

# **Regional Appropriateness of Blood Transfusion Audit**



## **Summary Report**

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# Overview

Until 1996 blood transfusion was not covered in any review mechanism of the NHS and historically most patients were transfused when their haemoglobin fell below near normal limits. However more recently various national reports have highlighted major areas of concern such as the transmission of infection, serious transfusion errors, inconsistent variation of practice and indeed the possibility of potential shortages of blood itself. Evidence has also emerged that there is no absolute need to transfuse anaemic patients until they are symptomatic or until they approach a critical level of haemoglobin at which stage the benefits of blood outweigh the risks of transfusion. In other words, if a transfusion is given without being genuinely needed the patient may be exposed to a multitude of risks without significant benefit and a valuable and potentially limited resource that may be needed elsewhere is wasted.

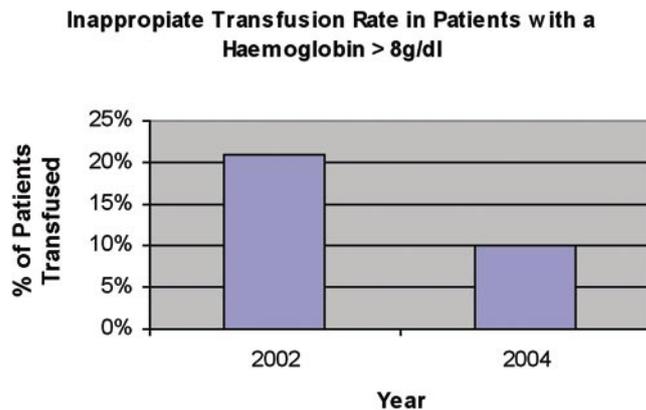
This report examines a large population of patients in 13 hospitals across Northern Ireland who have been transfused blood prior to the audit period. It looks in detail at the patients' relevant clinical demographics on admission and determines the patients' haemoglobin and MCV prior to admission. It also looks in detail at the transfusion episode of each patient and determines if the transfusion was justified. Finally it examines how much blood was given at each episode and determines whether or not the total number of units given was justified.

The report concludes that although the majority of blood is transfused with clinically acceptable indications, there are many potential areas for improvement by all grades of staff, in all specialities, in all hospitals across Northern Ireland. The vast majority of patients that eventually require transfusion are anaemic on admission to hospital and a proportion of these could have been treated before admission by pharmaceutical intervention and avoided transfusion. The audit also identified that 19% of transfused patients did not fall below the consensus threshold for transfusion and were therefore inappropriately transfused. Excessive transfusion of blood (i.e. too many units given) was identified in 29% of transfused patients that were audited in detail.

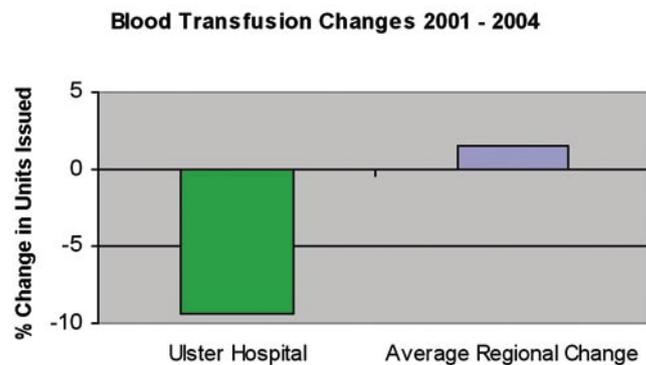
The report recommends that whenever possible a patient's haemoglobin concentration should be optimised before hospital admission to create a higher level, potentially avoiding the need for transfusion. It also recommends that patients should only be considered for transfusion when an appropriate transfusion threshold is reached and if transfusion is needed, that only an appropriate amount of blood is given. Groups of patients at high risk for inappropriate transfusion are identified for special attention at the decision to transfuse stage and a region wide programme of education in good transfusion practice is recommended.

# Introduction

In the Ulster Hospital an audit of 60 transfusion episodes was conducted in 2002. Twenty percent of audited patients with haemoglobin of 8.0g/dl or greater had a transfusion defined as inappropriate by the audit. Following this audit relevant specialities with a high incidence of inappropriate transfusions were informed of areas for improvement in practice and relevant guidelines reinforced. A re audit using similar criteria in 2004 found the inappropriate transfusion rate to be halved:



During the timescale of the two audits, the overall use of blood in Northern Ireland was examined:



Despite an increase in patient activity the hospital achieved an overall reduction of 9.3% (6524 to 5909 units) in the number of units issued in the period 2001 – 2004 compared to a regional increase of 1.5% (63359 to 64312 units) in the same timescale.

It was considered that the same variation in practice throughout the province could be identified. This audit was established to identify both excellence in practice and areas needing improvement in order to ensure compliance with both CREST and National guidelines. If the results of the audit within the Ulster Hospital could be extrapolated across the province, many patient and resource benefits could be achieved by consensus-based regional recommendations.

An application was thus made on behalf of the Northern Ireland Regional Transfusion Committee to the Regional Multiprofessional Audit Group to attract funding for a major regional audit. The application was successful and the audit was funded with the Regional Multiprofessional Audit Group granting £19,918 and the Northern Ireland Audit Advisory Committee £10,000 for the audit project to proceed.

# Project Methodology

The Regional Transfusion Committee agreed to form a Lead Audit Group for this project. The 11 Hospital Blood Transfusion Committee Chairs within Northern Ireland were invited to become members of this group. It was also agreed at an early stage that an external expert should be invited to join the group to provide advice and guidance at every stage of setting up and conducting the audit. The group were very fortunate to secure the agreement of Professor Mike Murphy - Professor of Transfusion Medicine, Oxford - an internationally recognised expert to take on this role. Additional skilled members were co-opted into the group for guidance resulting in the Lead Audit Group finally consisting of a multiprofessional group comprised of one or more representatives of the following disciplines: Haematology, Medicine, Surgery, Anaesthesia, Blood Transfusion Service, Haemovigilance, Nursing, Laboratory Staff, Quality Development Officer.

The group identified several areas that were relevant to best practice in blood transfusion including:

- Hospital admission and pretransfusion haemoglobin levels
- Administering blood when an appropriate threshold has been reached that indicates transfusion should be given
- When blood transfusion is actually given – only the minimum number of units to raise the haemoglobin level above the threshold should be given

The Lead Audit Group agreed on a number of criteria for the audit and a review of all the major current guidelines was taken. The audit criteria were selected for higher thresholds in each of the categories.

The Group agreed the following criteria for appropriate transfusion:

- If patient is under 65 and has no cardiovascular/cerebrovascular problems  
 **The transfusion threshold is below 7g/dl**
- If patient is over 65 and has no cardiovascular/cerebrovascular problems  
 **The transfusion threshold is below 8g/dl**
- If patient has known cardiovascular/cerebrovascular history\*  
 **The transfusion threshold is below 9g/dl**

*\*Previous MI, angina, hypertension, heart failure, pulmonary oedema, peripheral vascular disease*

- If the patient is appropriately symptomatic\*\* and this is documented whichever the group above  
 **The transfusion threshold is below 10g/dl**

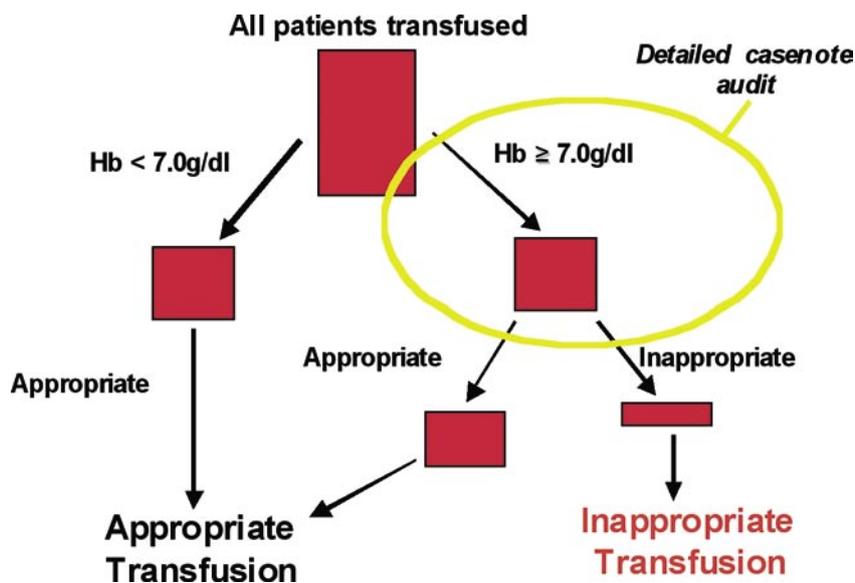
*\*\*Symptoms such as dyspnoea, angina, palpitations, tachycardia, orthostatic hypotension and syncope that is documented and likely to be due to anaemia. (Tiredness alone is not an appropriate symptom for transfusion)*

- If there is documented/obvious evidence of ongoing significant bleeding at time of transfusion  
*Causing symptoms as above or bleeding > 500ml / hour and not stopping*  
 **The transfusion threshold is below 10g/dl**
- If there is current or recent (within 3 months) marrow failure or chemotherapy or radiotherapy  
 **The transfusion threshold is below 10g/dl**

A further objective of the audit was to identify the proportion of patients over transfused at each transfusion episode. Overtransfusion was defined as a transfusion that the post transfusion haemoglobin was 2.0g/dl greater than the above transfusion thresholds.

# Audit Design

Transfusion episodes were examined retrospectively to determine the relevant parameters at the time of transfusion. Transfusion episodes to be audited in detail were preselected by laboratory data for pretransfusion haemoglobins  $\geq 7.0\text{g/dl}$ . Pretransfusion haemoglobins  $< 7\text{g/dl}$  were assumed to be appropriate and were noted for inclusion in the overall number of transfusion episodes.



## Audit Sampling:

The numbers of case notes to be examined in detail in each hospital were:

- 200 case notes in the largest (13000-17000 transfused units per year) two user hospitals
- 100 case notes in the 4 intermediate (4500-7000 transfused units per year) user hospitals
- 60 case notes in the 7 smaller (1200-2500 transfused units per year) user hospitals

## Exclusions:

- Repeated transfusion episodes for the same patient
- Children under 16 years

A total number of 1220 casenotes were reviewed in detail. This number of casenotes was constrained by funding as the detailed casenote audit was paid on a fee per item basis. There was a bias towards auditing a higher proportion of casenotes per unit transfused in the smaller hospitals. The Lead Audit Group felt it was important that all hospitals in the region were involved and 60 cases was considered the minimum number of episodes to be audited to allow analysis of meaningful local data.

Each Trust received financial remuneration for casenotes audited and over 60% of funding was distributed to Trusts at an early stage for data collection.

## **HOSPITAL CO-ORDINATION**

Each hospital appointed a Local Hospital Co-ordinator who was the Transfusion Chair or nominated representative.

## **DATA COLLECTORS & TRAINING**

Due to the very clinical nature of the data the Lead Audit Group agreed it was important to have as many data collectors whose work was associated with blood transfusion as possible. The data collectors for each hospital were recruited locally on the advice of the chair of the Hospital Transfusion Committee and came from many varied multidisciplinary backgrounds relating to blood transfusion practice i.e. Haematology, Medicine, Anaesthesia, Haemovigilance personnel, Laboratory BMSO and nursing staff.

Data collectors attended a training day at the end of which they could:

- Understand the objectives of the audit
- Carry out reliability and validity study to allow for inconsistencies to be identified
- Suggest amendments to the audit proforma as necessary

The training was assessed using worked examples for extraction and interpretation of data, followed by a reliability and validity pilot.

## **AUDIT PROFORMA**

The audit proforma had many pilot versions, which were tested and refined - following extensive consultation before the final version was accepted. The proforma was written in simple easy to understand terms and had qualifying explanatory instructions included. The audit sought information for each patient transfusion episode including:

- Identification of the speciality involved
- Age, sex and relevant medical history of the patient
- Reason for hospital admission
- Other relevant therapies used such as iron, folic acid, vitamin B12 etc
- Haemoglobin on (or immediately prior to) admission
- MCV value on admission and whether it was judged to be low or high by local laboratory indices
- Interval between pretransfusion haemoglobin test and actual transfusion
- Documented symptoms and signs of anaemia
- Grade of doctor determining need for transfusion
- Decision making process to transfuse
- Documentary evidence of reason to transfuse
- Post transfusion haemoglobin

## **INSTRUCTION BOOKLET**

An instruction booklet containing worked examples was sent to all data collectors to aid with the selection of cases to be audited. Master log sheets were also distributed with the instruction booklet for the data collectors to complete.

## **DATA COLLECTION**

Data collection took place between April and August 2005. An audit facilitator, for completeness and overall quality of data collection, checked returned forms centrally.

## **EXPERT REVIEW**

Two expert consultant reviewers for concordance with the data collectors' decision checked all completed forms independently. When the expert reviewers were not in complete agreement – the discrepant forms were further reviewed together and an agreed decision was reached. Transfusion episodes considered to be either inappropriate or an overtransfusion underwent one final review to eliminate any doubtful decisions.

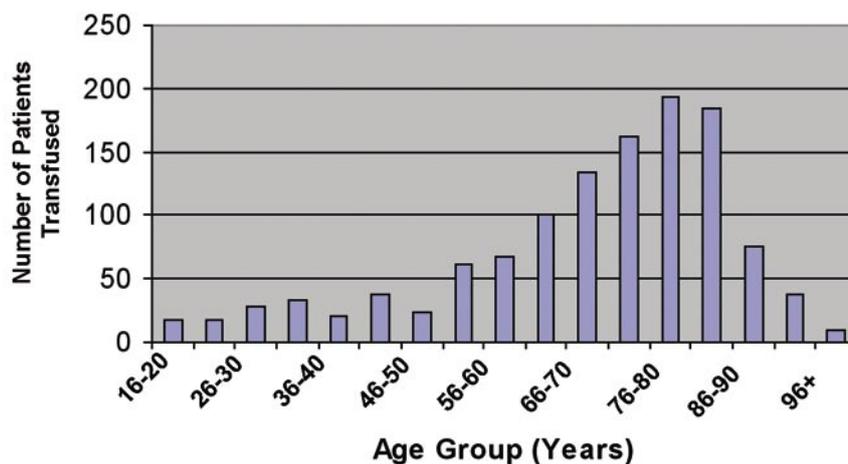
# Summary of Results & Recommendations

A total of 2853 transfusion episodes were initially reviewed of which 82% were found to have taken place with a pretransfusion haemoglobin of 7g/dl or greater.

Of these episodes the casenotes were requested and some 1222 patients each had an audit form completed for the identified transfusion episode and returned to the Audit Co-ordinator of which 1215 were suitable to be used in the audit. Two duplicate episodes and five cases audited with a pretransfusion haemoglobin <7.0g/dl were excluded.

## DEMOGRAPHIC DETAILS

The age distribution of patients transfused is illustrated below:



This graph shows a trend of increasing transfusion with age, the mean age being 68 years and a median age of 72 years. This can be explained by increasing morbidity in the elderly and higher thresholds for transfusion. The graph suggests the likely increase in demand for blood in the future given the expected aging of our population.

The gender distribution of transfusion recipients and overall blood use at the audit episodes is as indicated below:

Breakdown of Patients Transfused by Gender

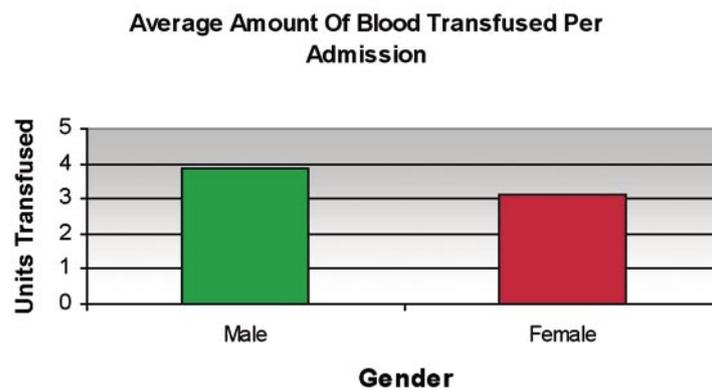


Blood Used at Audit Episode by Gender

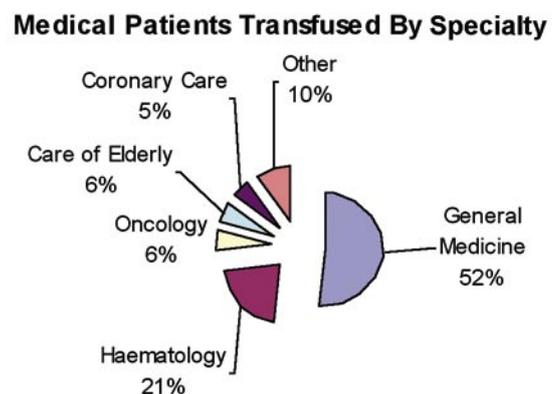
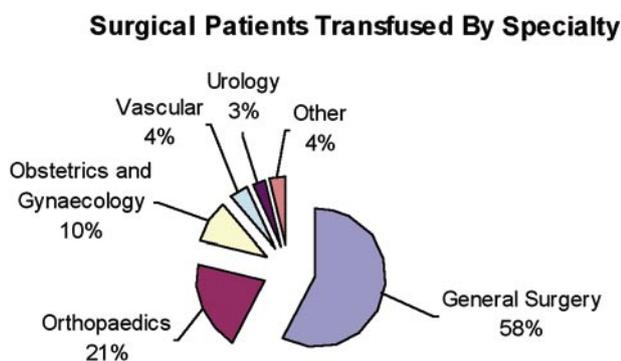


It was noted from the audit that some 54.5% of the patients receiving transfusion were female and 45.5% were male. Only one isolated transfusion episode was audited per patient so it was not surprising that the distribution of blood during these episodes was quite close to the demographic breakdown with females receiving 52.5% of blood transfused compared to 47.5% in males. Males were given slightly more blood at their audited transfusion episode than females (2.24 units vs 2.07 units).

The audit identified 1143 patients with complete data on the total number of units (i.e. all episodes) transfused; overall, males were transfused more blood (3.9 units vs 3.1 units) than females per hospital admission:

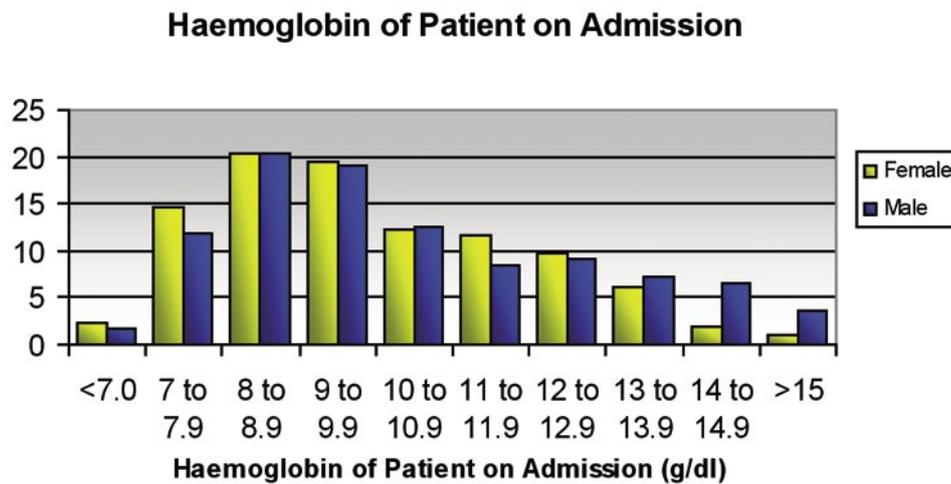


The audit revealed that 49.7% of transfused patients reviewed were admitted under a medical speciality and 50.3% were under a surgical team. The breakdown of the respective groups was quite varied as illustrated below:

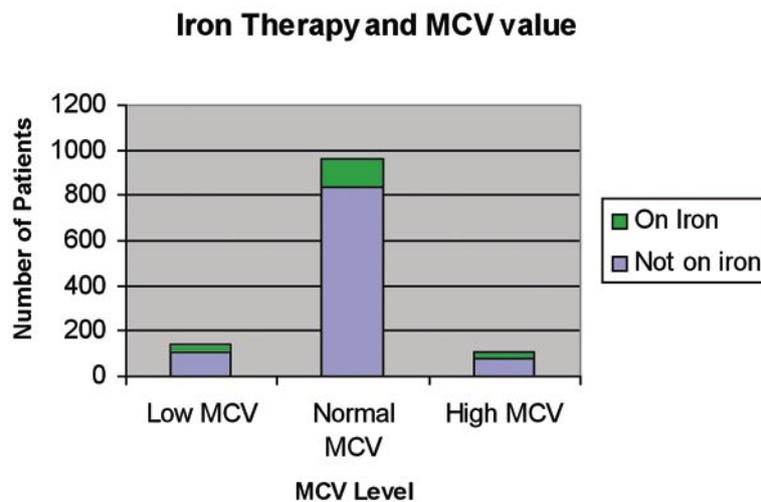


## Haemoglobin on Admission

The haemoglobin on admission or immediately prior to admission was recorded in each transfused patient. The data shows that the majority of patients who were transfused are anaemic on admission to hospital:



147 (12.1%) of patients were noted to have a low MCV and only a small proportion were on any iron replacement:

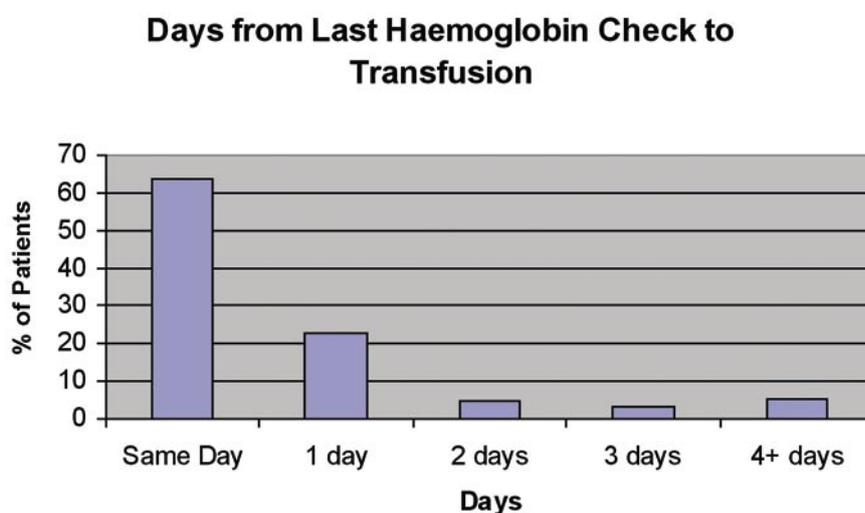


### Recommendation 1

**Every effort should be made to optimise patients' haemoglobin by simple means prior to hospital admission. Iron deficiency anaemia should be appropriately investigated and treated whenever possible by iron, either oral or intravenous and not by transfusion. This will require co-ordination of medical and surgical outpatient assessment, and collaboration and interaction with primary care.**

## Pretransfusion Haemoglobin Checks

It was found that some patients were transfused on the basis of a haemoglobin result from many days earlier without further haemoglobin checks. Other patients were transfused on outdated or erroneous results without checking the actual current results for that day which would have excluded transfusion.



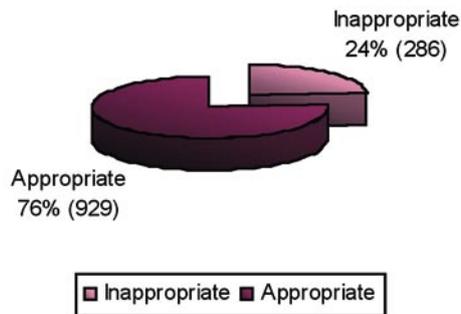
### Recommendation 2

**All patients whenever possible should have a haemoglobin result checked and reviewed immediately prior to transfusion.**

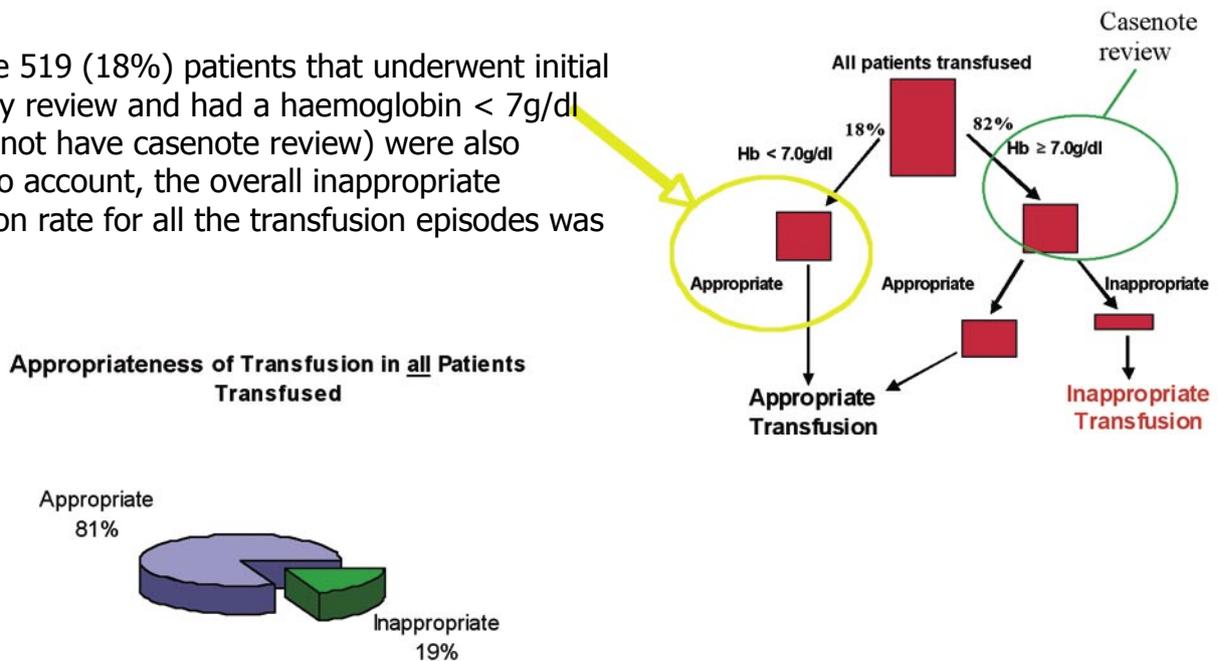
## The Appropriateness of Transfusion

Twenty four percent of patients transfused with an initial haemoglobin  $\geq 7.0\text{g/dl}$  should not have been transfused as they had a pretransfusion haemoglobin above the agreed threshold for an appropriate transfusion.

### Appropriateness of Transfusion Decision (casenotes)



When the 519 (18%) patients that underwent initial laboratory review and had a haemoglobin  $< 7\text{g/dl}$  (and did not have casenote review) were also taken into account, the overall inappropriate transfusion rate for all the transfusion episodes was 19%:



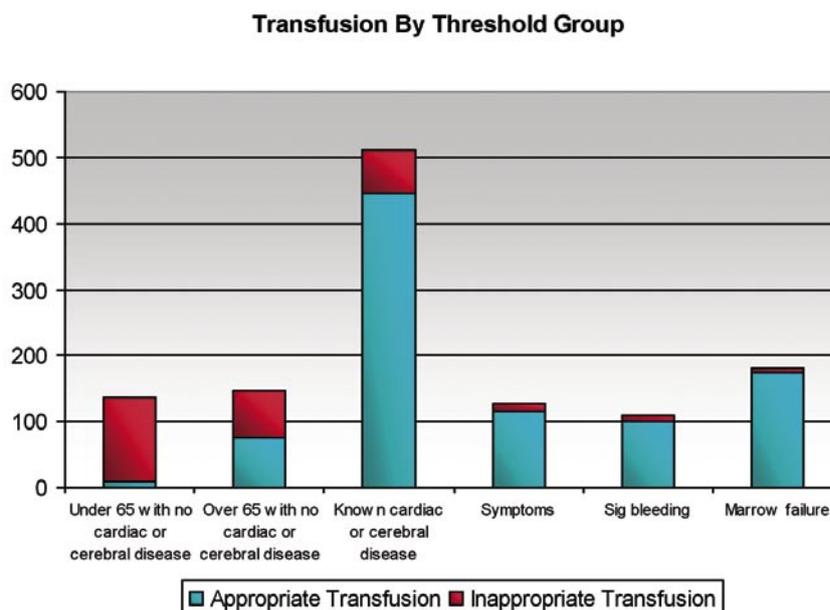
This indicates that many patients were exposed to a transfusion that was not judged absolutely necessary. Furthermore, the majority (75%) of this group did not need any further transfusion during their hospital stay and therefore could have avoided exposure to transfusion altogether.

### Recommendation 3

**Patients should only be considered for transfusion when their haemoglobin level has fallen below an appropriate transfusion threshold.**

## Groups at Risk of Inappropriate Transfusion

When the appropriateness of transfusion was examined according to transfusion threshold group, the following pattern emerged:



It can be seen that the majority fall into three categories:

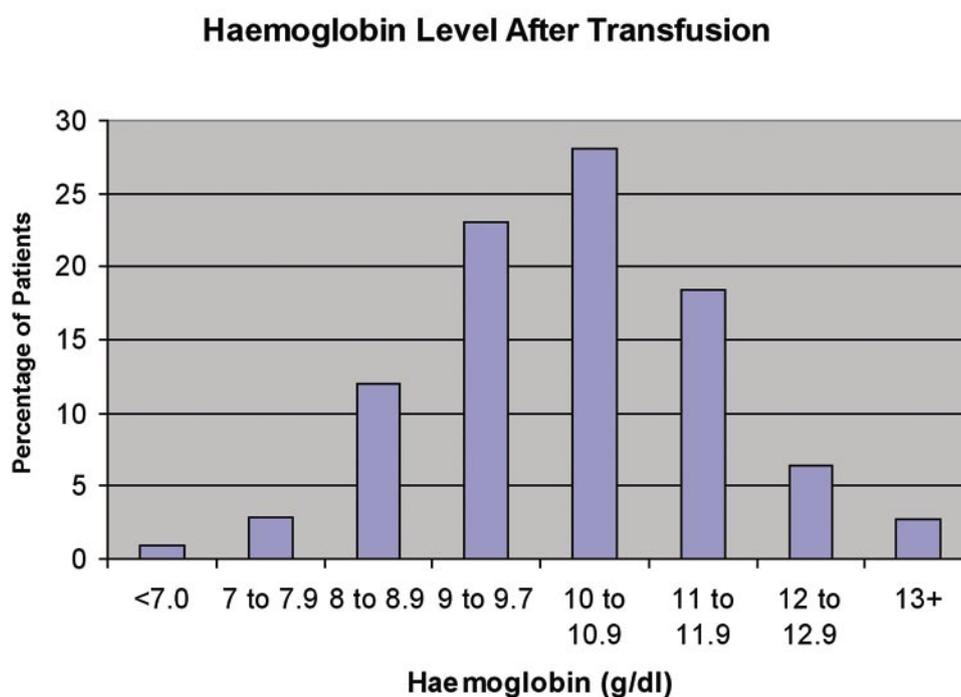
- 127 (92.7%) of asymptomatic, stable patients under 65 years old
- 72 (48.6%) of patients over 65 years old without cardiac or cerebrovascular disease
- 64 (12.5%) of patients with some cardiac or cerebrovascular disease

### Recommendation 4

**Particular attention should be paid to the decision to transfuse in all healthy patients without cardiac or cerebrovascular disease who will have low transfusion thresholds and are particularly at risk of inappropriate transfusion.**

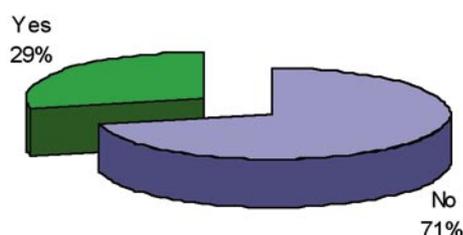
## Overtransfusion

The audit identified that patients were frequently transfused to a haemoglobin level well in excess of their original transfusion threshold:

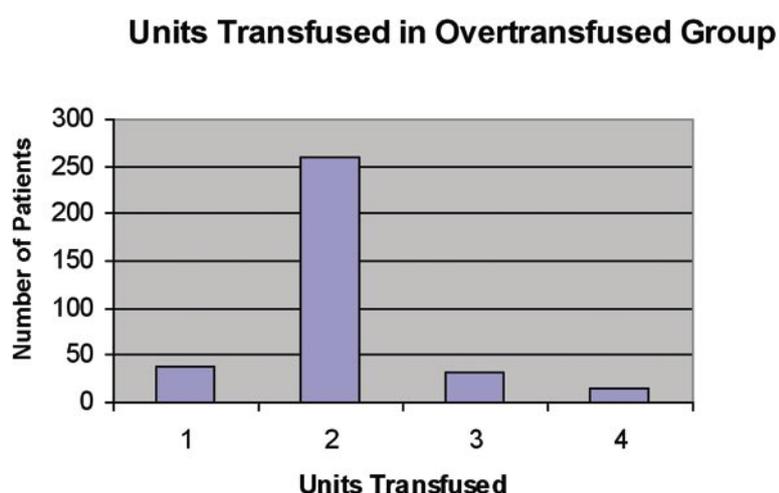


One of the objectives of the audit was to identify overtransfusion of more than 2g/dl above the threshold transfusion figure and this was found to be 353 (29%) of audited patients.

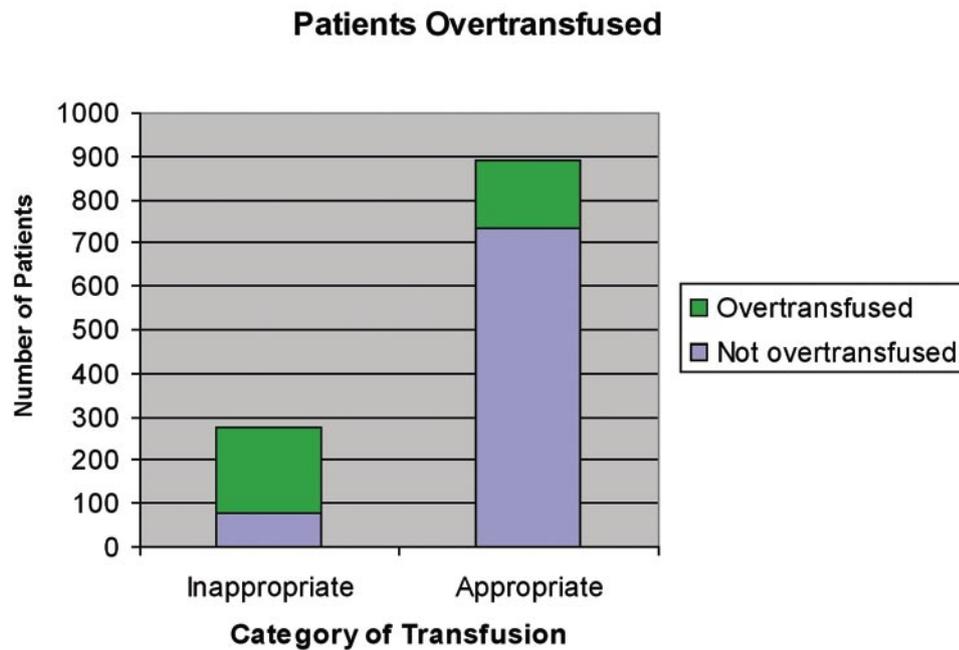
### Patients Overtransfused At This Transfusion Episode



The breakdown of units transfused in the overtransfused group revealed that 298 patients only had a 1 or 2 unit transfusion:



196 (72%) of patients inappropriately transfused were overtransfused and 156 (17%) of the group judged to be appropriately transfused were also overtransfused:



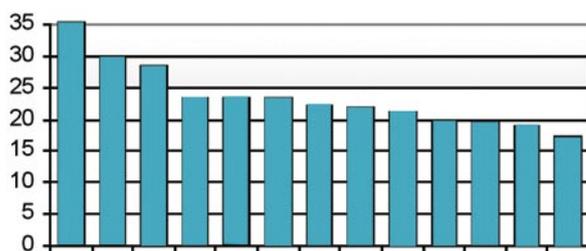
## Recommendation 5

**Overtransfusion should be avoided. When deciding how many units to transfuse, consideration should be given to the transfusion threshold for the patient, the size of the patient and whether or not significant active bleeding is present. Single unit transfusions may be appropriate in some cases.**

## Where Practice Change Is Needed

Inappropriate transfusion decisions were not confined to any one hospital, clinical speciality or grade of doctor making the decision to transfuse. Some variations in practice could be explained by casemix and local trigger policies, but no one hospital provided an outstanding example of good practice:

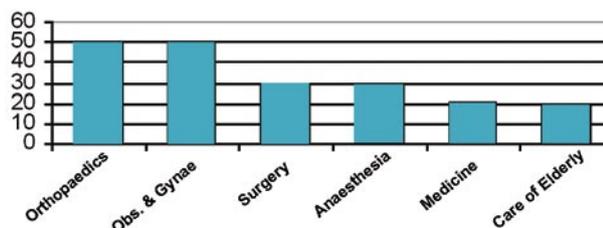
**Inappropriate Transfusion Rates  
By Hospital**



(Range 18% to 35%)

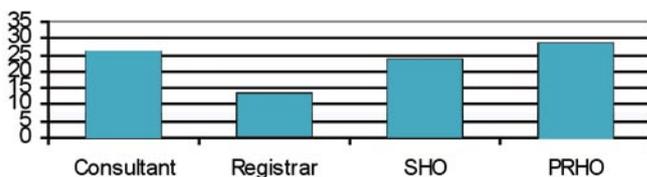
Hospital

**Inappropriate Transfusion By Selected  
Specialty**



(Range 20% to 50%)

**Inappropriate Transfusion By  
Doctor**



(Range 13% to 28%)

Grade of Doctor

On the basis of such a wide distribution of inappropriate transfusion across so many specialities, it is clear that education to improve practice needs to be widespread across the region.

### Recommendation 6

**Education to reduce inappropriate transfusion needs to be directed to all grades of doctors, across all specialities in all hospitals within the region.**

# Limitations

While this audit was designed, developed and extensively piloted by a multi-professional team of experienced professionals, several areas of potential bias were still identified:

- Only one transfusion episode was audited per patient. This excluded patients with frequent transfusion and high thresholds such as marrow failure patients from repeated inclusion that may have largely been appropriate transfusion episodes
- In some hospitals, there was a rather high incidence of case note unavailability and certain categories of transfused patients may have been omitted disproportionately
- Some patients may have had near patient testing (with a low result that merited transfusion) that was not recorded anywhere in the notes but which may have been an appropriate figure to indicate transfusion
- There is some criticism that the 10g/dl threshold for chemotherapy/radiotherapy/marrow failure patients is too high
- Smaller hospitals were over-represented in terms of cases audited per overall number of units transfused
- Otherwise healthy patients with mild hypertension were categorised as “cardiac” patients and were allowed a higher threshold than was likely to be necessary
- Inter-hospital comparison is difficult to perform as there is casemix variation between different hospitals. Hospitals with high numbers of haematology patients (threshold 10g/dl) would be expected to perform better than those with high numbers of young fit patients (threshold 7g/dl)

## Audit Facilitation Team

- Hospitals will have their individual performance data returned to them so they can identify areas for practice improvement
- The report will be published and widely distributed throughout the region
- An educational presentation will be made available to all hospital transfusion committees and Haemovigilance Practitioners
- An education day will be organised to coincide with the launch of the report

## The Northern Ireland Regional Transfusion Committee (NIRTC)

- The NIRTC should fully endorse the 6 main recommendations of the report
- The NIRTC or a nominated subgroup should explore how prehospital anaemia can be best improved interacting with a multiprofessional team of Hospital Specialists and Primary Care
- There should be an updating of the CREST Blood Transfusion Guidelines to define better and further improve the clarity of its transfusion thresholds, particularly in the 7g/dl to 10g/dl mid range. This request should be initiated through the NIRTC
- Primary Care representation should be invited onto the committee as primary care has a significant role in preventing transfusion

## Hospital Blood Transfusion Committees

- The 11 Blood Transfusion Chairs will present the data with the agreed recommendations to their committees and disperse the findings widely throughout their hospitals
- Upper Limit Transfusion Thresholds similar to the audit criteria should be introduced in all hospitals in the region
- The HTC should request from the appropriate authorities within the hospital that the Blood Transfusion Laboratory staff be empowered to question transfusion when the haemoglobin is above the Upper Limit Transfusion Thresholds

## Standardisation Group of the NIRTC

- The new regional blood ordering request form should incorporate the indication for transfusion. Such indications will facilitate hospital blood bank staff to challenge and possibly prevent inappropriate requests

## Haemovigilance Practitioners

- Hospital Haemovigilance Practitioners must engage in widespread education regarding inappropriate transfusion and overtransfusion that the audit has identified
- There should be ongoing monitoring / audit of the level of inappropriate transfusion

## **Department of Health**

- This report identifies that all hospitals, specialities and grades need to improve their practice. It recommends that widespread education is essential to inform clinicians fully of the improvements possible in blood transfusion practice. The NIRTC has endorsed such education but recognises that it is only likely to be driven by a full implementation of the Regional Haemovigilance Programme in all the hospitals in the region

## **Individual Trusts**

- Trusts should fully endorse these recommendations and the education of their staff
- Hospital Transfusion Teams should be fully implemented as laid out in HSS Circular MD6/03 - Better Blood Transfusion – Appropriate Use of Blood 2003
- There should be high-level endorsement of the empowerment of Blood Transfusion Staff to query transfusion above Upper Limit Transfusion Thresholds

## **Lead Audit Group of the NIRTC**

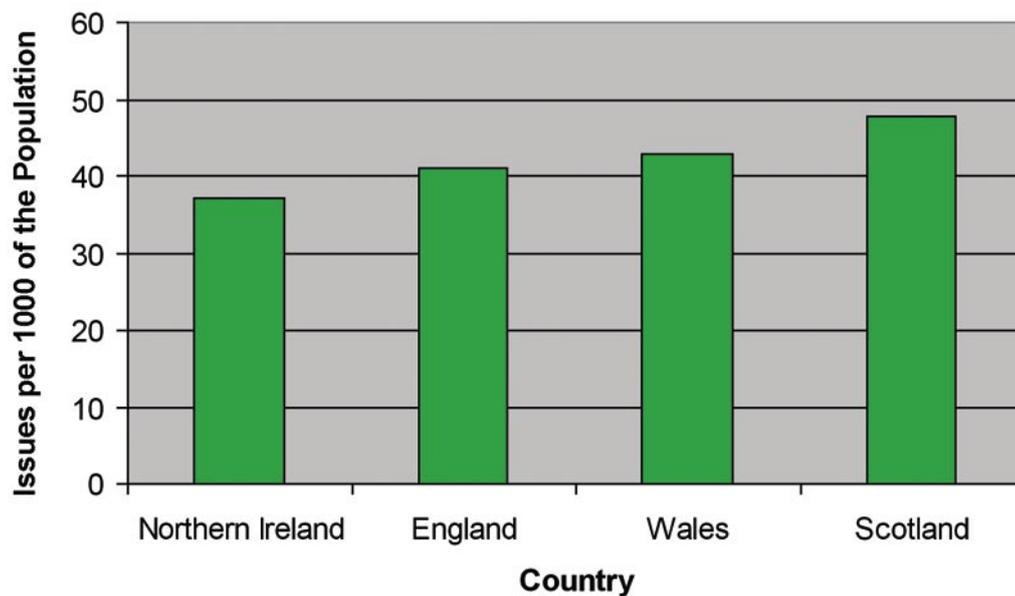
- The data should be presented to a GP forum to highlight the problem of pre-hospital anaemia
- The Lead Audit Group should consider when to repeat the audit to monitor the effectiveness of the audit plan

# Discussion

It should be recognised that 19% of patients having an inappropriate transfusion episode in this audit does not mean that 19% of blood is administered inappropriately. The audit has not allowed repeat episodes in the same patient (thus excluding the necessary repeated episodes in marrow failure and bleeding patients which are invariably appropriate) and so the actual figure number of inappropriate units transfused may be considerably less than 19%.

While the audit suggests that inappropriate transfusion and overtransfusion rates are high, it should be pointed out that that Northern Ireland already has the lowest number of blood issues per capita out of the four countries in the UK suggesting that practice is better than elsewhere in the UK.

**Blood Issues per 1000 of the Population (2004/2005)**



However despite this relatively superior performance this audit clearly demonstrates that potential still exists to both significantly decrease transfusion episodes and also reduce excessive transfusion in individual patients. Such actions would reduce patient exposure to blood and conserve a vital resource to be available for other patients when it is really needed.

As accepted triggers for transfusion fall or become better defined, what was once considered an appropriate transfusion may become regarded as inappropriate. Some hospitals had high inappropriate use because their transfusion triggers were simply set too high. The transfusion criteria used for the audit are much better defined than previous regional publications and as a synthesis of all current available standards they allocate an upper haemoglobin limit of transfusion acceptability for predetermined groups within the grey area for transfusion between 7g/dl and 10g/dl.

The audit group went to some lengths to agree generous thresholds for this audit above which transfusion could not be described as anything but inappropriate.

**This should not be taken to mean that once the haemoglobin falls below these thresholds that transfusion is either necessary or appropriate. Transfusions given must always be justified and based on the patient's clinical condition and needs.**

For example, transfusing an asymptomatic 33 year old with mild hypertension (Hypertension = Cardiac = threshold of 9.0g/dl allowed in the audit) 2 days post operatively with a Haemoglobin concentration of 8.3g/dl with no significant further blood loss expected could not be judged appropriate.

Similarly transfusing a 67 year old otherwise healthy patient (Age = threshold of 8.0g/dl allowed in the audit) with haemoglobin of 7.8g/dl with untreated iron deficiency anaemia is equally inappropriate.

There are several publications suggesting that young healthy patients tolerate haemoglobin concentrations less than 7.0g/dl, and that a threshold of 8.0g/dl is as safe as 9.0g/dl for some cardiac patients. There is also increasing evidence that restrictive strategies may actually be beneficial in many patient groups compared to more liberal approaches. Many doctors already practice such strategies based on best evidence and clinical judgement for the benefit of their patients and are indeed very much encouraged to continue to do so.

**It is important to realise that there is no "universal trigger" and that the decision to transfuse is multifactorial and should include the patient's stability, symptoms, evidence of significant bleeding and relevant co-morbidity in addition to a haemoglobin level.**

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- Serious Hazards of Transfusion (SHOT) reports 2001-2002 and 2002-2003.

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# Notes

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