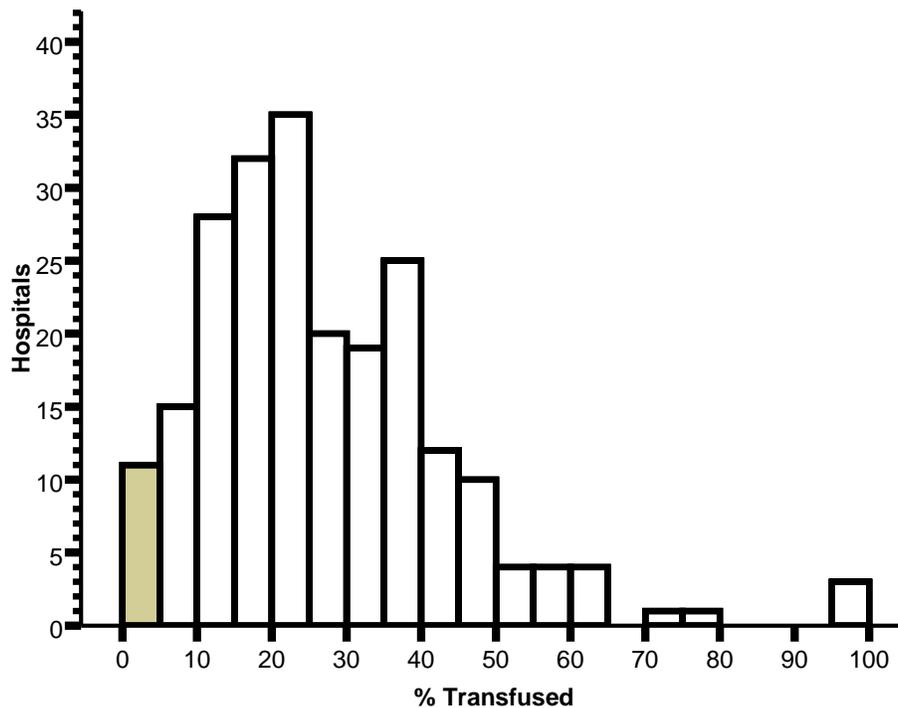
1. % patients transfused (within 28 days before surgery to 14 days afterwards)

	National (7465)		Your site (40)	
	%	N	%	N
YES	25	1823	<b>8</b>	<b>3</b>
NO	75	5518	<b>93</b>	<b>37</b>
Not Known		124		

#### **Comment**

*In the year 2000, a national study showed that 51% of patients undergoing a Total Hip Replacement were transfused<sup>(6)</sup>. It is encouraging to see a significant drop in the national rate of transfusion.*

#### Hospital variation histogram for the percentage of audit patients transfused



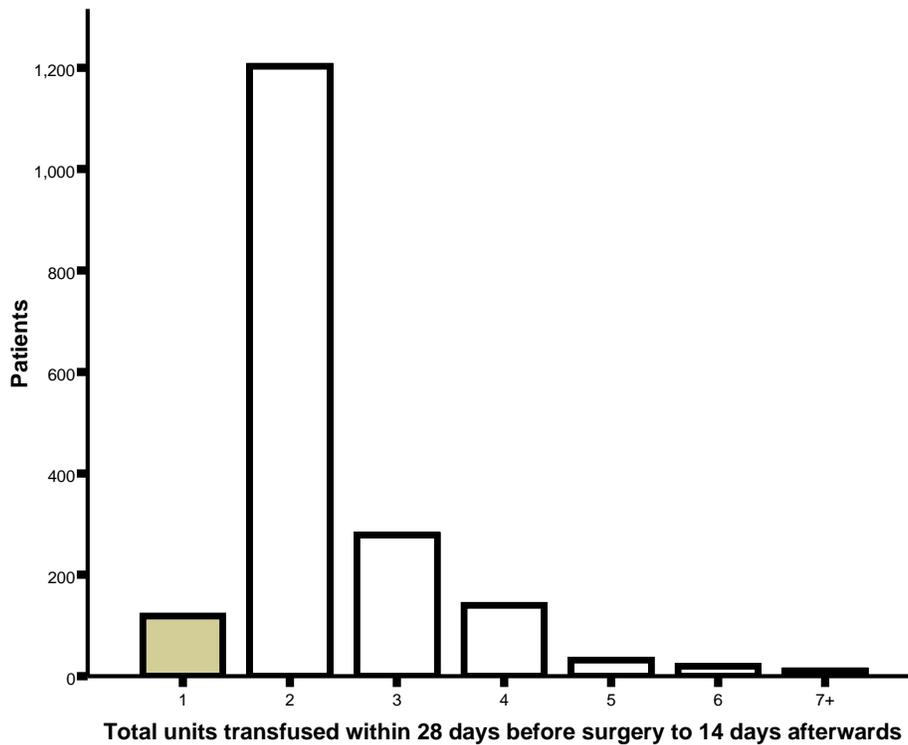
In your hospital the percentage of patients transfused in this audit was **8%**

2. Number of units transfused per patient (within 28 days before surgery to 14 days afterwards)

Two-thirds of the patients who were transfused received two units of blood. About one-quarter (27%) received three or more units.

Units transfused	National (1823)		Your site (3)
	%	N	N
1	7	119	
2	67	1203	<b>3</b>
3	15	278*	
4	8	140	
5	2	32	
6	1	20	
7+	0.6	11	
Mean units	2.4 units		<b>2.0</b>
Not known	20		

\*Includes one patient transfused 2.5 units and one patient transfused 3.4 units



## **b) Performance against standards**

### **STANDARD STATEMENT 1**

*Hospitals have effective means of assessing a patient's anaemia prior to surgery and take appropriate corrective action when necessary.*

**Rationale Statement:** Better Blood Transfusion 2 (BBT2) <sup>(5)</sup> recommends hospitals should ensure that there are adequate arrangements for the preoperative assessment of patients. For planned surgery this assessment should permit the diagnosis and correction of anaemia and optimisation of haemostatic function perioperatively.

**Criterion 1 – The hospital operates a pre-assessment clinic**

**Criterion 2 - The clinic has the facility to perform a full blood count**

**Criterion 3 - The clinic has a mechanism for referral and correction of anaemia**

*Measured by*

*Q2, Q3 and Q4 organizational tool. Must answer “yes” to each to meet the standard.*

		National (204) %	N	Your site
Q2	Does your hospital operate pre-operative assessment clinics for patients undergoing primary, elective, unilateral total hip replacement?	99.5	202/203	<b>Yes</b>
Q3	If YES (Q2) does the clinic cover taking the patient's full blood count?	99.5	198/199	<b>Yes</b>
Q4	If YES (Q3) is there a system for referring abnormal results to a doctor for the correction of anaemia?	95	183/192	<b>Yes</b>

**Comment** *Virtually all hospitals state that they have a mechanism for identifying and correcting anaemia pre-operatively.*

## **STANDARD STATEMENT 2**

*Patients assessed in the pre-assessment clinic have their anaemia managed effectively.*

### Rationale Statement

The Association of Anaesthetists of Great Britain and Ireland (AAGBI) recommends <sup>(7)</sup> that patients should have a full blood count performed when placed on the waiting list for an elective surgical procedure. They also recommend that anaemia should be identified and corrected during the pre-operative period. This is endorsed by the British Orthopaedic Association <sup>(9)</sup>.

### **Criterion 1 – Every patient has a full blood count performed before surgery.**

In the audit 29% (2177/7414) of patients did not have an Hb reported within 28 days before surgery. For your hospital this was **8% (3/40)**. We acknowledge that some hospitals may test the patients' Hb earlier than 28 days, and these will not be taken into account for the audit. These results exclude 51 who had a pre-surgery transfusion.

### **Criterion 2 - The patient has a recent pre-operative Hb of 12 g/dl or more**

In the audit 15% (795/5237) of patients had an Hb of less than 12 g/dl. For your hospital this was **14% (5/37)**

Pre-operative Hb g/dl	National *		Your site	
	%	N	%	N
Performed	71	5237/7414	<b>93</b>	<b>37/40</b>
Hb ≥12	85	4442/5237	<b>86</b>	<b>32/37</b>
Hb <12	15	795/5237	<b>14</b>	<b>5/37</b>

\*The national denominator of 7414 excludes 51 who had a pre-surgery transfusion.

### **Range of pre-operative haemoglobin results**

Pre-operative Hb g/dl	%	N of patients
<8.0	0.0	1
8.0-8.9	0.2	15
9.0-9.9	1	62
10.0-10.9	2	159
11.0-11.9	7	558
12.0-12.9	15	1138
13.0-13.9	21	1542
14.0-14.9	15	1093
15.0+	9	669
No pre-surgery HB (within 28 days pre)	29	2177
Pre-surgery transfusion	1	51
Total	100	7465

**Comment** *A significant number of patients are going for surgery without having had a pre-operative Hb level performed during the four weeks preceding surgery. Despite hospitals having the facility to identify and correct anaemia pre-operatively, 15% of patients are admitted for surgery with a haemoglobin of less than 12 g/dl which increases the likelihood of receiving donor blood threefold. For patients with haemoglobin levels below normal range for age and sex in your hospital, attempts should be made to correct the anaemia with*

iron/vitamin therapy. It is acknowledged that some of these patients may remain refractory to treatment.

**Discussion** Studies have shown that a pre-operative Hb of <12 g/dl increases the likelihood of transfusion threefold <sup>(9)</sup>. The national audit findings support this statement:

		Transfused during or after surgery (within 14 days)			
		National (7465)		Your site (40)	
		%	N	%	N
Pre-surgery Hb (g/dl)	<12.0	57	454/790	<b>20</b>	<b>1/5</b>
	12.0+	20	869/4409	<b>6</b>	<b>2/32</b>
	No known pre-surgery Hb (within 28 days pre)	21	449/2091	<b>0</b>	<b>0/3</b>
Not known if transfused during or after surgery		N=124		<b>N=0</b>	
Pre-surgery transfusion		N=51		<b>N=0</b>	

### **Recommendations**

- **In order to minimize the likelihood of a patient receiving a donor blood transfusion, pre-operative anaemia should be corrected as far as possible.**
- **Hospitals should have a written policy for identification and management of anaemia in pre-assessment clinics.**
- **Surgeons seeing patients at initial consultation must ensure that patients have a full blood count, and that anaemic patients are investigated and steps taken to correct the anaemia before surgery.**
- **General Practitioners referring patients for surgery should take measures to optimize the haemoglobin.**

### **STANDARD STATEMENT 3**

*Postoperatively, all patients who are asymptomatic are not transfused unless their pre-transfusion Hb concentration is <8 g/dl.*

#### **Rationale Statement**

BBT2 recommends that Trusts should ensure appropriate blood transfusion policies are in place, implemented and monitored.<sup>(5)</sup> AAGBI recommends that haemoglobin concentration should be monitored peri-operatively and guide red-cell transfusion<sup>(7)</sup>. BCSH guidelines state that red cell transfusion is not indicated when haemoglobin concentration is greater than 10 g/dl.<sup>(10)</sup> Red cell Transfusion is indicated when haemoglobin concentration is less than 7 g/dl. In patients who may tolerate anaemia poorly (for example patients over 65 or patients with cardiovascular or respiratory disease) transfusion of red cells is indicated when haemoglobin is less than 8 g/dl. Symptomatic patients should be transfused.

#### **Criterion 1 – Hospitals have a policy that a decision to transfuse a stable post-total hip replacement patient is consistently based on the Hb level**

47% (91/195) of hospitals had a policy. Your hospital **DID NOT** have a policy. Nationally, the Hb trigger was less than 8 g/dl for 19% (17/91), 8 g/dl for 54% (49/91), above 8 g/dl for 9% (8/91) and within a range (typically 7 – 9 g/dl) for 14% (13/91). Unknown for 4% (4/91).

#### **Criterion 2 - An Hb is done before transfusion**

There were 1330 patients transfused during days 1 to 14 after surgery. Of these, 88% (1167) had a postoperative pre-transfusion Hb tested.

**Your hospital 100% (2/2).**

#### **Criterion 3 - The Pre-Transfusion Hb value is <8 g/dl**

52% (604/1167) of Hb values were less than 8 g/dl.

**Your hospital 50% (1/2)**

**Comment** *During surgery and in the first 24 hours after surgery, the trigger for transfusion is more likely to be blood loss or symptoms of anaemia, rather than the haemoglobin concentration. On the other hand, in the period 24 hours to 14 days after surgery the haemoglobin concentration is more likely to be the trigger. Therefore we excluded patients who were transfused during surgery and on the same day as surgery.*

*48% of patients transfused had a pre-transfusion haemoglobin greater than 8 g/dl and in some of these patients transfusion could have been avoided. However, it is possible that a minority of patients were transfused on the basis of symptoms, blood loss or co-morbidity. 23% (267/1167) of the transfused patients audited were in ASA<sup>(11)</sup> class III or IV, indicating that they had diseases which were not well controlled. Even allowing for these, it is still likely that a significant number of patients were transfused unnecessarily on the basis of haemoglobin trigger alone.*

### **Recommendation**

**Every hospital should have a transfusion policy to guide transfusion in the peri- / post-operative period, based upon one or more of the following:**

- **Symptoms**
- **Haemoglobin concentration**
- **Estimated blood loss**

**Trusts should ensure that their prescribers are aware that it is not necessary to transfuse patients who are asymptomatic, not bleeding and have a haemoglobin of  $\geq 8\text{g/dl}$ .**

#### **STANDARD STATEMENT 4**

*Patients who are transfused 2 or more units of blood and whose post-transfusion Hb is above 10 g/dl, may have been transfused excessively.*

#### **Rationale Statement**

Patients whose pre-transfusion Hb was  $\leq 7.9$  should not be transfused to achieve a 'normal' haemoglobin concentration (i.e. 12 g/dl). It is appropriate to use a one-unit transfusion to exceed the transfusion threshold of 8 g/dl. <sup>(7) (9)</sup>

The number of units transfused was known for 1314 of 1330 patients transfused during days 1 to 14 after surgery. 17% (229) received one unit, 70% (922) received two units and 12% (163) received three or more units.

Of those given 2 or more units, 65% (609/944) had a post-transfusion Hb level of 10 g/dl or more. The post-transfusion Hb was unknown for 141 cases.

**In your hospital 0% (0/1)** of patients who received 2 or more units of red cells had a post-transfusion Hb level of 10 g/dl or more.

**Comment** *The majority of patients who have received 2 or more units of blood may have been unnecessarily over-transfused.*

#### **Recommendation**

**In order to avoid over-transfusion, single-unit transfusions may be appropriate. Hospitals should review the number of units transfused against their patients' post-transfusion Hb at regular intervals.**

## Section 2 - SUPPLEMENTARY FINDINGS

### Anti-platelet drugs

#### Rationale statement

The Association of Anaesthetists of Great Britain and Ireland states <sup>(7)</sup> that haemorrhagic risk is increased when aspirin and clopidogrel are taken concomitantly. Therefore these drugs need to be stopped for 7 days to be confident of adequate platelet function. However, due consideration must be given to the risk associated with stopping these drugs.

The majority of hospitals reported having a system to stop anti-platelet drugs before surgery:

		National (204)		Your site
		%	N	
Q5	Is there a system for stopping anti-platelet drugs before surgery?	91	178/196	<b>No</b>

The audit findings in those patients known to have stopped suggest that this system was only effective (i.e. at least 7 days before surgery) for 55% (367/664):

		National (7465)		Your site (40)	
		%	N	%	N
Q23	Do the pre-operative assessment notes indicate the patient was on antiplatelet drugs?	22	1613/7406	<b>18</b>	<b>7/40</b>
Q24	(If Yes to Q23) is there any note of advice to stop?	48	749/1575	<b>0</b>	<b>0/7</b>
Q25	(If Yes to Q24) is there a note of when to stop or if actually stopped?	86	664/769		<b>/0</b>
<u>Days from surgery to date of stopping:*</u>					
	More than 10 days before operation	8	55		
	7-10 days before operation	47	312		
	Closer to operation or after operation	39	257		
	Timing not known	6	40		

The median time to stop antiplatelet drugs was 7 days before surgery, IQR 5-8 days before, 10-90th centile range 1-13 days before.

The table above suggests that 45% of patients taking antiplatelet drugs pre-operatively were not stopped in sufficient time to allow the patient to be free from haemorrhagic risk.

**Comment** *Where an opportunity exists to reduce the patient's risk of an haemorrhagic event by stopping antiplatelet drugs, it should be done at least seven days before surgery. In some patients it may not be possible to stop the medication.*

## **Cell salvage**

### **Rationale Statement**

Intraoperative cell salvage can greatly reduce the need for donor blood and should be considered for surgery where blood loss greater than 1 litre is anticipated.

Nationally, 61% (122/199) of hospitals reported having cell salvage and /or cell saver equipment for use with patients undergoing primary, elective, unilateral total hip replacement.

### **In your hospital cell salvage / cell saver equipment IS available.**

In the national audit sample, autologous cell salvage transfusions (intra-operative and post-operative) were used in 20% (1333/6747) cases.

### **In your hospital it was used for 63% (25/40) patients.**

**Comment**     *1330 patients received autologous blood and 300 (23%) of these patients also received donor blood during or after surgery (up to 14 days).*

*5403 patients did not receive any autologous blood and 3111 (24%) of these patients received donor blood.*

*In 718 patients the autologous transfusion status was unknown and 176 (25%) of these patients received donor blood.*

## Section 3 - SUPPORTING COMPARATIVE STATISTICS

Data on 7465 cases were submitted by 223 hospitals, median 40 per hospital, Inter-Quartile range (IQR) 28-40, range 1-75. 140 NHS hospitals submitted 5003 cases median 40; 83 independent hospitals submitted 2462 cases median 34.

**Table 1 - Co-morbidity**

		National (7465)		Your site (40)	
		%	N	%	N
Q28	Is there evidence in the notes of any of the following? If known:	97	7263 known	<b>100</b>	<b>40 known</b>
	Sickle Cell Disease	0.1	10		
	Heart disease	20	1462		<b>21</b>
	Chronic lung disease	6	427		
	Long-term anti-coagulation	5	357		<b>4</b>
	Renal disease	2	115		<b>1</b>
	None of the above	73	5307		<b>18</b>

**Table 2 - ASA Grade**

		National (7465)		Your site (40)	
		%	N	%	N
Q13	What was the patient's ASA score? Recorded	84	6238	<b>40</b>	<b>16</b>
	I	19	1175		<b>2</b>
	II	62	3876		<b>9</b>
	III	18	1144		<b>4</b>
	IV	1	50		<b>1</b>
	V	-	1		

**Table 3 - Hospital Transfusion Committee**

BBT2<sup>(4)</sup> recommends that Trusts should secure appropriate membership and functioning of their Hospital Transfusion Committee.

		National (204)		Your site
		%	N	
Q15	Is the orthopaedic directorate represented on the hospital transfusion committee?	69	134/194	<b>Yes</b>
Q16	(If YES Q15) How often in the past 12 months has someone from the orthopaedic directorate attended the hospital transfusion committee?			<b>Not known</b>
	Never	34	45	
	One	22	30	
	Two	18	24	
	Three	11	15	
	Four	7	10	
	More than four	5	7	
	Not known	2	3	

**Recommendation : Nationally, orthopaedic representation at Hospital Transfusion Committees needs to be improved and more consistent attendance encouraged.**

**Table 4 - Total Blood loss**

Blood loss during surgery was known for 37% (2778/7465). **Your site 10% (4/40).**  
 Blood loss after surgery was known for 51% (3772/7465). **Your site 30% (12/40).**

		Blood loss after surgery					Not known	Total
		<500ml	500-999ml	1000-1499ml	1500-1999ml	2000+ ml		
Blood loss during surgery	<500ml	487	121	10	1	0	651	1270
	500-999ml	525	131	15	2	1	478	1152
	1000-1499ml	106	25	4	4	0	109	248
	1500-1999ml	27	15	1	1	0	29	73
	2000+ml	10	3	2	0	0	20	35
	Not known	1785	462	32	2	0	2406	4687
Total		2940	757	64	10	1	3693	7465

**Table 5 - Duration of surgery (min)**

	National (7277 known)		Your site (40)
	Median	IQR	Median
Duration of surgery (min)	97	75-120	<b>90</b>

**Table 6 - Patient age**

The number of years from birth year to the year 2006 was taken as a proxy for age for 7463 patients, unknown 2.

	National (7463)		Your site (40)	
	Mean	SD	Mean	SD
Age of patient	69	11	<b>72</b>	<b>9</b>

**Table 7 - Gender**

		National (7465)		Your site (40)		
		%	N	%	N	
Q1	Is the patient Male or Female?	Male	37	2779	<b>40</b>	<b>16</b>
		Female	63	4585	<b>60</b>	<b>24</b>
		Not known	-	1	-	

**Table 8 - Ordering blood**

Having blood cross-matched preoperatively for Primary Total Hip Replacement Surgery has been associated with high transfusion rates <sup>(12)</sup>

			National (204)		Your site
			%	N	
Q7	Which of these is the preferred method when ordering blood for transfusion in connection with primary, elective, unilateral total hip replacement?	Group & Save	73	146/199	<b>Group and Crossmatch</b>
		Group & Crossmatch	27	53/199	
Q8	Does your hospital have an electronic blood issue facility?		40	80/200	<b>No</b>
Q9	Does your hospital have a Maximum Surgical Blood Ordering Schedule (MSBOS) that covers primary, elective, unilateral total hip replacement?		90	177/197	<b>Yes</b>
Q10	If YES (Q9) Enter "G&S" if MSBOS says Group & Save or enter the suggested number of units allowed.	Group & Save	69	120/175	<b>2 units</b>
		2 units	28	49/175	
		3-4 units	3	5/175	
		1-4 units	1	1/175	

Group and save was the method of ordering blood for transfusion for 81% (63/78) of hospitals with an electronic blood issue facility, group and crossmatch being the method for 19% (15/78). Group and save was the method of ordering blood for transfusion for 69% (82/119) of hospitals with no electronic blood issue facility, group and crossmatch being the method for 31% (37/119).

**Table 9 - Primary, elective, unilateral hip replacements performed in the past year**

			National (203)		Your site
Q1	How many primary, elective, unilateral hip replacements has your hospital performed in the past year?	Median: 184 IQR: 102-313 Range: 17-1477 N=180, not stated for 24			<b>Not known</b>
<i>Median for NHS was 270, IQR 165-350 and median for independent sector was 99, IQR 62-149.</i>					

**Table 10 – Grades of surgeon performing the operation**

		National (7465)		Your site (40)
		%	N	
Q6	Who performed the operation?	99	7404 known	<b>40 known</b>
	Consultant only	69	5135	<b>40</b>
	Consultant and non-consultant(s)	18	1367	
	Non-consultant(s) only	12	902	

**Table 11 – Grade of anaesthetist**

		National (7465)		Your site (40)
		%	N	
Q8	What was the grade of anaesthetist?	96	7172 known	<b>40 known</b>
	Consultant only	80	5766	<b>40</b>
	Consultant and non-consultant(s)	5	368	
	Non-consultant(s) only	14	1038	

**Table 12 - Type of anaesthesia**

		National (7465)		Your site (40)
		%	N	
Q10	What was the type of anaesthesia?	99	7382 known	<b>40 known</b>
	General anaesthetic	51	3743	<b>31</b>
	Spinal (intrathecal)	59	4350	<b>14</b>
	Epidural	10	730	
	Nerve block	13	945	<b>26</b>
	Sedation	19	1401	<b>1</b>

**Table 13 – Use of low molecular weight heparin**

		National (7465)		Your site (40)
		%	N	
Q27	Starting from the date of surgery, was the patient started on low molecular weight heparin?	99	7391 known	<b>40 known</b>
	If known:			
	Started immediate pre-op	21	1596	
	Started post-op – day 1/2/3	49	3653	<b>37</b>
	Started later	1	106	<b>1</b>
	Not started on heparin	28	2036	<b>2</b>

**Table 14 - Audits of blood use in last year**

BBT2<sup>(4)</sup> recommends that Trusts should carry out regular multi-disciplinary audit of transfusion practice.

		National (204)		Your site
		%	N	
Q13	Have there been any orthopaedic audits of blood use in the last year in your hospital?	45	88/197	<b>No</b>
Q14	If YES (Q13) how many audits of this kind have been conducted?			
	One	65	57	
	Two	14	12	
	Three	13	11	
	Four or more	6	5*	
	Not known	3	3	

\* 12 (4 sites), 7 (1 site)

## Section 4 - SUPPORTING NATIONAL STATISTICS

### Transfusions given

Transfusions given before surgery (closest to surgery but within 28 days)

Overall there were 51 transfusions before surgery (0.7%) from 41 hospitals.

Transfusions started during surgery

There were 156 transfusions during surgery (2.1%) from 90 hospitals.

Transfusions given after surgery, on the day of surgery (day 0)

There were 452 such transfusions (6.1%) from 158 hospitals.

**Table 15 – Transfusion by ASA grade**

ASA	Patients	%Transfused*	Total n
Grade I	1175	19	224/1151
Grade II	3868	25	945/3820
Grades III-V	1195	35	412/1176
Not known	1227	20	242/1194

\* Transfusion (within 28 days before surgery to 14 days afterwards)

**Table 16 - Transfusion by comorbidity**

ASA	Patients	%Transfused*	Total n
Renal disease	115	40	46/114
Sickle cell	10	60	6/10
Heart disease	1462	31	442/1445
Lung disease	427	28	119/422
Anti-coagulant	357	28	97/352
None of above	5307	23	1199/5238

\* Transfusion (within 28 days before surgery to 14 days afterwards)

**Table 17 - Combinations of anaesthesia**

GA	Spinal	Epidural	Nerve block	Patients
-	Yes	-	-	3061
Yes	-	-	-	1816
Yes	Yes	-	-	837
Yes	-	-	Yes	720
Yes	-	Yes	-	309
-	Yes	Yes	-	250
-	Yes	-	Yes	142
-	-	Yes	-	125
-	-	-	Yes	53
Yes	Yes	Yes	-	37
Yes	Yes	-	Yes	21
			Other combinations	11

**Table 18 - Patient ventilated (if receiving General anaesthesia)**

		National (3743GA)	
		%	N
Q11	(If you selected General anaesthetic) Was the patient ventilated?	70	2371/3368
Q12	(If Yes to Q11) Was IPPV recorded on the anaesthetic chart?	75	1399/1876

**Table 19 – Aprotinin and Tranexamic Acid**

Aprotinin is reported as being used as prophylactic therapy to reduce donor blood requirements particularly during cardiothoracic surgery. <sup>(8)</sup>

		National (7465)	
		%	N
Q21	Was Aprotinin (Trasylol) used on day of surgery?	0.1	8/7409
Q22	Was tranexamic acid (Cyklokapron) used on day of surgery?	5	343/7410

**Comment** *For the sample of patients included in this audit, only a very small percentage of patients were given these drugs. It is impossible therefore to comment here on their usefulness in reducing blood transfusion.*

**Table 20 - Pre-operative antiplatelet use and its relationship to blood loss**

	Blood loss after surgery				Total
	<500ml	500-999ml	1000-1499ml	Not known	
Stopped more than 10 days before day of surgery	24	4	0	27	55
Stopped 7-10 days before day of surgery	119	33	5	155	312
Stopped 1-6 days before day of surgery or after surgery	108	29	1	121	259
Advice to stop, but not known when	19	3	1	18	41
On anti-platelets but no advice to stop	331	94	6	492	923
Total	601	163	13	813	1590

**Table 21 - Use of low molecular weight heparin and its relationship to blood loss**

	Heparin					Total
	Started immediate post-op	Started post-op on day 1/2/3	Started later	Not started on heparin	Not known	
Blood loss during surgery						
<500ml	240	600	13	411	6	1270
500-999ml	300	559	19	267	7	1152
1000-1499ml	54	123	2	67	2	248
1500-1999ml	27	25	0	20	1	73
2000+ml	14	14	0	7	0	35
Not known	961	2332	72	1264	58	4687
Blood loss after surgery						
<500ml	705	1430	23	765	17	2940
500-999ml	201	341	6	206	3	757
1000-1499ml	18	27	1	18	0	64
1500-1999ml	3	3	0	4	0	10
2000+ml	0	0	0	1	0	1
Not known	669	1852	76	1042	54	3693

**Table 22 - Long term anticoagulation and its relationship to blood loss**

Long-term anti-coagulation	Blood loss during surgery						Total
	<500ml	500-999ml	1000-1499ml	1500-1999ml	2000+ml	Not known	
YES	60	46	14	2	0	235	357
NO	1210	1106	234	71	35	4452	7108
Total	1270	1152	248	73	35	4687	7465

**Table 23 - Transfusion by use of heparin**

Heparin	Patients	%Transfusion*	Total n
Started immediate post-op	1596	28	437/1579
Started post-op - day 1/2/3	3653	25	912/3632
Started later	106	25	26/103
Not started on heparin	2036	22	426/1979
Not known	74	46	22/48

\* Transfusion (within 28 days before surgery to 14 days afterwards)

**Table 24 - Transfusion by length of surgery**

Duration of surgery (minutes)	Patients	%Transfusion*	Total n
<60	685	19	133/683
60-89	2014	20	396/1984
90-119	2371	24	570/2332
120-179	1923	31	577/1890
180+	284	39	106/272
Not known	188	23	41/180

\* Transfusion (within 28 days before surgery to 14 days afterwards)

**Table 25 – Comparison of organizational factors in NHS and independent hospitals**

		NHS (126)		Independent (77)		
Q1	How many primary, elective, unilateral hip replacements has your hospital performed in the past year?	Median 270		Median 98		
		N=114		N=66		
Q2	Does your hospital operate pre-operative assessment clinics for patients undergoing primary, elective, unilateral total hip replacement?	99.2	124/125	100	78/78	
Q3	If YES (Q2) does the clinic cover taking the patient's full blood count?	100	122/122	98.7	76/77	
Q4	If YES (Q3) is there a system for referring abnormal results to a doctor for the correction of anaemia?	92	108/117	100	75/75	
Q5	Is there a system for stopping anti-platelet drugs before surgery?	88	106/120	95	72/76	
Q6	Does your hospital have cell salvage and /or cell saver equipment for use with patients undergoing primary, elective, unilateral total hip replacement?	68	84/124	51	38/75	
Q7	Which of these is the preferred method when ordering blood for transfusion in connection with primary, elective, unilateral total hip replacement?	Group & Save	79	98/124	64	48/75
		Group & Crossmatch	21	26/124	36	27/75
Q8	Does your hospital have an electronic blood issue facility?	58	72/125	11	8/75	
Q9	Does your hospital have a Maximum Surgical Blood Ordering Schedule (MSBOS) that covers primary, elective, unilateral total hip replacement?	95	118/124	81	59/73	
Q11	Do you have a policy that the decision to transfuse a stable post-total hip replacement patient is consistently based on the Hb level?	43	53/123	53	38/72	
Q13	Have there been any orthopaedic audits of blood use in the last year in your hospital?	50	61/123	36	27/74	
Q15	Is the orthopaedic directorate represented on the hospital transfusion committee?	76	94/123	56	40/71	
Q17	In your hospital, which grades of surgeon would normally perform primary, elective, unilateral total hip replacements?	Consultant	100	123/123	100	75/75
		Associate specialist	54	66/123	3	2/75
		SpR	53	65/123	1	1/75
		Staff grade/clinical assistant	33	41/123	-	0/75
		SHO	2	3/123	-	0/75
		Fellow	8	10/123	-	0/75
		Consultant only	29	36/123	96	72/75
		Consultant and non-consultant(s)	71	87/123	4	3/75
Q18	Do any nursing/care homes to which your patients are transferred insist on a minimum Hb value in discharged patients?	2	3/122	0	0/72	

*Comment in relation to organisational audit Q18 (Do any nursing/care homes to which your patients are transferred insist on a minimum Hb value in discharged patients?) – only 3 sites said they were aware of nursing homes with restrictions relating to Hb.*

## References

- 1 Which groups of patients are transfused? A study of red cell usage in London and south east England. Stanworth S.J et al. Vox Sanguinis (2002)83:352-357
- 2 The Sanguis study group. Use of blood products for elective surgery in 43 European hospitals. Transfus Med 1994;4: 251-68.
- 3 Hari Boralessa (personal communications)
- 4 Giovanetti AM et al Quality assessment of transfusion practice in elective surgery. Transfusion 1988;28: 166-69. Hari Boralessa et al. Retrospective study on Red Cell Usage in Primary Total Knee Replacement Surgery. Vox Sang 2000;79:231-234
- 5 Health Service Circular 2002/009 (BBT2)  
[http://www.transfusionsguidelines.org.uk/docs/pdfs/bbt\\_hsc\\_2002-009.pdf](http://www.transfusionsguidelines.org.uk/docs/pdfs/bbt_hsc_2002-009.pdf)
- 6 Review of transfusion practice in orthopaedic surgery. H Boralessa, et al. Current orthopaedics. Vol. 18, 2, April 2004 p126 - 134
- 7 Blood Transfusion and the Anaesthetist – Red Cell Transfusion, (Sept 2001) AAGBI. <http://www.aagbi.org/publications/guidelines.htm#b>
- 8 Van Oeveren W, Jansen NJG, Bidstrup BP (1987). Effects of aprotinin on haemostatic mechanisms during cardiopulmonary bypass. *Annals of Thoracic surgery*; 44:640-645.
- 9 Blood conservation in elective orthopaedic surgery; British Orthopaedic Association, April 2005.  
<http://www.boa.ac.uk/site/showpublications.aspx?ID=59>
- 10 Guidelines for the clinical use of red cell transfusion. BJH, 2001,112, 1-10
- 11 American Society of Anesthesiologists – Physical Status Classification System. <http://www.asahq.org/clinical/physicalstatus.htm>
- 12 Roberts.M, Ahya R, Greaves M, Maffulli N. A one centre prospective audit of peri and postoperative blood loss and transfusion practice in patients undergoing hip or knee replacement surgery. Ann R coll Surg Engl 2000;82:44-8

## Communication plan for the audit

- The audit will be included in biannual reports to the Healthcare Commission.
- Results have been communicated in a full report to NHS Trust medical directors. Electronic copies of the report have been sent to the Chair of the Hospital Transfusion Committee and to the Hospital Transfusion Team, who were also advised that a full report is lodged with the Medical Director. For independent hospitals, a full report has been sent to the nominated contact.
- A full report has been sent to Mr. Keith Tucker, President of the British Hip Society, who will arrange further distribution within the orthopaedic community. Dr. Sandy Kidd and Dr. Andrew Mortimer (Royal College of Anaesthetists) advised on distributing the report within the anaesthetic community, and Prof. John Lumley and Mr. John Thompson advised on distribution within the surgical community via the Royal College of Surgeons.
- Steering Group representatives of the medical Royal colleges, societies and associations will be asked to comment in their respective bulletins and to carry a copy of the full report on their organization's websites.
- Articles will be prepared for publication in *Hip International* and *Orthopaedics*, and a presentation prepared for the British Blood Transfusion Society in September 2007 and for the British Hip Society and NATA in 2008.
- A Microsoft PowerPoint slideshow showing regional versus national results will be available via the National Comparative Audit website.

## Appendix A – Data items included in the Organizational Audit

- How many primary, elective, unilateral hip replacements has your hospital performed in the past year?
- Does your hospital operate pre-operative assessment clinics for patients undergoing the procedure?
- If yes, does the clinic cover taking the patient's Full Blood Count?
- If yes, is there a system for referring abnormal results to a doctor for the correction of anaemia?
- Is there a system for stopping antiplatelet drugs before surgery?
- Does your hospital have cell salvage and /or cell saver equipment for use with patients undergoing the procedure?
- Is group & save or group & cross match the preferred method when ordering blood?
- Does your hospital have an electronic blood issue facility?
- Does your hospital have a Maximum Surgical Blood Ordering Schedule (MSBOS) that covers the procedure?

- If yes, what is the suggested number of units allowed?
- Do you have a policy that orthopaedic surgeons consistently transfuse the stable post-total hip replacement patient based on the Hb level, and if so what is that level?
- Have there been any orthopaedic audits of blood use in the last year in your hospital and if so how many?
- Is the orthopaedic directorate represented on the hospital transfusion committee?
- If yes, how often in the past 12 months has a representative from the orthopaedic directorate attended the hospital transfusion committee?
- In your hospital, which grades of surgeon would normally perform primary, elective, unilateral total hip replacements?
- Do any nursing/care homes in your area insist on a certain Hb value in discharged patients and if so what values are required?

## Appendix B – Data items included in the Episode Audit

- Dates and times of red blood cell transfusions
- Dates and times of Full Blood Count and Clotting Screens
- Is the patient Male or Female?
- Patient's year of birth
- Date of surgery?
- What was the surgery start time?
- What was the surgery stop time?
- Who performed the operation?
- What was the grade of anaesthetist?
- What was the type of anaesthesia
- Was the patient ventilated?
- Was IPPV recorded on the anaesthetic chart?
- What was the patient's ASA score?
- How much blood was lost during surgery?
- If a drain was used how much blood was lost in the 24 hours after surgery?
- Were any autologous cell salvage transfusions used?

- If intra-operative cell salvage, how many mls were reinfused?
- If post-op cell salvage, how many mls. were reinfused?
- Was Aprotinin (Trasylol) used on day of surgery?
- Was tranexamic acid (Cyklokapron) used on day of surgery?
- Do the pre-operative assessment notes indicate the patient was on antiplatelet drugs?
- If yes, is there any note of advice to stop?
- If yes, is there a note of when to stop or whether actually stopped?
- If yes, what date was it stopped?
- Was low molecular weight heparin used?
- Is there any evidence of co-morbidity:
- Sickle Cell Disease
- Heart disease
- Chronic lung disease
- Long-term anti-coagulation
- Renal disease
- What was the patient's discharge destination?