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National Comparative Audit of Blood Transfusion

NHS Blood and Transplant

National Comparative Audit of Blood Transfusion

Audit of the Use of Platelets

St. Elsewhere's NHS Foundation Trust

March 2007

Acknowledgements

We wish to thank all those who have participated in the National Comparative Audit of Platelet Transfusion. 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:

Chesterfield Royal Hospital
Great Ormond Street Hospital, London
Freeman Hospital, Newcastle-upon-Tyne
Rotherham District General Hospital
Royal Liverpool University Hospital
Russells Hall Hospital, West Midlands
West Middlesex University Hospital
Queen's Medical Centre, Nottingham
Manchester Royal Infirmary
Torbay Hospital
The Royal London Hospital
Noble's Hospital, Isle of Man
University College, London
Leicester Royal Infirmary, Leicester

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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 Borralessa, NHS Blood and Transplant; Dr Hannah Cohen, British Society for Haematology; Jean Gaffin, Brent teaching Primary Care Trust; 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; Jane Ingham, Royal College of Physicians; 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`Shaugnessy, 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; Dr Dorothy Stainsby, Serious Hazards of Transfusion; Tanya Hawkins, Specialist Practitioners of Transfusion; Dr Craig Taylor, NHS Blood and Transplant; Mr John Thompson, Royal College of Surgeons; Dr Gill Turner, Norfolk and Norwich University Hospital; Alan Burgess, Lay representative; Adrian Copplestone, National Blood Transfusion Committee; Jonathan Potter, Royal College of Physicians.

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CONTENTS

Executive summary

Introduction
In the year 2005-06 over 217 000 units of platelets were issued to hospitals in England, at a cost of £ 47.7 million. Over the past decade, there has been a significant increase in the demand for platelets and the cost of healthcare attributed to platelet transfusion therapy. While platelet transfusion is an essential and life saving treatment in some clinical situations, there are significant risks of blood component therapy[1] and it is important to ensure appropriate clinical use.

This is the first national audit of platelet transfusion therapy in the UK. The audit attempts to examine appropriateness of platelet use against audit standards, which have been drawn, where possible, from the current national guidelines[2]. The audit allows hospitals to compare their own practice with the national data.

Methods
All NHS trusts and independent hospitals in the UK were invited to participate in the audit. The audit tool was piloted in 14 hospitals during March 2006. An audit tool webpage was designed in April and May, and data for the main audit was entered electronically, between June and October 2006. The target audit sample was 40 consecutive patients receiving a platelet transfusion - 10 intensive care unit (ITU) patients, 15 haematology, 10 cardiac and 5 miscellaneous. Patients of all ages were eligible. Current practice was evaluated against the audit standards.

Audit sample
This audit examines platelet use in 4,421 patients, from 182 NHS, and 5 independent hospitals in the UK. The audit sample consists of 2125 haematology patients, 912 ITU patients, 361 patients undergoing cardiac surgery and 1023 patients assigned to the miscellaneous category. Of 4,421 platelet transfusions audited, the reason for platelet transfusion was stated for 93% (4100/4421); of these 57% (2338/4100) were given for prophylaxis (in the absence of bleeding).

- Of 2125 platelet transfusions given to haematology patients, reason for platelet transfusion was not stated for 7% (149/2125). Of the remaining platelet transfusions in haematology patients, the vast majority (72%, 1423/1976) were for prophylaxis.
- The reason for platelet transfusion was not stated for 4% (41/912) of ITU patients; of the remaining 871 ITU cases, platelet transfusions were therapeutic (to control bleeding) in 53% (462/871), and prophylactic in 47% (409/871).
- Of 361 transfusions in cardiac cases, the reason for platelet transfusion was not given for 36% (131/361); of the remaining 230 cardiac transfusions, 15% (35/230) were prophylactic, and 85% (195/230) were given to treat bleeding either during (38%, 75/195) or after (62%, 120/195) surgery.
- In the miscellaneous category, 54% (552/1023) of platelet transfusions were therapeutic and 46% (334/1023) were given for prophylaxis.

Key findings of non-compliance with the audit standards
The audit highlights a significant lack of compliance with the current BCSH guidelines and other audit standards. Of 4,421 transfusions audited, appropriateness could be determined for 3,726 (84%) transfusions. Of 3,726 transfusions, 43% (1601/3726) transfusions did not comply with the audit standards. The main findings are summarised below for each audit category.

Main findings of cardiac audit

- Of 361 platelet transfusions given to patients undergoing cardiac surgery, appropriateness could be evaluated for 230 transfusions. Of these, 15% (35/230) did not comply with the audit standards. However, as the reason for transfusion was not given for 28% of cardiac cases, it is possible that the above evaluation may be an underestimate.

- 59% (174/293) platelet transfusions given to patients undergoing a cardiac procedure involving cardiopulmonary bypass (CPB) comply with the current BCSH guidelines as the reason for transfusion was to control bleeding.

- 17% (61/361) of patients receiving a platelet transfusion did not have their pre-transfusion platelet count checked. Where a pre-transfusion platelet count was checked, it was done on the same day as transfusion in only 55% (198/361) of cases.

- 54% (21/39) of patients undergoing a surgical procedure that did not involve (CPB), were given a platelet transfusion when a pre-transfusion count was > 80 x 10^9/L (well in excess of the recommended platelet count). The fact that 13/21 patients in the non-CPB category were not anti-platelet drugs, makes it even more difficult to justify these transfusions.

- There appears to be a significant variation in platelet transfusion triggers for patients undergoing Extra-Corporeal Membrane Oxygenation (ECMO)

Main findings of haematology audit

- Of 2125 platelet transfusions given to haematology patients, 1867 transfusions could be evaluated for appropriate use. Of these, 60% (803/1867) did not comply with the audit standards.

- The majority (60%, 653/1090) of haematology patients who received platelet transfusion for routine prophylaxis (in the absence of any haemorrhagic manifestation or high risk of bleeding), were transfused when pre-transfusion count was > 10 x 10^9/L, which is the recommended trigger for such transfusions.

- 21% (107/515) patients who were not bleeding and did not undergo an invasive procedure but had sepsis, were on antifungals or had acute promyelocytic leukaemia (APML, n5) received prophylactic platelet transfusion when a pre-transfusion count was ≥ 20 x 10^9/L. This shows poor compliance with the recommendations in the current BCSH guidelines.

- 30% (448/1419) of inpatients receiving platelet transfusion did not have pre-transfusion platelet count checked on the same day.

- 16% (43/262) of patients who received prophylactic platelet transfusion prior to an invasive procedure, had a pre-transfusion count of ≥ 50 x 10^9/L, and post-transfusion count was not checked in 21% (54/262).

Main findings of ITU audit

- Of 912 transfusions given to ITU patients, 823 could be evaluated for appropriate use. Of these, 49% (402/823) did not comply with the audit standards.

- The majority (59%, 139/236) of patients, who received platelet transfusion in the absence of bleeding, or a planned invasive procedure, were transfused when pre-transfusion platelet count was ≥ 30 x 10^9/L.

- 42 % (67/161) of patients who received platelet transfusion prior to an invasive procedure had a pre-transfusion count of ≥ 50 x 10^9/L, indicating poor compliance with the current BCSH guidelines for the use of platelet transfusions.

- 46% (196/426) of patients who received platelet transfusion to control bleeding, had a pre-transfusion platelet count of ≥ 50 x 10^9/L.

Main findings of the miscellaneous category audit

- Of 1023 platelet transfusions given to patients in this category, appropriateness could be determined for 806 transfusions. Of these, 45% (361/806) did not comply with the audit standards.

- 35% (363/1023) of patients receiving platelet transfusions did not have a pre-transfusion platelet count checked on the same day as transfusion.

- The majority (66%, 107/161) of medical patients were transfused platelets for routine prophylaxis when the pre-transfusion platelet count was > 10x10^9/L, indicating poor compliance with the national guidelines.

- 52% (57/130) of patients were given platelets transfusions to cover an invasive procedure despite the pre-transfusion platelet count being > 50 x 10^9/L.

- 38% (197/515) of patients who received platelets for a haemorrhagic manifestation had pre-transfusion platelet count of ≥ 50 x 10^9/L, again showing poor compliance with national guidelines.

Discussion

Despite the complexity of many factors involved in making clinical decisions regarding platelet transfusion therapy, the audit dataset provides sufficient information to allow an evaluation of appropriate platelet use against the audit standards. To enable benchmarking, the individual hospital results are presented in comparison with the national results for each audit standard in the main report. However it should be noted that some hospitals provided data on very small number of cases, and they should take this into consideration when interpreting their own results. The national results show a significant non-compliance with the current guidelines and the audit standards in all categories of patients, highlighting the need to re-examine current platelet transfusion practice in all areas. Most notable non-compliance was observed in the setting of prophylactic platelet transfusions in haematology, ITU and medical patients who were thrombocytopenic but stable, with no evidence of bleeding. It should be noted that the observed non-compliance does not necessarily mean that all non-compliant transfusions were inappropriate, but

rather that platelets were transfused at a higher threshold than that recommended in the guidelines. Likewise it is not possible to translate the level of non-compliance to an equivalent reduction in platelet use that might be achieved by improving compliance; however better compliance is likely to achieve a significant reduction in platelet usage and the associated cost, as well as improve platelet availability.

There are several reasons that might explain a degree of non-compliance with the recommended transfusion thresholds in the reality of clinical practice, as described in the recently published literature[3,4,5]. It is acknowledged that a 100% compliance with a transfusion guideline is unrealistic, however, the level of non-compliance observed in this audit is remarkable. It is important to realise that the current practice of prophylactic platelet transfusion is not evidence based and at present we do not know that it is optimal or even necessary. Several studies are currently underway to address these questions but, in the meantime, it is important that every effort is made to adhere with the currently recommended thresholds for platelet transfusion. There is evidence to show that it is possible to reduce platelet use by adapting lower thresholds for platelet transfusion[6,7,8].

Conclusion

The results of this audit show that a large number of platelet transfusions (45%, 1681/3734) did not comply with the audit standards. There is clearly a need to re-evaluate current platelet transfusion practice, to develop local transfusion protocols, to educate prescribers, and perform regular audits to ensure compliance. The audit highlights the need for clinical research to evaluate clinical outcomes and efficacy of platelet transfusion therapy, particularly in the setting of prophylactic transfusions. The audit also highlights the need for developing more comprehensive national guidelines for the use of blood component therapy, particularly in cardiac surgery and ITU.

Recommendations

The following recommendations are drawn based on the audit findings. Hospitals should develop and implement an action plan to address recommendations 1 to 4.

1. Hospital Transfusion Committees must ensure that there are written local guidelines for the use of platelets in all clinical specialties where platelet transfusions take place. As a minimum, these guidelines should be developed for platelet use in haematology, oncology, ITU, cardiac surgery, vascular surgery, hepatic surgery, and for the management of patients with massive haemorrhage. Where national guidelines exist, these should form the basis of local guidelines.

2. Hospitals must educate all clinicians responsible for making the decision to prescribe platelet transfusions. This should include consultants, middle grade and junior doctors.

3. Hospitals should carry out regular (at least annual) audits of compliance with the guidelines.

4. Hospitals should consider the implementation of new technologies such as point of care testing using thromboelastography to help guide the appropriate use of platelet transfusions in cardiac, liver and vascular surgery and for other surgical procedures with high risk of bleeding such as multiple trauma, massive haemorrhage and high risk obstetric surgery.

5. The BCSH should consider developing comprehensive guidelines for the use of platelets in ITU and cardiac surgery, in collaboration with the British Cardiovascular and Intensive Care Societies.

An action plan is being developed by the audit project group in collaboration with the regional transfusion committees to assist hospitals in meeting these recommendations.

MAIN REPORT

The main audit report is divided into 7 sections.

Section I) Introduction and audit methodology
Section II) Results of Cardiac audit
Section III) Results of Haematology audit
Section IV) Results of ITU audit
Section V) Results of Miscellaneous audit
Section VI) References
Section VII) Appendices

Section I. Introduction and audit methodology:

This section describes the purpose, aims and objectives, audit methodology, data handling and analysis, presentation of audit results and the plan for dissemination of audit findings. Key audit results and recommendations are described in the executive summary.

Why is this audit necessary?

In the year 2005-06, over 217 000 therapeutic doses of platelets were issued to hospitals in England, representing a cost of £ 47.7 million. Whilst there has been a significant decline in the use of red cells, the demand for platelets has increased in recent years. This may be partly explained by factors such as more intensive treatment protocols for patients with malignancy and complex surgery, but it may also reflect inappropriate clinical use.

There are significant risks of blood component therapy. Bacterial contamination, Transfusion Related Acute Lung Injury (TRALI), allergic transfusion reactions, and alloimmunisation resulting in platelet refractoriness are significant hazards of platelet transfusion (Serious Hazards of Transfusion {SHOT} annual reports)[1]. An equally important issue is the rising cost of blood component therapy in the UK. There is, therefore, a need to ensure appropriate clinical use of platelets.

The National Comparative Audit of the use of Platelets provides important information about current clinical practice and level of compliance with published national guidelines[2], and its comparative element is designed to encourage best practice.

What does this audit do?

- Evaluates clinical platelet transfusion practice using standards drawn from British Committee for Standards in Haematology (BCSH) guidelines[2], where available.
- Compares platelet transfusion practice of individual participating hospitals with national practice.
- Identifies areas of poor practice to encourage better practice by the dissemination of audit findings and through educational events.

This audit aims to achieve:

- The stimulation of discussion and debate at a number of regional meetings, as a means of increasing awareness about:
- the scale of inappropriate platelet transfusion practice
- the risks to patients, and the costs of inappropriate platelet transfusion practice
- a better understanding about good platelet transfusion practice

- Improvement in platelet transfusion practice

The principal stakeholders are:
- NHS Trusts
- Independent hospitals
- NHS Blood & Transplant
- Medical Royal Colleges
- Healthcare Commission

Methods

How were Trusts and hospitals recruited to the audit?

All NHS Trusts and Independent hospitals in England were invited to participate in the audit. Trusts and hospitals in Wales, Northern Ireland and Scotland were invited to participate via nominated contacts within the blood services in those countries.

A letter, explaining the reason for the audit, the purpose of the audit, the proposed timescale, and the proposed dataset to be collected, was sent from the clinical audit lead to the managers of independent hospitals, and 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. Non-responders were sent reminder letters and were contacted by telephone, resulting in a high level of recruitment to the audit.

279 NHS hospitals and 74 independent hospitals were invited to participate. Of these, 227 (81%) NHS hospitals and 20 (27%) independent hospitals agreed to participate, with data received from 182 NHS (168 from England) and 5 independent hospitals.

What is the nature and size of the case sample for this audit?

Participants were asked to collect data over a 3-month period. The target sample was 40 consecutive patients receiving a platelet transfusion - 10 ITU patients, 15 Haematology, 10 Cardiac and 5 Miscellaneous. All patient ages were eligible.

What was the data collection method?

Participants had the choice of collecting data on a prospective or recent retrospective basis, depending on their operational preferences, always provided the cases were, as far as possible, consecutive, so as to eliminate selection bias. Data entry was directly onto the audit tool webpage designed for the purpose (see appendix A for items included). Benefits of web-based data entry include more accurate data and less incomplete fields, resulting in an overall higher quality of information on which to base this report.

Audit Pilot

The audit tool was piloted on paper in March 2006 by 14 hospitals representing a mix of District General Hospitals and large University hospitals. A short technical pilot of the electronic data capture was undertaken in May 2006. The main audit began in June 2006.

What is the communication plan for this audit?

Results are being communicated by means of this written report to

- NHS Trust medical directors (full printed report)
- NHS trust chief executives (printed executive summary)
- Trust's haematology, medical, surgical, ITU and cardiac surgery departments.

Electronic copies of full reports and A4 summaries of key findings and learning points will be sent to:

- Hospital Transfusion Teams, with the request to widely disseminate
- Chairs of hospital transfusion committees
- Chairs of regional transfusion committees
- In independent hospitals, a report will be sent to the nominated contact.

A summary of the audit will be included in biannual reports to the Healthcare Commission. Results will be submitted as abstracts for presentation at appropriate conferences and seminars, as well as for publication in appropriate professional, peer reviewed journals.

NHS Blood and Transplant will not issue a press release, but the Royal College of Physicians may make a release. A slideshow summarizing results will be available.

Data handling

This was the first transfusion audit to use web entry and the data checking facilities were not as advanced as they will be for future audits. Consequently there was some routine data cleaning necessary, particularly to gain consistency between different scales of measurement (e.g. for dose) and removing gross outliers and removing information for dates out of sequence (e.g. a before transfusion platelet count occurring after transfusion).

Presentation of results

Wherever possible the audit question numbers (e.g. C1 which refers to question 1 in the cardiac audit) 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 interquartile range (IQR). Missing data (often termed ‘insufficient information’) are reflected by variation in patient denominators.

Individual hospital results (presented in the main report as the number of patients) 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.

Section II. Results of the cardiac audit

The audit sample: YOUR SITE 0 CASES

There were 361 audit cases from 39 sites, median 10 cases per site, inter-quartile range 8-10 cases, range 1-40 cases. The national results shown below comprise data for 321 cases from 33 English NHS hospitals (89% of all audit cases), 19 from 3 English independent hospitals, 12 from 2 NHS hospitals in Wales and 9 from 1 NHS hospital in Northern Ireland. In England there were 30 centres that were known to perform cardiac surgery and the audit includes data from 80% (24/30) of these.

Of 361 cases, 10% (37/361) were children. The surgical procedure was primary coronary artery bypass graft (CABG) in 47% (168/361), second or subsequent CABG in 6% (20/361), aortic valve replacement in 27% (96/361), and various paediatric cardiac procedures in10% (37/361). 37% (134/361) included, among others, a combination of CABG and aortic &/or mitral valve replacement. 87% (303/349) involved cardiopulmonary bypass (CPB), and 73% (255/347) were elective.

In 78% (283) of cases the platelet transfusion was given on the same day as the surgical procedure, for 11% (39) the day after, and another 6% (20) within 2-13 days post-operatively. The remaining 5% (19) comprised insufficient data.

More detailed demographic data can be found at the end of cardiac section.

Key Findings

- 59% (174/293) platelet transfusions given to patients undergoing a cardiac procedure involving CPB complied with the current BCSH guidelines as the reason for transfusion was to control bleeding. Of the remaining 41% (119/293) of platelet transfusions in the CPB category,
    - 11% (32/293) transfusions were given for prophylaxis i.e., for low platelet counts in the absence of bleeding (this practice is against the current BCSH guidelines), and
    - No reason was stated for 31% (94/293) of platelet transfusions, and hence appropriateness could not be determined for these transfusions.

- 54% (21/39) of patients undergoing a surgical procedure that did not involve CPB, were given platelet transfusion when a pre-transfusion count was > 80 x 10^9/L. 13/21 had received no anti-platelet drugs during the 5 days before surgery.

- 17% (61/361) of patients receiving platelet transfusion did not have pre-transfusion platelet count checked. Where a pre-transfusion count was checked, it was done on the same day as transfusion in only 55% (198/361) of cases.

- There appears to be a significant variation in platelet transfusion triggers for patients undergoing Extra-Corporeal Membrane Oxygenation (ECMO)

Audit Standards

This audit attempts to examine appropriate platelet use in cardiac surgery in the UK. Although the current BCSH (2003) guidelines for the use of platelet transfusion[2] provide some guidance on platelet transfusion therapy in procedures involving CBP, these are not comprehensive. The evidence base for appropriate platelet use in this setting is lacking and there are no published guidelines that specifically address the issue of platelet use in cardiac surgery. It is therefore acknowledged that whilst the following audit standards, drawn solely for the purpose of this audit, may be considered good clinical practice (GCP), but are not evidence based.

Evaluation of current practice against audit standards:

Audit standard C1: Patients undergoing cardiopulmonary bypass surgery should only be given platelet transfusion if there is uncontrolled non-surgical bleeding during or after surgery (BSCH 2003).

Current Practice:

- Of 303 procedures involving CPB, platelet transfusion was given to control bleeding during or after surgery in **59%** (174/293) cases, 10 cases with insufficient information excluded.
- **Your site: /** cases received platelet transfusion to control bleeding.
- Of the CPB cases, in 32% (94/293) no reason was given, whereas in 9% (25/293) the *only* reason given for platelet transfusion was a low platelet count. The current BCSH guidelines recommend against the use of prophylactic platelet transfusions (in the absence of bleeding) in cardiopulmonary bypass surgery.
- When platelets were transfused because of low platelet count (in the absence of bleeding), the median (IQR) platelet count was 67 x 10^9/L (46-89), n=25 for procedures involving CPB, and 29 x10^9/L (10-49), n=10 for procedures where CPB was not involved

Reason(s) for platelet transfusion

		National (361) Cardiopulmonary bypass involved				**Your site (0)** Cardiopulmonary bypass involved	
		YES (303)		NO (46)		YES ()	NO ()
		%	N	%	N	**N**	**N**
C19	Reason* platelet transfusion was given:						
	Severe bleeding in theatre?	11	34	11	5		
	Oozing from surgical site?	13	39	4	2		
	Bleeding after surgery?	36	110	30	14		
	Low platelet count during or after surgery?	11	32	26	12		
	"No reason" given	31	94	17	8		
	Whole section blank (insufficient information)	3	10	15	7		

* Multiple reasons were given for some cases.

Audit standard C2: Platelet count should be checked before platelet transfusion is given (BCSH 2003).

Current Practice:

- In cardiac surgery involving CPB, microvascular bleeding may occur due to impaired coagulation, thrombocytopenia and/or transient platelet function defect induced by CPB. Whilst a normal platelet count gives no indication of platelet function, and is therefore unhelpful in deciding whether platelet transfusion is indicated, it is useful to know if there is significant thrombocytopenia, i.e., platelet count of < $50x10^9$/L, as it may help determine the appropriate dose of platelet transfusion necessary. It is therefore considered good practice to check pre-transfusion platelet count whether or not the procedure involves CPB circuit. Whilst it is acknowledged that in some cases clinical urgency may require a therapeutic intervention before laboratory results are known, a blood sample for platelet count should nevertheless be taken prior to transfusing platelets.

- Pre-transfusion platelet count was known in 84% cases (254/303) in the CPB category, it was stated as not recorded for 10% (31/303) and insufficient information was given for 6% (18/303).

- **Your site: /** CPB cases had a pre-transfusion platelet count checked.

- Pre-transfusion platelet count was checked in 83% (38/46) of cases where the surgical procedure did not involve CPB.

- **Your site: /** non-CPB cases had a pre-transfusion platelet count checked.

- Where a pre-transfusion platelet count was checked in either category, it was checked on the same day as platelet transfusion in only 55% (198) of cases. In 20% (74) cases it was checked the day before transfusion, whereas in 8% (28) it was checked 2-20 days prior to platelet transfusion. This indicates poor practice.

- For procedures not involving CPB, and where a patient is not on anti-platelet therapy, platelet transfusion is unlikely to be necessary if pre-transfusion platelet count is ≥ 80 x 10^9/L. For 21 of 39 (54%) procedures the pre-transfusion platelet count was ≥ 80 x 10^9/L. Of these 21, 13 were not receiving antiplatelet drugs, but 5 were (3 on clopidogril & aspirin, 2 on aspirin), with insufficient information for 3.

Timing of pre- and post transfusion platelet count

		National (361)		**Your site (0)**
		%	N	**N**
C15	Date of PRE-transfusion platelet count			
	Same day as platelet transfusion	55	198	
	Day before platelet transfusion	20	74	
	2-12 days before platelet transfusion	8	28	
	Insufficient information	17	61	
C17	Date of POST-transfusion platelet count			
	Same day as platelet transfusion	49	177	
	Day after platelet transfusion	42	152	
	2-4 days after platelet transfusion	3	11	
	Insufficient information	6	21	

Pre- and Post Transfusion Platelet Counts:

- The pre- and post transfusion platelet counts in the following tables are stratified by whether or not the cardiac procedure involved CPB (C5):
- It is interesting to note that over 50% of patients receiving platelet transfusions in the CPB category had a platelet count ≥ 130 x 10^9/L. The assumption must have been that the bleeding (where this was stated as the reason for transfusing platelets) was due to platelet function defect, which is difficult to confirm or exclude in a timely manner, unless thromboelastography (TEG) is used to monitor haemostasis in theatre. However TEG was used in only 24% (70/291) cases. It is therefore difficult to determine whether the majority of platelet transfusions were, in fact, appropriate.

Pre- and post transfusion platelet counts

	Cardiopulmonary bypass (CPB) involved (303)	National (303)				**Your site ()**	
		Median	IQR	10-90th centile	N	Median	N
C14	*Pre-transfusion platelet count?	132	76-217	55-282	254		
C16	Post-transfusion platelet count?	143	112-178	84-233	285		
	Difference POST minus PRE	12	-51 to +50	-130 to 96	244		

	Cardiopulmonary bypass (CPB) NOT involved (46)	National (46)				**Your site ()**	
		Median	IQR	10-90th centile	N	Median	N
C14	*Pre-transfusion platelet count?	89	44-161	15-221	39		
C16	Post-transfusion platelet count?	128	87-178	57-210	45		
	Difference POST minus PRE	31	-9 to +53	-60 to 108	39		

* It should be noted that only 55% of cases had pre-transfusion platelet count checked on the same day as platelet transfusion, therefore pre-transfusion counts in remaining cases are of limited value in determining appropriate use.

Audit Standard C3: Where blood components are transfused to control bleeding, clotting screen or point of care test using thromboelastograph (TEG) should be undertaken to guide blood component therapy (GCP).

Current Practice:

Non-surgical bleeding may be due to abnormalities of coagulation, thrombocytopenia or impaired platelet function. It is therefore considered good practice to evaluate clotting at the time of bleeding in order to guide appropriate blood component therapy. The above audit standard is applied to clotting being checked within 24 hours before platelet transfusion. It is accepted, as a limitation of retrospective audit, that this is too wide a gap since the clotting checked even a few hours before the onset of bleeding may give little indication of what is happening at the time of bleeding. However, precise timing of the onset of bleeding in relation to the time of clotting evaluation is often poorly documented in clinical notes.

- Of 361 cases, clotting screen within 24 hours or monitoring by thromboelastography was performed in 87% (303/348) cases.
- **Your site: /0** cases clotting screen or monitoring by thromboelastography was performed.

Whether clotting screen was checked in the 24 hours before platelet transfusion.

		National (361) Cardiopulmonary bypass involved				**Your site (0)** Cardiopulmonary bypass involved	
		YES (303)		NO (46)		YES ()	NO ()
		%	N	%	N	**N**	**N**
C22	Patient had clotting screen checked in the 24 hours before platelet transfusion	80	239/298	74	34/46		
	If checked <24h:						
C23/25	Prothrombin time >=18 sec and/or INR >=1.5	35	83/235	31	7/33		
C26/27	APTT ratio >=1.5 or APTT value >38sec	48	108/225	50	17/34		
C28	Fibrinogen level <= 1.0 g/L	12	20/162	16	3/19		
	Any of the abnormalities	55	130/238	53	18/34		

		National (361)		**Your site (0)**
		%	N	N
C29	Patient's clotting was monitored using Thromboelastography (TEG)*	26	88/336	

Whether clotting was checked using Thromboelastography (TEG)
*****In 66/88 cases both the clotting screen and TEG monitoring were performed.

Audit Standard C4: In the presence of non-surgical bleeding, coagulation abnormalities that persist after reversing heparin, should be treated with FFP and or Cryoprecipitate as appropriate (GCP).

Current Practice:

Intra-operative or post-operative non-surgical bleeding may be due to abnormal coagulation rather than platelet dysfunction. It is therefore considered appropriate to treat significant clotting abnormalities that persist after reversing heparin, and are associated with non-surgical bleeding, with Fresh Frozen Plasma (FFP) and/or cryoprecipitate, as indicated by coagulation or TEG profile.

The audit shows that of 281 cases where clotting screen was checked within 24 hours, a clotting abnormality (either INR >1.5, &/or APTT ratio >1.5 &/or Fibrinogen ≤1g/L) was present in 56% (156/281). Of these, 54% (85/156) had intra-operative (17) or post-operative (68) bleeding, and 76% (65/85) were treated with FFP &/or cryoprecipitate. However, 35% of cases (55/156) showed a clotting abnormality in the absence of any bleeding, and 53% (28/55) of these were also given FFP and / or cryoprecipitate which may have been unnecessary and therefore inappropriate.

- In the presence of non-surgical bleeding, if clotting abnormal, cryo and or FFP was given in 76% (65/85).
  Your site: / received FFP &/or Cryoprecipitate.

- In the absence of bleeding, abnormal clotting results were still corrected with FFP and/or Cryoprecipitate in 53% (28/55).
  Your site: /received FFP &/or Cryoprecipitate.

Audit Standard C5

a) In CPB cases, heparin therapy should be monitored (GCP)

b) Immediately post-op (CPB), heparin should be reversed with protamine sulphate (GCP)

Current Practice:

		National (361) %	N	**Your site (0) N**
C31	Heparin treatment was monitored (by ACT* &/or APTT**)	94	317/337	

*Activated Clotting Time, ** Activated Partial Thromboplastin Time

- 91% (287/317) of CPB cases received heparin. The remaining 9% (30/317), are also likely to have received heparin but this information was not provided.
- Heparin treatment was monitored (C33) mainly by ACT alone (77%, 277/282), in 3 cases by APTTR alone and 2 cases by ACT and APTTR.
- Considerable variation was noted in the ACT values as shown in the following table.

ACT values (Cardiopulmonary bypass cases only)

	Cardiopulmonary bypass involved	National (303) Median	IQR	N	**Your site ()** Median	N
C20	Highest recorded ACT value during procedure	697	525-1000	266		
C21	Lowest recorded ACT value during procedure	133	123-155	267		

Protamine sulphate

		National (361) %	N	**Your site (0) N**
C35	Was heparin reversed with protamine sulphate?*	91	224/244	***I***

*****Technical issues with the software may have prevented some auditors from entering protamine sulphate data having said YES to the use of heparin, hence the 244 denominator.

- For 195 adults the median (IQR) dose of protamine used (C36) was 300 mg (200-350 mg). For 15 children (under 16, but most less than 1 year of age) the median (IQR) dose of protamine used was 32 (20-35) mg.
- 15 patients (from 9 sites) were reported to have been on warfarin at any time during the 3 days before transfusion (C37). For 5 of the 15 patients warfarin treatment was stopped before surgery, for 2 cases two days before surgery, for 2 cases three days before surgery, timing unknown for 1 case. For 6 of the 10 cases for which warfarin treatment was not stopped before surgery the reason given was 'transplant, therefore date of surgery unpredictable', and these were all from the same site. Other reasons given were 'patient was still under the treatment of the cardiologist' (1 case), 'mechanical valve in situ' (1 case), and 'emergency procedure' (1 case). The reason was not known for 1 case.

Audit Standard C7: Anti-Platelet drugs should, where appropriate, be discontinued 5-7 days before elective surgery (AHA/ACC guideline for CABG[9])

Current Practice:

The benefit of anti-platelet agents in the treatment of acute coronary syndromes may outweigh the increased risk of perioperative bleeding if coronary bypass is performed early in the course of acute event. However in other patients such as chronic stable angina, antiplatelet agents should be discontinued a week prior to elective cardiac operation[9].

It should however be noted that this audit did not seek to ascertain whether patients receiving antiplatelet therapy in whom antiplatelet drug(s) were not discontinued 5 or more days prior to planned surgery, had a recent acute coronary event.

Were anti-platelet drugs discontinued >5 days in advance of planned cardiac surgery?

Anti-platelets – emergency procedures (92)

C30	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?	National (92) Cardiopulmonary bypass involved YES (72) %	N	NO (20) %	N	**Your site** Cardiopulmonary bypass involved YES () N	NO () N
	Clopidogril (Plavix)*	21	15	25	5		
	Aspirin	33	24	30	6		
	None of the above	49	35	35	7		
	Whole section blank (insufficient information)	14	10	30	6		

Anti-platelets – elective procedures (255)

C30	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?	National (255) Cardiopulmonary bypass involved YES (230) %	N	NO (25) %	N	**Your site (X)** Cardiopulmonary bypass involved YES () N	NO () N
	Clopidogril (Plavix)*	9	20	16	4		
	Aspirin	23	52	36	9		
	None of the above	63	145	56	14		
	Whole section blank (insufficient information)	11	26	8	2		

* Overall, when cardiopulmonary bypass was involved then 8% (25/303) were on both Clopidogril (Plavix) and Aspirin. When cardiopulmonary bypass was NOT involved then 17% (8/46) were on both Clopidogril (Plavix) and Aspirin

Additional information / observations
Data given in the following sections does not directly relate to the audit standards.

I) Demographic data from the cardiac audit

			National (361) %	N	**Your site (0) N**
C1	Gender	Male	71	257	
		Female	29	103	
C10	Adult or child (<16 y)?	Child	10	37*	
		Adult	90	324	
C2	Age of child (date platelet transfusion)	First year	56	21/37	
			Mean	SD	**Mean**
	Age of Adult (date platelet transfusion)	Years	68	12	

*from 6 hospitals.

C4 Cardiac surgical procedure	National (361) %	N	**Your site (0) N**
Primary Coronary Artery Bypass Graft (CABG)	47	168	
Second or subsequent CABG	6	20	
Aortic valve replacement surgery (AVR)	27	96	
Paediatric cardiac surgery	10	37	
Other*	37	134	

40 procedures (11% of 361) involved both Primary Coronary Artery Bypass Graft (CABG) and Aortic valve replacement surgery (AVR)

*47 of the 134 others were mitral valve repair/replacement surgery (MVR), and 17 of these 46 were with CABG or AVR.

		National (361) %	N	**Your site (0) N**
C5	Surgical procedure involved cardiopulmonary bypass?	87	303/349	
C6	Was the procedure emergency or elective?			
	Emergency	27	92/347	
	Elective	73	255/347	

II) Was platelet transfusion given before during or after surgery?

		National (361) %	N	**Your site (0) N**
C18	Platelet transfusion given:			
	Before surgery	5	18	
	During surgery	32	116	
	After surgery	61	222	
	Not stated	1	5	

III) Platelet transfusion in patients undergoing Extra-Corporeal Membranous Oxygenation (ECMO):

8 patients (from 3 hospitals) were on Extra Corporeal Membranous Oxygenation (ECMO) 6 children, 2 adults.

An audit standard has not been defined for appropriate platelet use in this setting. However it is of interest to note the variation in pre-transfusion platelet counts.

Three patients with pre-transfusion platelet counts of 65, 99 and 146 respectively, received platelet transfusion but no reason was stated for this intervention.

Days from pre-transfusion platelet count date to transfusion	Days from transfusion to post-transfusion platelet count	C14 Pre-transfusion platelet count (x 10^9/L)	C16 Post transfusion platelet count (x 10^9/L)	Post minus pre transfusion platelet count (x 10^9/L)	REASON FOR PLATELET TRANSFUSION
0	0	38	82	44	Low platelet count during surgery
0	0	65	84	19	No reason given
0	0	70	82	12	Bleeding after surgery
0	1	86	140	54	Oozing from surgical site
0	0	99	108	9	No reason given
0	0	111	165	54	Oozing from surgical site
0	0	146	170	24	No reason given
0	0	269	404	135	Bleeding after surgery

IV) Anti-fibrinolytic therapy

Aprotonin data

		National (361) Cardiopulmonary bypass involved				**Your site (0)** Cardiopulmonary bypass involved	
		YES (303)		NO (46)		YES ()	NO ()
		%	N	%	N	**N**	**N**
C41	Patient received Aprotonin during surgery	51	149/292	7	3/42		
C42	Total dose of Aprotonin given (n=152)						
	1 MU or less*	12	18		1		
	>1MU but <=2 MU	22	33		-		
	>2MU but <=4 MU	17	26		-		
	>4MU but <=6 MU	18	27		1		
	>6MU	12	18		-		
	Insufficient data	18	27		1		

* 5/19 were children

Tranexamic acid data

		National (361) Cardiopulmonary bypass involved				**Your site (0)** Cardiopulmonary bypass involved	
		YES (303)		NO (46)		YES ()	NO ()
		%	N	%	N	**N**	**N**
C43	Patient received Tranexamic acid during surgery	25	73/292	10	4/42		
C44	Total dose of Tranexamic acid given (mg)	Median	2000	Median	3000		
		IQR	2000-4000	IQR	-		
		N	70	N	4		

- For those with surgery involving cardiopulmonary bypass 71% (210/295) received either Aprotonin or Tranexamic acid during surgery. 12 patients received both Aprotonin and Tranexamic acid, 137 Aprotonin alone and 61 Tranexamic acid alone.

- There is a wide variation in the dose of aprotinin used.

- For those with surgery NOT involving cardiopulmonary bypass 16% (7/43) received either Aprotonin or Tranexamic acid during surgery. No patients received both Aprotonin and Tranexamic acid, 3 Aprotonin alone and 4 Tranexamic acid alone.

Section III. Results of the Haematology Audit

The Audit Sample YOUR SITE: 15 CASES

There were a total of 2125 audit cases from 170 sites, median 13 cases per site, inter-quartile range 7-15 cases, range 1-40 cases. The national results shown below comprise data for 1959 cases from 158 English NHS hospitals (92% of all audit cases), 28 from 1 English independent hospital, 52 from 7 NHS hospitals in Wales, 41 from 2 NHS hospitals in Northern Ireland and 45 from 2 NHS hospitals in Scotland.

Of 2125 cases:

- 55% (1163) received platelets for routine prophylaxis,
- 26% (553) had a bleeding manifestation,
- 12% (262) were given platelets to raise count prior to an invasive procedure
- 7% (149) the reason for platelet transfusion was not stated.
- 67% (1419) were inpatients, and
- 32 % (695) were day cases.

Additional demographic details of the haematology audit sample are given at the end of this section

Definition of prophylactic and therapeutic platelet transfusions
The transfusion was regarded as *therapeutic* if the auditor stated that the transfusion had been given to treat bleeding. In the absence of bleeding it was regarded as *prophylactic* if the reason stated for transfusion was to raise platelet count prior to an invasive procedure. It was regarded as *routine prophylaxis* if platelet transfusion was given simply to raise platelet count to reduce the risk of bleeding i.e., these patients were not bleeding nor was the transfusion given to cover an invasive procedure. Applying this hierarchical definition to the 2125 cases: 26% (553) of transfusions were therapeutic, 12% (262) were to raise platelet counts before an invasive procedure, 55% (1161) were for routine prophylaxis whilst for 7% (149) there was insufficient information to classify.

Your site: 2 Therapeutic, **5** to raise counts before an invasive procedure, **5** for routine prophylaxis and **3** insufficient information to classify.

Key Findings

- The majority (60%, 653/1090) of haematology patients who received platelet transfusion for routine prophylaxis (in the absence of any haemorrhagic manifestation or high risk of bleeding), were transfused when pre-transfusion count was over 10 x 10^9/L. This shows poor compliance with the current BCSH guidelines.

- 21% (107/515) patients who were not bleeding and did not undergo an invasive procedure but had sepsis, were on antifungals (excluding prophylaxis with fluconazole) or had APML (5) received prophylactic platelet transfusion when a pre-transfusion count was ≥ 20 x 10^9/L. Again this shows poor compliance with the BCSH guideline[2].

- 30 % (448/1419) of inpatients receiving platelet transfusion did not have pre-transfusion platelet count checked on the same day.

- 16% (43/262) of patients who received prophylactic platelet transfusion to raise count prior to an invasive procedure, had a pre-transfusion count of ≥ 50 x 10^9/L, and post-transfusion count was not checked in 21% (54/262).

Audit Standards

The audit standards for platelet transfusion therapy in haematology patients are based on the current BCSH guidelines for the use of platelet transfusions[2], where specific guidance is provided. Other standards, where the BCSH guidelines do not provide a specific recommendation, have been developed solely for the purpose of this audit. These are not evidence based but considered good clinical practice (GCP) for the purpose of this audit.

Evaluation of current practice against audit standards

Audit Standard H1: The threshold for prophylactic platelet transfusion (where there is no evidence of major or minor bleeding) should be a pre-transfusion count of ≤10 x 10^9/L. This applies to all cases except patients with sepsis (on i.v. antibiotics or antifungal therapy), acute promyelocytic leukaemia (APML), or those with abnormal clotting where a pre-transfusion platelet threshold ≤ 20 x 10^9/L is considered appropriate (BCSH guidelines).

Current Practice:

- Of 1161 patients who received platelets for routine prophylaxis, pre-transfusion platelet count was done for 97% (1122) with the count known for 94% (1090) of cases.

- Of 575 patients who received platelet transfusion for routine prophylaxis (and who did not have a haemorrhagic manifestation, sepsis or APML), **only 41%** (237/575) had a pre-transfusion platelet count of ≤10 x 10^9/L, i.e., 59% (338/575) of transfusions did not comply with the national guidelines.

- **Your site: 0/0** cases without bleeding or clinical factors indicating the threshold for prophylaxis should be ≤10 x 10^9/L had a pre-transfusion platelet count of ≤10 x10^9/L.

    - National compliance with this standard was **only 37%** (89/239) for inpatients, and **44%** (148/335) for day cases.

- Of 515 patients who received platelet transfusion for routine prophylaxis, who had no haemorrhagic manifestation but who were either septic or had APML, pre-transfusion platelet count was less than 20 x 10^9/L in **79%** (408/515) cases, i.e., 21% (107/515) transfusions did not comply with the national guidelines.

- **Your site: 4/4** cases had a pre-transfusion platelet count of <20x10^9/L.

Audit Standard H2: All inpatients should have pre-transfusion platelet count checked on the same day as platelet transfusion (GCP).

Current Practice:

- Of 1419 haematology inpatients who received platelets, pre-transfusion count was done on the same day as transfusion in only **70%** (971/1392).
- **Your site: 11/14** cases had a pre-transfusion platelet count checked on the same day.

	INPATIENTS	National (1419)		**Your site (14)**
		%	N	N
H20	Date of PRE-transfusion platelet count (1392)			
	Same day as platelet transfusion	70	971	**11**
	Day before platelet transfusion	22	303	**2**
	2 days before	3	48	
	3+ days before	2	22	
	Insufficient information	3	48	**1**
H23	Date of POST-transfusion platelet count (1197)			
	Same day as platelet transfusion	15	174	
	Day after platelet transfusion	69	828	**9**
	2 days after	10	124	**3**
	3-4 days after	3	33	
	5+ days after	1	14	
	Insufficient information	2	24	**1**

Audit Standard H3: Outpatients should have platelet counts checked within 2 days in advance of platelet transfusion (GCP).

Current Practice:

- Of 695 day cases, pre-transfusion platelet count was checked within 2 days in advance of platelet transfusion in **87%** (562/645).
- **Your site: 1/1** day cases had a pre-transfusion platelet count checked within 2 days in advance of platelet transfusion.

	DAY CASES	National (695)		**Your site (1)**
		%	N	N
H20	Date of PRE-transfusion platelet count (645)			
	Same day as platelet transfusion	60	386	
	Day before platelet transfusion	20	131	**1**
	2 days before	7	45	
	3+ days before	10	66	
	Insufficient information	3	17	
H23	Date of POST-transfusion platelet count (332)			
	Same day as platelet transfusion	23	75	
	Day after platelet transfusion	20	67	
	2 days after	15	49	
	3-4 days after	19	62	
	5+ days after	23	75	**1**
	Insufficient information	1	4	

Audit Standard H4: Platelet transfusion is not necessary for bone marrow biopsy (BCSH guidelines).

Current Practice:

- Of 45 patients undergoing bone marrow biopsy 37 received prophylactic platelet transfusion to raise platelet counts for the procedure, 8 were therapeutic. Median pre-transfusion count was 13 x 10^9/L for the prophylactic transfusions.

- **Your site: 1** patients undergoing bone marrow biopsy received prophylactic platelet transfusion to raise platelet counts for the procedure.

Audit Standard H5: If platelet transfusion is given to raise platelet counts before an invasive procedure:

a) pre-transfusion count should be less than 50, and:

b) post transfusion count should be checked (BCSH guidelines).

Current Practice:

H5a)

- Of 262 patients receiving prophylactic platelet transfusion to raise platelet count prior to an invasive procedure, pre-transfusion count was known in 92% (241/262). It was less than 50 x 10^9/L in **82%** (198/241).

- **Your site: 5/5** patients receiving prophylactic platelet transfusion to raise platelet count prior to an invasive procedure, pre-transfusion count was less than 50.

H24	If platelet transfusion given to raise the platelet count prior to any of the following procedures (multiple answers possible) -	Total 262	Pre-transfusion platelet count X 10^9/L		Pre-transfusion platelet count of 50 or higher		Post transfusion increment X 10^9/L	
			Median	N	%	N	Median	N
	Hickman line	79	29	72	18	13/72	24	61
	Non-tunnelled subclavian line	6	45	6	33	2/6	15	6
	Internal jugular line	11	24	10	30	3/10	33	9
	Femoral line	5	10	5	-	0/5	21	4
	PICC Line	6	16	6	-	0/6	31	5
	Lumbar puncture	23	24	23	-	0/23	30	19
	Bone marrow biopsy	37	14	36	11	4/36	20	26
	Upper GI endoscopy	7	32	5	-	0/6	14	5
	Other procedure**	88	30	77	25	19/77	19	57

** Patients undergoing major surgery, ophthalmic or neurosurgery were excluded from the above analysis where type of "other" procedure was stated.

Where platelet transfusion was given to raise the platelet count prior to an invasive procedure, the median count before transfusion was 26 (IQR 15-44) and the median platelet increment was 21 (IQR 8-38). Pre-transfusion count was 50 or more for 18% (45/241)

H5b)

- Of 262 patients receiving prophylactic platelet transfusion to raise platelet count prior to an invasive procedure listed in table H4, post transfusion platelet count was checked in **79%** (206/260).

- **Your site: 5/5** patients receiving prophylactic platelet transfusion to raise platelet count prior to an invasive procedure listed in table H4, had post-transfusion platelet count checked.

	PROPHYLACTIC transfusion to raise platelet count prior to an invasive procedure	National (262) %	N	**Your site (5)** N
H18	Pre-transfusion platelet count done	96	251/261	**5**
H21	Post-transfusion platelet count done	79	206/260	**5**
	Pre and Post-transfusion platelet count done	77	202/260	**5**

Audit Standard H6: Anti-platelet drugs should be discontinued in severely thrombocytopenic patients requiring platelet transfusion therapy (GCP).

Current Practice:

- Anti-platelet drugs were being given to 33 / 2125 (1.5%) severely thrombocytopenic patients requiring platelet transfusion.

- **Your site: 0** patients were on aspirin and/or other antiplatelet drugs.

H8	Was patient prescribed any of the following drugs at the time of platelet transfusion?	National (2125) %	N	**Your site (15)** N
	Aspirin	1	25	
	Clopidogril	0.2	5	
	Dipyridamole	-	0	
	Abciximab (ReoPro)	0.1	3	

Audit Standard H7: Patients receiving HLA matched platelets should have evidence of HLA antibodies (BCSH guidelines).

Current Practice:
The current BCSH guidelines on the use of platelet transfusions recommend that patients with platelet refractoriness should be given HLA matched platelets if HLA antibodies are present. However, a trial of HLA matched platelets is occasionally justified in refractory cases where platelet transfusion is necessary to control bleeding in the absence of non-immune causes and anti-HPA antibodies. The audit questionnaire did not seek sufficient information about the non-immune causes of refractoriness. However in 20% (18/90) of cases HLA matched platelets were used in the absence of HLA antibodies which suggests inappropriate use of HLA matched platelets in some cases.

		National (2125)		**Your site (15)**
		%	N	N
H15	Platelets were HLA matched	5	106/2033	**0**
H16	If yes, were they requested specifically as HLA matched for this patient?	91	92/101	
H17	If yes, did the patient have documented HLA antibodies	80	72/90	

Additional information / observations:

The following sections do not directly relate to the audit standards.

I) Demography of haematology audit sample

			National (2125)		Your site (15)
			%	N	N
H1	Gender	Male	58	1236/2118	**12**
		Female	42	882/2118	**3**
H11	Adult or child (<16 y)?	Child	6	130/2118	
		Adult	94	1988/2118	**15**
H2	Age of child (at platelet transfusion)	First year	9	12/128	
			Mean	SD N	Mean N
	Age of Adult (at platelet transfusion)	Years	61	17 1978	**62** **15**

		National (2125)		Your site (15)
H3	Primary haematological diagnosis?	%	N	N
	Acute Myeloid Leukaemia (AML)	37	793	**9**
	Acute Lymphoblastic Leukaemia (ALL)	6	133	
	Chronic Myeloid Leukaemia (CML)	2	39	
	Chronic Lymphocytic Leukaemia (CLL)	4	84	**1**
	Non-Hodgkins Lymphoma (NHL)	15	314	**2**
	Hodgkin's disease (HD)	2	33	
	Myeloma (MYL)	7	157	
	Myelodysplastic Syndrome (MDS)	12	249	**1**
	Aplastic anaemia	6	125	
	Other*	9	184	**2**
	Not known	0.7	14	

*Others included ITP: idiopathic thrombocytopenia purpura (44), myelofibrosis (16), acute promyelocytic leukaemia (6), MPD myeloproliferative disorder (4), essential thrombocythaemia (3), TTP Thrombolytic Thrombocytopenia (2), NAITP: Neonatal Alloimmune thrombocytopenia (1)

			National (2125)		Your site (15)
			%	N	N
H4	Was the patient inpatient or day case?	Day case	33	695/2114	**1**
		Inpatient	67	1419/2114	**14**

		National (2125)		Your site (15)
H5	Reason for the current admission?	%	N	N
	Chemotherapy	33	709	**4**
	New diagnosis at this admission	11	228	**4**
	Infection / Sepsis	16	334	**5**
	Bleeding	13	271	**1**
	Other*	32	671	**1**
	Not stated	5	113	

*Half of these others (333/671) were for blood component therapy reasons (e.g. low platelet count / prophylaxis / routine transfusion top-up), comprising 16% (333) overall

		National (2125)		**Your site (15)**
		%	N	N
H6	Patient prescribed IV antibiotics at the time of the platelet transfusion	37	755/2035	**10**

		National (2125)		**Your site (15)**
H8	Was patient prescribed any of the following drugs at the time of platelet transfusion?	%	N	N
	Anti-fungal treatment: *			
	Amphotericin B	2	41	
	Ambisome	4	79	
	Amphocil	-	1	
	Caspofungin	2	48	**2**
	Voriconazole	2	49	**1**
	Itraconazole	10	210	
	Anti-platelet drugs			
	Aspirin	1	25	
	Clopidogril	0.2	5	
	Dipyridamole	-	0	
	Abciximab (ReoPro)	0.1	3	
	Anticoagulants			
	Heparin (in any form)	1	24	**1**
	Warfarin	0.6	12	
	AntiThymocyte Globulin (ATG)	0.4	9	
	Cyclosporin	3	56	
	Mycofenolate Mofetil (MMF)	0.4	8	

*****We did not ask about fluconazole as it would have been prophylactic treatment in almost all cases.

Anti-fungal treatments used in 19% (413/2125) of patients. Combined anti-fungal treatment for 4% (15/413) of treated patients: Amphotericin B & Itraconazole (n=5), Caspofungin & Voriconazole (n=3), Ambisome & Caspofungin (n=2), Ambisome & Itraconazole (n=2), Ambisome & YES (n=1), Amphotericin B & Voriconazole (n=1), Caspofungin & Itraconazole (n=1).

Anti-platelet drugs used for 1.6% (33/2125) of patients. No combined therapy

Heparin dose was regarded as prophylactic in 13/24 cases, as therapeutic in 7/24, with insufficient dose information for 4/24.

II) Were Pre and Post transfusion platelet counts checked?

	1. Routine PROPHYLAXIS	National (1161) %	National (1161) N	**Your site (5)** N
H18	Pre-transfusion platelet count done	97	1122/1159	**5**
H21	Post-transfusion platelet count done	71	827/1157	**4**
	Pre and Post-transfusion platelet count done	70	812/1156	**4**

	2. PROPHYLACTIC transfusion to raise platelet count prior to an invasive procedure	National (262) %	National (262) N	**Your site (5)** N
H18	Pre-transfusion platelet count done	96	251/261	**5**
H21	Post-transfusion platelet count done	79	206/260	**5**
	Pre and Post-transfusion platelet count done	78	202/260	**5**

	3. THERAPEUTIC transfusion to treat a bleeding manifestation	National (553) %	National (553) N	**Your site (2)** N
H18	Pre-transfusion platelet count done	97	536/550	**2**
H21	Post-transfusion platelet count done	74	403/548	**2**
	Pre and Post-transfusion platelet count done	72	395/547	**2**

	4. Insufficient information regarding the reason for transfusion	National (149) %	National (149) N	**Your site (3)** N
H18	Pre-transfusion platelet count done	99	134/136	**3**
H21	Post-transfusion platelet count done	78	99/127	**3**
	Pre and Post-transfusion platelet count done	78	99/127	**3**

III) What were Pre and Post transfusion platelet counts?

	1. Routine PROPHYLAXIS	National (1161) Median	IQR	10-90th centile	N	**Your site (5)** Median	N
H19	PRE-transfusion platelet count?	12	8-18	5-28	1090	**13**	**4**
H22	POST-transfusion platelet count?	30	20-43	13-64	808	**33**	**3**
	Difference POST minus PRE	16	7-28	0 to 45	779	**23**	**3**

	2. PROPHYLACTIC to raise platelet count prior to an invasive procedure:	National (262) Median	IQR	10-90th centile	N	**Your site (5)** Median	N
H19	PRE-transfusion platelet count?	26	15-45	7-66	241	**14**	**5**
H22	POST-transfusion platelet count?	53	33-80	19-109	197	**59**	**5**
	Difference POST minus PRE	21	8-38	-2 to 66	187	**27**	**5**

	3. THERAPEUTIC transfusion (to treat bleeding)	National (553) Median	IQR	10-90th centile	N	**Your site (2)** Median	N
H19	PRE-transfusion platelet count?	14	7-21	4-35	517	**8**	**2**
H22	POST-transfusion platelet count?	32	19-55	10-83	394	**27**	**2**
	Difference POST minus PRE	16	4-32	-1 to 54	378	**19**	**2**

	4.Insufficient information regarding the reason for transfusion	National (149) Median	IQR	10-90th centile	N	**Your site (3)** Median	N
H19	PRE-transfusion platelet count?	15	10-25	5-46	125	**7**	**3**
H22	POST-transfusion platelet count?	35	22-60	13-104	99	**35**	**3**
	Difference POST minus PRE	18	4-41	-2 to 70	95	**11**	**3**

IV) If a patient had a bleeding manifestation, what was it?

H25	If platelet transfusion was given to treat bleeding manifestation, was it:	National (553) %	N	**Your site(2)** N
	Petechial rash	16	86	**1**
	Bruising	19	103	
	Bleeding	66	364	**1**
	If Bleeding (n=364), then site was			
	Nose	31	113	
	Mouth	19	70	
	Gastrointestinal (GI) tract	26	93	**1**
	Respiratory tract	4	14	
	Central Nervous System	2	6	
	Venepuncture site	0.5	2	
	Site of bone barrow biopsy	1	4	
	Site of central venous catheter (Hickman line)	2	8	
	Obstetric bleed	0.3	1	
	Haematuria	8	29	
	Other*	19	67*	
	Insufficient information	1	5	

*****Other bleeding manifestations included subconjunctival haemorrhage, retinal haemorrhage, and vaginal bleeding.
The audit questionnaire did not seek information about clinical outcomes of patients who received platelets to treat bleeding.

V) Indications given for platelet use in the absence of bleeding

H24	If transfusion was prophylactic (to prevent bleeding in a patient with very low platelet count), was it…	National (1423) %	N	**Your site (10)** N
1	Routine prophylaxis (Low platelet count but not bleeding)	82	1161	**5**
2	To raise the platelet count prior to a procedure?	18	262	**5**
	If platelet transfusion given to raise the platelet count prior to any of the following procedures (n=262):			
	Hickman line	30	79	**3**
	Non-tunnelled subclavian line	2	6	
	Internal jugular line	4	11	
	Femoral line	2	5	
	PICC Line	2	6	
	Lumbar puncture	9	23	
	Broncho-alveolar lavage	0.4	1	
	Transbronchial Lung biopsy	0.4	1	
	Open Lung biopsy	-	0	
	Liver biopsy	0.4	1	
	Splenic biopsy	0.8	2	
	Bone marrow biopsy	14	37	**1**
	Upper GI endoscopy	3	7	
	Sigmoidoscopy	-	0	
	Colonoscopy	1	3	
	Other procedure**	35	88**	**2**
	If for bone marrow biopsy, patient also had a trephine biopsy	81	29/36	**1**
	If given for upper GI endoscopy: biopsy was taken		2/7	
	If given for upper GI bleed, patient had other procedure		0/7	
	If given prior to colonoscopy, biopsy taken		2/3	
	Or, resection of a polyp was carried out		1/2	

** Platelets were transfused for a wide range of other procedures including lymph node biopsy, removal of Hickman lines, dental extractions, pleural aspiration and various orthopaedic surgical procedures.

VI) Adverse reactions reported:

		National (2125) %	N	**Your site (15)** N
H28	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion*	3	57*/1723	**0**

- 31 hospitals reported one, 7 hospitals two and 4 hospitals three reactions.
- All but 6 were considered to be related to platelet transfusion.
- 23 were either non-haemolytic febrile transfusion reactions, or urticarial rash.
- One patient had severe anaphylactoid reaction with angioedema,
- Transfusion Related Acute Lung Injury (TRALI) was suspected in one case.

Section IV. Results of the ITU Audit

The Audit Sample **YOUR SITE: 4 CASES**

There were a total of 912 audit cases from 153 sites median 6 cases per site, inter-quartile range 4-9 cases, range 1-17 cases. The national results shown below comprise data for 857 cases from 142 English NHS hospitals (94% of all audit cases), 2 from 2 English independent hospitals, 34 from 5 NHS hospitals in Wales, 12 from 2 NHS hospitals in Northern Ireland and 4 from 2 NHS hospitals in Scotland.

- Of 912 ITU cases
  - 57% (523) were male
  - 92% (843) were adults
  - 8% (69) were children (age 16 years or under)
  - Reason for admission to ITU was stated as
    - Post-operative in 39% (357)
    - Trauma in 8% (71)
    - Sepsis in 27% (248)
    - Respiratory failure in 17% (157)

- Further demographic details are given at the end of ITU section.

Definitions of prophylactic and therapeutic platelet transfusions

The transfusion was regarded as *therapeutic* if the auditor stated that the transfusion had been given to treat bleeding. In the absence of bleeding it was regarded as *prophylactic* if the reason stated for transfusion was to raise platelet count prior to an invasive procedure, or as *routine prophylaxis* if platelet transfusion was given simply to raise platelet count to reduce the risk of bleeding i.e. these patients were not bleeding nor was the transfusion given to cover an invasive procedure. Applying this hierarchical definition to the 912 cases 51% (462) of transfusions were therapeutic, 18% (165) were to raise platelet counts before an invasive procedure, 27% (244) were for routine prophylaxis whilst for 4% (41) there was insufficient information to classify.

Your site: 3 Therapeutic, **0** to raise counts before an invasive procedure, **1** for routine prophylaxis and **0** insufficient information to classify.

Key Findings

- The majority (59%,139 /236) of patients who received platelet transfusion in the absence of bleeding, or a planned invasive procedure, were transfused when pre-transfusion platelet count was $\geq 30 \times 10^9$/L.

- 42 % (67/161) of patients who received platelet transfusion prior to an invasive procedure had a pre-transfusion count of $\geq 50 \times 10^9$/L, indicating poor compliance with the current BCSH guidelines for the use of platelet transfusions.

- 46% (196/426) of patients who received platelet transfusion to control bleeding, had a pre-transfusion platelet count of $\geq 50 \times 10^9$/L.

Audit Standards:

Platelet transfusions are frequently given to patients in intensive care units but there is little evidence base to guide whether these are clinically appropriate. The current BCSH guidelines for the use of platelet transfusion[2] provide some guidance which is applicable to patients in the ITU setting. However, there are no published guidelines that specifically address the use of platelet transfusion in ITU patients. The majority of audit standards are therefore based on what is considered good clinical practice (GCP) for the purpose of this audit.

The threshold platelet counts defined in the following standards are set higher than those for prophylactic platelet transfusion in haematology patients for the following reasons:

a) abnormalities of coagulation due to Disseminated Intravascular Coagulation (DIC), liver dysfunction or other causes is relatively common in ITU setting
b) Sepsis is common in these patients
c) Invasive procedures are frequently performed and many patients have arterial lines inserted
d) lack of evidence base for safety or efficacy of a lower threshold for platelet transfusion in the ITU setting

Evaluation of current practice against audit standards:

Audit Standard ITU 1: Routine prophylactic platelet transfusion (transfusion because of a low platelet count but no evidence of bleeding) should not be given unless a pre-transfusion platelet count is less than 30 x 10^9/L (GCP).

Current Practice:

- Of 244 patients who received platelet transfusion because of a low platelet count, in the absence of bleeding or a planned invasive procedure, a pre-transfusion platelet count was stated for 236 patients. Of these 236 cases, **only 41%** (97/236) had a pre-transfusion platelet count of < 30 x 10^9/L.

- **Your site: 1 / 1** patients receiving routine prophylactic platelet transfusion had a pre-transfusion platelet count of < 30 x 10^9/L

- However it is interesting to note that of the 97 cases with pre-transfusion count of < 30 x 10^9/L, only 74% (72/97) had another risk factor for bleeding (sepsis or a clotting abnormality). It can reasonably be argued that a lower threshold pre-transfusion count of <20 might have been appropriate for the remaining 26% (n 25) cases where there was no evidence of sepsis &/or coagulation abnormality.

Audit standard ITU 2: All patients should have pre-transfusion platelet counts checked on the same day as platelet transfusion (GCP).

Current Practice:

- Of 912 ITU cases who received platelet transfusion, **only 79%** (721/912) had pre-transfusion count checked on the same day (i.e. within 24 hours) as platelet transfusion.

- **Your site: 4/4** patients had pre-transfusion platelet count checked on the same day as platelet transfusion

		National (912)		**Your site (4)**
		%	N	N
ITU12	Date of PRE-transfusion platelet count			
	Same day as platelet transfusion	79	721	**4**
	Day before platelet transfusion	15	136	
	Two or more days before platelet transfusion	2	15	
	Insufficient information	4	40	
ITU14	Date of POST-transfusion platelet count			
	Same day as platelet transfusion	46	421	**2**
	Day after platelet transfusion	42	383	**1**
	Two or more days after platelet transfusion	3	23	**1**
	Insufficient information	9	85	

Audit standard ITU 3: If platelet transfusion is given to raise platelet count before an invasive procedure:

a) pre-transfusion count should be less than 50 x 10^9/L (BCSH 2003[2]), and;

b) post-transfusion platelet count should be checked (BCSH 2003[2]).

Current Practice:

ITU 3a)

- Of 165 cases who received platelet transfusion to raise count prior to an invasive procedure (excluding major surgery), a pre-transfusion count was less than 50 x 10^9/L in **only 58%** of cases (94/161).

- **Your site: 0/0** patients receiving platelet transfusion to raise count prior to an invasive procedure had a pre-transfusion platelet count < 50 x 10^9/L.

ITU 3b)

- 153/165 **(93%)** had post-transfusion platelet counts, for 7 there was no date recorded and for 5 there was a problem with date logic.
- **Your site: 0/0** had post-transfusion platelet counts checked.

	PROPHYLACTIC to raise platelet count before an invasive procedure	National (165)				Your site (0)	
		Median	IQR	10-90th centile	N	Median	N
ITU11	PRE-transfusion platelet count?	44	28-63	18-84	161		**0**
ITU13	POST-transfusion platelet count?	78	48-109	32-146	153		**0**
	Difference POST minus PRE	29	8-50	-5 to 79	151		**0**

Audit Standard ITU 4: If platelet transfusion is given to control bleeding (excluding Central Nervous System (CNS) and ophthalmic bleeding):

a) Pre-transfusion platelet count should be less than 50 x 10^9/L (BCSH 2003[2]).
b) Clotting should be checked (GCP).

Current Practice:

ITU 4a)

- Of 462 patients who received platelet transfusion to control bleeding, in 14 patients the site of bleeding was stated as central nervous system (CNS) and these are excluded from the audit standard ITU 4a, as a higher pre-transfusion platelet threshold is appropriate for these cases.

- Of 448 patients who received platelet transfusion to control bleeding (excluding CNS bleeding), **only 54%** (230/426) had a pre-transfusion platelet count of <50 x 10^9/L.

- **Your site: 2/3** patients receiving platelet transfusion to control bleeding (excluding CNS bleeding) had a pre-transfusion platelet count < 50 x 10^9/L.

ITU 4b

- Of 462 patients receiving platelets to control bleeding, clotting screen was checked in **96 %** (437/457) (insufficient information was given for 5 cases).

- **Your site: 3/3** patients receiving platelet transfusion to control bleeding had clotting screen checked.

  - Of 437patients in whom clotting screen was checked, it was abnormal (either INR >1.5, & / or prothrombin time >18 sec, & / or APPT ratio >1.5, & / or APPTT 38 sec & / or fibrinogen level ≤ 1 g/L) in 72 % (313).
  - Of the 313 cases with abnormal clotting screen, 74 % (233/313) received FFP and / or cryoprecipitate.

Additional information / observations:

I) Demographic data from the ITU audit

			National (912)			**Your site (4)**	
			%	N			N
ITU1	Gender	Male	57	523			**4**
		Female	43	389			
ITU7	Adult or child (<16 y)?	Child	8	69			
		Adult	92	843			**4**
ITU2	Age of child (at platelet transfusion)	First year	70	47/67			
			Mean	SD	N	Mean	N
	Age of Adult (at platelet transfusion)	Years	58	17	833	**68**	**4**

ITU4	What was the reason for admission to ITU?	National (912)		**Your site (4)**
		%	N	N
	Post-operative	39	357	
	Trauma	8	71	
	Sepsis	27	248	**1**
	Respiratory failure	17	157	
	Other*	30	275	**3**
	Whole section left blank – insufficient data	0.5	5	

Multiple reasons were possible – and for 20% (183/912) multiple reasons were stated. The main combinations were sepsis & respiratory failure (38), sepsis & other (35), sepsis & post-operative (25), post-operative & other (21), respiratory failure & other (16), post-operative & trauma (13), post-operative & respiratory failure (10), sepsis, respiratory failure & other (8).

*Other reasons for admission included severe GI haemorrhage, Renal and/ or hepatic decompensation.

ITU3 What is the primary diagnosis or the main underlying condition?

A primary diagnosis was stated for 903 of 912 audited cases. The majority of post-operative ITU admissions followed complex abdominal, ruptured aneurysm, thoracic, and trauma surgery. Main categories of medical patients admitted to ITU included patients with sepsis, gastrointestinal haemorrhage, acute renal failure and progressive liver dysfunction.

II. What was the indication for platelet transfusion in ITU patients?

		National (462)		**Your site (3)**
ITU16	If platelet transfusion was given to treat bleeding manifestation, was it:	%	N	N
	Bleeding	95	441	**3**
	Bruising	2	10	
	Petechial rash	2	11	
ITU17	If Bleeding (N=441), please specify site:			
	Nose	4	16	
	Mouth	5	21	
	Gastrointestinal (GI) tract	39	172	**2**
	Respiratory tract	5	21	
	Central Nervous System	3	14	
	Venepuncture site	4	18	
	Site of bone barrow biopsy	-	0	**-**
	Site of central venous catheter (Hickman line)	3	15	
	Obstetric bleed	5	20	
	Haematuria	2	11	
	Other *	41	179	**1**

**Others comprised post-operative bleeding for a variety of surgical procedures*

III) Where platelet transfusion was given to raise platelet count prior to an invasive procedure, what procedure was carried out?

		National (165)		**Your site (0)**
ITU15	Was platelet transfusion given to raise the platelet count prior to any of the following procedures?	%	N	N
	Central line insertion?	19	32	
	Arterial line insertion?	10	17	
	Tracheostomy?	25	41	
	Broncho-alveolar lavage?	0.6	1	
	Lumbar puncture?	4	6	
	Liver biopsy?	1	2	
	Other invasive procedure*	53	87	

In some cases multiple procedures were carried out – in 26 cases, comprising: central & arterial line insertion (12), central line insertion & tracheostomy (3), arterial line insertion & other (3), tracheostomy & other (2), central & arterial line insertion & tracheostomy (2), central & arterial line insertion & other (2), central line insertion & other (1), central line insertion, broncho-alveolar lavage, lumbar puncture & liver biopsy (1).

**Other included upper GI endoscopy (13), laparotomy/abdominal surgery (21), aneurysm repair surgery (5). Other reasons given included a wide range of procedures such as insertion of chest drains, paracentesis, removal of central lines, laparatomy and various surgical procedures.*

IV) What were pre-transfusion and post transfusion platelet counts x 10^9/L?

Median Pre- and post-transfusion platelet counts:

	1. ROUTINE PROPHYLAXIS (low platelet count but no bleeding or invasive procedure)	National (244) Median	IQR	10-90th centile	N	**Your site (1)** Median	N
ITU11	PRE-transfusion platelet count?	35	20-51	12-68	236	**15**	**1**
ITU13	POST-transfusion platelet count?	67	43-96	25-136	227	**91**	**1**
	Difference POST minus PRE	28	13-53	0 to 89	223	**76**	**1**

	2. PROPHYLACTIC to raise platelet count prior to an invasive procedure	National (165) Median	IQR	10-90th centile	N	**Your site (0)** Median	N
ITU11	PRE-transfusion platelet count?	44	28-63	18-84	161		**0**
ITU13	POST-transfusion platelet count?	78	48-109	32-146	153		**0**
	Difference POST minus PRE	29	8-50	-5 to 79	151		**0**

	3. THERAPEUTIC transfusion	National (462) Median	IQR	10-90th centile	N	**Your site (3)** Median	N
ITU11	PRE-transfusion platelet count?	46	26-69	15-112	440	**27**	**3**
ITU13	POST-transfusion platelet count?	80	56-117	36-155	417	**123**	**3**
	Difference POST minus PRE	29	9-58	-11 to 88	406	**19**	**3**

	4.Insufficient information regarding the reason for transfusion	National (41) Median	IQR	10-90th centile	N	**Your site (0)** Median	N
ITU11	PRE-transfusion platelet count?	47	26-63	19-168	34		**0**
ITU13	POST-transfusion platelet count?	88	64-127	38-170	30		**0**
	Difference POST minus PRE	31	16-57	-13 to 98	30		**0**

Median pre- and post-transfusion platelet counts in patients having prophylactic transfusion before undergoing invasive procedures (165):

	Total 165	Pre-transfusion platelet count X 10^9/L		Pre-transfusion platelet count of 50 or higher		Platelet count increment post transfusion X 10^9/L	
		Median	N	%	N	Median	N
If platelet transfusion given to raise the platelet count prior to any of the following procedures (multiple answers possible)							
Central line insertion?	32	42	32	44	14/32	25	32
Arterial line insertion?	17	33	17	41	7/17	28	16
Tracheostomy?	41	46	40	43	17/40	30	38
Broncho-alveolar lavage?	1	57	1	100	1/1	25	1
Lumbar puncture?	6	38	6	17	1/6	24	6
Liver biopsy?	2	79	2	100	2/2	18	2
Other invasive procedure*	87	48	84	46	39/84	30	77

	Total N	Pre-transfusion platelet count X 10^9/L		Pre-transfusion platelet count of 50 or higher		Platelet count increment post transfusion X 10^9/L	
		Median	N	%	N	Median	N
No procedure but low platelet count	244	35	236	28	65/236	28	223

V) Was clotting screen checked in the 24 hours before platelet transfusion?

		National %	National N	**Your site** N
ITU20	Did patient have clotting screen checked in the 24 hours before platelet transfusion?			
	1. Routine Prophylaxis (to raise a low platelet count, no bleeding or invasive procedure)	91	219/241	**1/1**
	2. PROPHYLACTIC to raise platelet count prior to an invasive procedure	95	157/165	**/0**
	3. Therapeutic, to treat bleeding	94	437/467	**3/3**

1) Routine prophylaxis category: (Patients receiving platelet transfusion to raise a low platelet count, in the absence of bleeding or invasive procedure)

ITU21	If clotting screen checked <24 hours then:	National (219) %	National (219) N	**Your site (1)** N
	Prothrombin time >=18 sec and/or INR >=1.5	47	100/214	
	APTT ratio >=1.5 or APTT value >38sec	56	117/209	
	Fibrinogen level <= 1.0 g/L	11	16/147	
	Any of the above abnormalities noted	68	149/218	**1**

40% of abnormalities (60/149) treated with cryoprecipitate or Fresh Frozen Plasma.

2. PROPHYLACTIC transfusion to raise platelet count prior to an invasive procedure.

ITU21	If clotting screen checked <24 hours then:	National (157) %	National (157) N	**Your site ()** N
	Prothrombin time >=18 sec and/or INR >=1.5	37	58/155	
	APTT ratio >=1.5 or APTT value >38sec	46	69/151	
	Fibrinogen level <= 1.0 g/L	9	9/97	
	Any of the above abnormalities noted	56	87/156	

47% (41/87) of abnormalities treated with cryoprecipitate or Fresh Frozen Plasma.

3) THERAPEUTIC transfusion to treat bleeding.

ITU21	If clotting screen checked <24 hours then:	National (437) %	National (437) N	**Your site (3)** N
	Prothrombin time >=18 sec and/or INR >=1.5	53	227/430	
	APTT ratio >=1.5 or APTT value >38sec	55	223/406	
	Fibrinogen level <= 1.0 g/L	21	63/305	
	Any of the above abnormalities noted	72	313/433	**2**

74% (233/313) of abnormalities treated with cryoprecipitate or Fresh Frozen Plasma.

VI) How many ITU patients receiving platelet transfusion were on anti-platelet agents or anticoagulated with heparin or warfarin?

Anti-platelets drugs:

ITU22	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?	Therapeutic (462)	Raise counts (165)	Low count (244)	Insufficient info (41)	**Your site (4)**
	Clopidogril (Plavix)	12	4	5	-	
	Aspirin	35	8	10	2	**1**
	Dipyridamole (Persantin)	1	1	-	-	
	Abciximab (ReoPro)	1	-	-	-	
	None of the above	328	132	187	16	**3**
	Whole section blank	92	23	45	23	

A total of 66 patients received anti-platelet drugs. Combinations comprised: clopidogril & aspirin (9), clopidogril & Abciximab (1), clopidogril & aspirin & dipyridamole (1), aspirin & dipyridamole (1), clopidogril & aspirin & dipridamole (1).

Heparin or Warfain:

		National (912)		**Your site (4)**
	Was the patient on any of the following anticoagulants at the time of the platelet transfusion?	%	N	N
ITU18	Heparin (in any form)	16	142/876	**0**
	PROPHYLACTIC	74	105/142	
	THERAPEUTIC	11	16/142	
	Not stated / insufficient information	15	21/142	
ITU19	Warfarin?	0.6	5/852	**0**

VII) Adverse reactions to platelet transfusion:

		National (912)		**Your site (4)**
		%	N	N
ITU24	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion*		8*/692	**0**

Excludes 200 stated as 'not recorded', and 20 that were blank

* 8 adverse reactions reported by 7 hospitals. However the following three were considered relevant.

- Urticaria
- Rise in temperature to 39C. Also being transfused blood.
- Widespread urticarial rash noted, affecting thighs, arms, abdomen and back.

Section V. Results of the Miscellaneous cases Audit

The miscellaneous platelet transfusion episodes audited were in patients who could not be included in the haematology, cardiac or ITU categories.

The Audit Sample YOUR SITE: 5 CASES

There were a total of 1023 audit cases from 164 sites, median 5 cases per site, inter-quartile range 4-8 cases, range 1-24 cases. The national results shown below comprise data for 955 cases from 151 English NHS hospitals (93% of all audit cases), 13 from 4 English independent hospitals, 28 from 5 NHS hospitals in Wales, 15 from 2 NHS hospitals in Northern Ireland and 12 from 2 NHS hospitals in Scotland.

- Of 1023 cases audited,
  - 52% (532) were male
  - 84% (856) were adults
  - 16% (160) were children (16 years or under)
  - 57% (588) were medical patients
  - 21% (213) were transfused in surgical wards
  - 14% (144) were transfused in surgical theatres.
- Demographic details for the miscellaneous category are given at the end of this section.

Definitions of prophylactic and therapeutic platelet transfusions:
The transfusion was regarded as *therapeutic* if the auditor stated that the transfusion had been given to treat bleeding. It was regarded as *prophylactic* if the reason stated for transfusion was to raise platelet count prior to an invasive procedure, whereas it was regarded as *routine prophylaxis* if platelet transfusion was given simply to raise platelet count to reduce the risk of bleeding i.e., these patients were not bleeding nor was the transfusion given to cover an invasive procedure.

For the Miscellaneous cases audit, there was no direct question about routine prophylaxis, and cases were assigned to this by exclusion, i.e., transfusion was not therapeutic, nor was it given to raise platelet count prior to a procedure. It is possible that a small number of “unknowns” are included in the routine prophylaxis category.

Applying this hierarchical definition to the 1023 cases 54% (552) of transfusions were therapeutic, 15% (152) were to raise platelet counts before an invasive procedure, 31% (319) were assumed for routine prophylaxis.

Your site: **0** Therapeutic, **5** to raise counts before an invasive procedure, **0** for routine prophylaxis .

Key Findings

- 35% (363/1023) of patients receiving platelet transfusions did not have a pre-transfusion platelet count checked on the same day as transfusion.

- The majority (66%, 107/161) of medical patients were transfused platelets for routine prophylaxis when the pre-transfusion platelet count was ≥ $10x10^9$/L, indicating poor compliance with the current national guidelines.

- 52% (57/130) of patients were given platelets transfusions to cover an invasive procedure despite the pre-transfusion platelet count being ≥ 50 x 10^9/L.

- 38% (197/515) of patients who received platelets for a haemorrhagic manifestation had pre-transfusion platelet count of ≥ 50 x 10^9/L.

Audit Standards

Where possible, the audit standards are based on the BCSH guidelines for platelets transfusions[2]. However where the BCSH guidelines do give specific recommendations for platelet transfusion therapy, and there is no published evidence base, audit standards are based on what is considered good clinical practice (GCP) solely for the purpose of this audit.

Evaluation of current practice against audit standards

Audit Standard M1: Patients receiving a platelet transfusion should have pre-transfusion platelet count checked on the same day as platelet transfusion (GCP).

Current Practice:

- Of 1023 patients receiving platelet transfusion, **only 65%** (660/1023) had pre-transfusion platelet count checked on the day of transfusion.

- **Your site: 4/5** patients receiving platelet transfusion had a pre-transfusion platelet count checked on the day of transfusion.

Time of pre-and post-transfusion platelet counts

		National (1023)		**Your site (5)**
		%	N	N
M20	Date of PRE-transfusion platelet count			
	Same day as platelet transfusion	65	660	**4**
	Day before platelet transfusion	22	230	**1**
	2-17 days before platelet transfusion	5	51	
	Unknown	8	82	
M22	Date of POST-transfusion platelet count			
	Same day as platelet transfusion	27	279	**1**
	Day after platelet transfusion	42	426	**3**
	2 days after platelet transfusion	6	63	**1**
	3-14 days after platelet transfusion	5	49	
	Unknown	20	206	

Audit standard M2: The threshold for routine prophylactic platelet transfusion (i.e. reason for transfusion low platelet count, in the absence of a bleeding manifestation or a clotting abnormality) in medical patients should be a pre-transfusion count of ≤ 10 x 10^9/L (BCSH 2003[2]).

Medical patients who had abnormal clotting and all surgical patients are excluded from this standard.

Current Practice:

There were 175 of 319 routine prophylaxis patients who were medical patients who had received platelets in the absence of bleeding, abnormal clotting or a planned invasive procedure, and of these **only 34%** (54/161) had a pre-transfusion platelet count of ≤10 x 10^9/L.

- **Your site: 0/0** medical patients receiving routine prophylactic platelet transfusion had a pre-transfusion platelet count of ≤10 x 10^9/L

Audit Standard M3: The threshold for routine prophylactic platelet transfusion in medical patients with a clotting abnormality (but no manifestation) should be a pre-transfusion count of ≤ 20 x 10^9/L (BCSH 2003[2]).

Current Practice:

Of 26 medical patients with a clotting abnormality but no bleeding manifestation, or a planned invasive procedure, **only 48%** (12/25) had a pre-transfusion platelet count of ≤20 x 10^9/L.

- **Your site: 0/0** medical patients who had a clotting abnormality but were not bleeding, had a pre-transfusion platelet count of ≤20 x 10^9/L

Audit Standard M4: Where platelet transfusion is given to raise platelet counts before an invasive procedure,

a) Pre-transfusion count should be ≤ 50 x 10^9/L (BCSH 2003[2])

b) Post-transfusion platelet count should be checked (BCSH 2003[2]).

Of 152 patients receiving platelets to raise counts 16 were undergoing major surgical procedures as listed below, and are excluded from audit standard M4a but not from audit standard M4b on the basis that a higher pre-transfusion platelet would have been appropriate for these procedures.

List of procedures excluded from standard M4a

-Burr Hole (1)	-Lung biopsy (1)	-Spinal Anaesthesia prior to emergency Caesarean Section (1)	-THR (6)
-Caesarean Section (1)	-Neurosurgery (1)	-Spinal surgery (1)	-Drainage of liver abscess (1)
-Elective LSCS (1)	-Right Thompson Hemiarthroplasty (1)	-Spinal surgery was cancelled due to low platelets despite transfusion (1)	

Current Practice:

M4a)

- Of 136 cases*, receiving platelet transfusion prior to an invasive procedure, **only 48%** (63/130) had a pre-transfusion count of ≤ 50 x 10^9/L.

- **Your site: 0/5** receiving platelet transfusion prior to an invasive procedure, had a pre-transfusion count of ≤ 50 x 10^9/L.

The 152 invasive procedures for which platelet transfusion was given to raise platelet count included central line insertion (12), lumbar puncture (7), insertion of chest drain (1), and there were 116 others described in free-text which included upper & lower GI endoscopy, liver biopsy, paracentesis, renal biopsy, bone marrow biopsy, splenectomy, pleural aspiration, hernia repair, dental extractions and femoral line insertion.

M4b)

- Of 152 cases receiving platelet transfusion prior to an invasive procedure, **81%** (123/152) had a post-transfusion platelet count.

- **Your site: 5/5** cases receiving platelet transfusion prior to an invasive procedure had post-transfusion platelet count.

If platelet transfusion was given to raise the platelet count the median count before transfusion was 53 (IQR 26-81), n=145 and the median rise in count was 32 (IQR 6-52), n=119. 80/145 cases had pre-transfusion counts of ≥ 50 X 10^9/L.

Audit Standard M5: Where platelet transfusion is given to control bleeding,

a) pre-transfusion platelet count should be <50 x 10^9/L, (and

b) Clotting screen should be checked (BCSH).

Current Practice:

M5a)

- Of 552 cases who received platelet transfusion to treat a bleeding manifestation, **only 62%** (318/515) had a pre-transfusion count <50 x 10^9/L.

- **Your site: 0/0** cases receiving platelet transfusion to treat a bleeding manifestation had a pre-transfusion count of <50 x 10^9/L.

M5b

- Of 552 cases who received platelet transfusion to treat a bleeding manifestation, clotting screen was checked within 24 hours in **only 77%** (421/545).

- **Your site: 0/0** cases receiving platelet transfusion to treat a bleeding manifestation, had a clotting screen checked.

- Of 421 patients in this category who had a clotting screen checked, 52% (217) had evidence of abnormal clotting (INR >1.5, &/or Prothrombin time >18 sec, &/or APTT ratio >1.5, &/or APTT >38 sec &/or fibrinogen ≤1g/L).

- Of 217 cases with abnormal clotting, 72% (146/203) were treated with FFP &/or cryoprecipitate.

Additional information / observations:

I) Demographic data from the Miscellaneous use audit

			National (1023)			**Your site (5)**	
			%		N		N
M1	Gender	Male	52		532		**3**
		Female	48		491		**2**
M15	Adult or child (<16 y)?	Child	16		160		
		Adult	84		856		**5**
M2	Age of child (at platelet transfusion)	First year	46		70/153		
			Mean	SD	N	Mean	N
	Age of Adult (at platelet transfusion)	Years	62	18	829	**54**	**5**

M3	Where was the patient at the time of the transfusion	National (1023) %	N	**Your site (5)** N
	Medical ward	57	588	**5**
	Surgical ward	21	213	
	Theatre	14	144	
	Other*	7	70	
	Not stated	1	8	

*Other includes A&E (21) and SCBU (25)

M4 What is the primary diagnosis or the main underlying condition?

A primary diagnosis was given for 1011 cases audited. Main categories included patients with advanced liver disease, malignancy, gastrointestinal haemorrhage, abdominal aortic aneurysm surgery, and sepsis particularly in neonates and pre-term babies.

M5 If the patient underwent surgery, what surgical procedure was carried out?

380 surgical procedures were done during June 2006 (32%), July 2006 (40%) and August 2006 (17%), with 11% before June 2006. Common surgical or invasive procedures requiring platelet transfusion included abdominal aortic aneurysm surgery, liver biopsy, liver surgery, abdominal surgery, radical hip arthroplasty, pelvic floor repair and revision hip arthroplasty.

The platelet transfusion was done on the same day as the surgical procedure for 77% (248/324), insufficient information for 56. For 23 it was done 1-8 days before surgery, for 27 the next day after surgery and for 26 2-24 days after surgery.

II) Details of pre- and post-transfusion platelet counts:

	1. Routine Prophylaxis (by exclusion)	National (319) Median	IQR	10-90th centile	N	Your site (0) Median	N
M19	PRE-transfusion platelet count?	19	11-41	7-74	279		**0**
M21	POST-transfusion platelet count?	61	33-96	22-179	227		**0**
	Difference POST minus PRE	31	12-57	1 to 94	221		**0**

	2. PROPHYLACTIC to raise platelet count prior to an invasive procedure	National (152) Median	IQR	10-90th centile	N	Your site (5) Median	N
M19	PRE-transfusion platelet count?	53	26-81	17-138	145	**67**	**5**
M21	POST-transfusion platelet count?	90	61-118	46-160	123	**96**	**5**
	Difference POST minus PRE	32	6-52	-7 to 82	119	**32**	**5**

	3. THERAPEUTIC transfusion (to treat bleeding)	National (552) Median	IQR	10-90th centile	N	Your site (0) Median	N
M19	PRE-transfusion platelet count?	36	18-72	9-155	516		**0**
M21	POST-transfusion platelet count?	74	41-112	25-165	466		**0**
	Difference POST minus PRE	26	7-50	-21 to 89	452		**0**

III) Indication for platelet transfusion

	If platelet transfusion was given to treat bleeding manifestation, was it:	National (552) %	N	Your site (0) N
	Petechial rash	4	24	
	Bruising	7	40	
	Bleeding	88	488	
M9	If Bleeding (N=488), then site was	N=488		
	Nose	10	50	
	Mouth	5	22	
	Gastrointestinal (GI) tract	37	180	
	Respiratory tract	2	11	
	Central Nervous System	2	11	
	Venepuncture site	0.6	3	
	Obstetric bleed	6	27	
	Haematuria	8	40	
	Other*	39	191	

*Other reasons given included the prevention or treatment of bleeding during or after various surgical procedures.

IV) Was clotting screen checked in the 24 hours before giving the platelet transfusion?

		National		**Your site**
		%	N	N
M23	Did the patient have clotting screen checked in the 24 hours before platelet transfusion?			
	1. Routine prophylaxis (defined by exclusion)	47	142/303	
	2. PROPHYLACTIC to raise platelet count prior to an invasive procedure	64	98/152	**5**
	3. Therapeutic (to treat bleeding)	77	421/545	

1. ROUTINE PROPHYLAXIS (by exclusion: Low count but no bleeding and no invasive procedure)

M23	If clotting screen checked <24 hours then:	National (142)		**Your site ()**
		%	N	N
M24/6	Prothrombin time >=18 sec and /or INR >=1.5	32	45/141	
M27/8	APTT ratio >=1.5 or APTT value >38sec	28	37/132	
M29	Fibrinogen level <= 1.0 g/L	4	3/84	
	Any of the above abnormalities noted	40	57/141	

53% of abnormalities (30/57) treated with cryoprecipitate or Fresh Frozen Plasma.

2. PROPHYLACTIC to raise platelet count to an invasive procedure:

M23	If clotting screen checked <24 hours then:	National (98)		**Your site (5)**
		%	N	N
M24/6	Prothrombin time >=18 sec and /or INR >=1.5	24	23/97	
M27/8	APTT ratio >=1.5 or APTT value >38sec	29	24/84	
M29	Fibrinogen level <= 1.0 g/L	9	5/55	
	Any of the above abnormalities noted	38	37/97	**1**

46% (17/37) of abnormalities treated with cryoprecipitate or Fresh Frozen Plasma.

3. THERAPEUTIC (TO TREAT BLEEDING)

M23	If clotting screen checked <24 hours then:	National (421)		**Your site ()**
		%	N	N
M24/6	Prothrombin time >=18 sec and /or INR >=1.5	43	180/417	
M27/8	APTT ratio >=1.5 or APTT value >38sec	31	122/391	
M29	Fibrinogen level <= 1.0 g/L	19	53/279	
	Any of the above abnormalities noted	52	217/419	

68% (147/217) of abnormalities treated with cryoprecipitate or Fresh Frozen Plasma.

V) Were patients receiving anti-platelet therapy or anticoagulation?

Anti-platelet therapy

M10	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?	Therapeutic (552)	Raise counts (152)	Insufficient info (319)	**Your site (5)**
	Clopidogril (Plavix)	19	8	12	
	Aspirin	59	15	25	
	Dipyridamole (Persantin)	3	-	2	
	Abciximab (ReoPro)	-	1	-	
	None of the above	394	112	213	**2**
	Whole section blank	91	20	77	**3**

A total of 66 patients received anti-platelet drugs. Combinations comprised: clopidogril & aspirin (9), clopidogril & Abciximab (1), clopidogril & aspirin & dipyridamole (1), aspirin & dipyridamole (1), clopidogril & aspirin & dipridamole (1).

Anticoagulants

		National (1023)		**Your site (5)**
	Was the patient on any of the following anticoagulants at the time of the platelet transfusion?	%	N	N
M11	Heparin (in any form)	6	57/975	**0**
	<=5000 PROPHYLACTIC	88	45/51	
	>5000 THERAPEUTIC	12	6/51	
M12	Warfarin?	3	28/956	**0**

VI) Reported adverse reactions to platelet transfusion

		National (1023)		**Your site (5)**
		%	N	N
M33	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion*	4	33/786	**0**

Excludes 204 not recorded and 33 blank

*33 patients were stated as having had a transfusion reaction but details were only provided for 29 cases. Of these 29 cases, the described adverse event was considered as relevant to platelet transfusion in 15 cases.

- 8 patients were reported to have developed skin rash following platelet transfusion, in 6 cases the rash was described as urticaria.
- 5 patents had febrile, non-haemolytic transfusion reaction (FNHTR).
- One patient was described as having developed “a severe allergic reaction” but further details were not given.

Section VI. References

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6. Rebulla P, Finnazi G, et al. The threshold for prophylactic platelet transfusions in adults with acute myeloid leukaemia. N Engl J Med 1997; 337:1870-75

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8. Diedrich B, Remberger M, et al. A prospective randomised trial of a prophylactic platelet transfusion trigger of 10x109/L versus 30 x 109/L in allogeneic haemopoietic progenitor cell transplant recipients. Transfusion 2005; 45: 1064-72.

9. ACC/AHA guidelines for coronary artery bypass graft surgery. Circulation 2004: 110: 1168-1176

Section VII) Appendices

Appendix A – Audit questions including definitions

Cardiac Dataset

Data item	**Question**
C1	Is the patient male or female?
C2	Patient's Date of Birth
C3	What was the date of the surgical procedure?
C4	What was the cardiac surgical procedure?
C5	Did surgical procedure involve cardiopulmonary bypass?
C6	Was the procedure emergency or elective?
C7	Was the patient on Extra Corporeal Membranous Oxygenation (ECMO)?
C8	What time did the platelet transfusion start?
C9	What was the date of the platelet transfusion?
C10	Is the patient adult or child (<16 y)?
C11	How many platelet packs/bags were transfused during the period 24 hours following the transfusion of first pack of platelets?
Rubric text	*If for a child the platelets were prescribed in mls as opposed to packs, please complete questions C12 & C13.*
C12	What was the dose of the platelets given during the period 24 hours following the transfusion of first pack of platelets?
C13	What was the child's weight?
C14	What was the pre-transfusion platelet count?
C15	What was the date of this count?
C16	What was the post-transfusion platelet count?
C17	What was the date of this count?
C18	Was platelet transfusion given before, during or after surgery?
C19	Was platelet transfusion given for any of these reasons:?
	Oozing from surgical site?
	Bleeding after surgery?
	Low platelet count during or after surgery?
	If yes, please state the platelet count
	No reason given

Data item	Question
C20	Please give the highest recorded ACT value during the procedure
C21	Please give the lowest recorded ACT value during the procedure
C22	Did the patient have clotting screen checked in the 24 hours before platelet transfusion?
Rubric text	*If yes, what was the*
C23	Prothrombin time (in seconds)
C24	Control time (seconds)
C25	INR
C26	APTT ratio
C27	APTT value in seconds
C28	Fibrinogen level
C29	Was patient's clotting monitored using Thromboelastography (TEG)?
C30	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?
	Clopidogril (Plavix) Aspirin Dipyridamole (Persantin) Abciximab (ReoPro) None of the above
C31	Did patient receive heparin during surgery?
Rubric text	*If yes,*
C32	What dose was given?
C33	How was heparin treatment monitored – APTTR and/or ACT?
Rubric text	*If APTTR, what was the*
C34	APTTR value
C35	Did the patient receive protamine sulphate to reverse heparin effect?
C36	If yes what was the total dose of protamine used?
C37	Was the patient on warfarin treatment at any time during the 3 days before transfusion?
C38	If yes, was it stopped before surgery?
C39	If yes, on what date was the warfarin stopped?
C40	If not stopped, please state reason why not stopped
C41	Did patient receive Aprotonin during surgery?
C42	If yes, what was the total dose given?

C43	Did patient receive Tranexamic acid during surgery?
Data item	**Question**
C44	If yes, what was the total dose given?
C45	Did patient also receive any of the following blood components during or within 24 hours of transfusion of first pack of platelets:?
	Cryoprecipitate - If yes, how many packs / bags were given?
	Fresh Frozen Plasma - If yes how many units (packs) were given?
	Red blood cells - If yes how many units were given?
C48	Did the patient receive recombinant Factor VIIa (Novoseven)
C49	Did patient need to be taken back to theatre for uncontrolled bleeding?
C50	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion?
C51	If yes, please give brief description

Haematology dataset

Data item	**Question**
H1	Is the patient male or female?
H2	Patient's Date of Birth
H3	What is the primary haematological diagnosis?:
	Acute Myeloid Leukaemia (AML) Acute Lymphoblastic Leukaemia (ALL) Chronic Myeloid Leukaemia (CML) Chronic Lymphocytic Leukaemia (CLL) Non-Hodgkins Lymphoma (NHL) Hodgkin's disease (HD) Myeloma (MYL) Myelodysplastic Syndrome (MDS) Aplastic anaemia Other, please specify
H4	Is the patient inpatient or day case?
H5	What is the reason for the current admission?:
	Chemotherapy New diagnosis at this admission Infection / Sepsis Bleeding Other (specify)

H6	Was the patient prescribed IV antibiotics at the time of the platelet transfusion?
H7	Was patient's spleen enlarged?
Data item	**Question**
H8	Was patient prescribed any of the following drugs at the time of platelet transfusion?:
	Anti-fungal treatment Amphotericin B Ambisome Amphocil Caspofungin Voriconazole Itraconazole
	Anti-platelet drugs Aspirin Clopidogril Dipyridamole Abciximab (ReoPro)
	Anticoagulants Heparin (include any form of heparin) **If yes, please state the daily dose given** Warfarin AntiThymocyte Globulin (ATG) Cyclosporin Mycofenolate Mofetil (MMF)
H9	What was the date of the platelet transfusion?
H10	What time did the platelet transfusion start?
H11	Is the patient adult or child (<16 y)?
H12	How many platelet packs/bags were transfused during the period 24 hours following the transfusion of first pack of platelets?
Rubric text	*If for a child the platelets were prescribed in mls as opposed to packs, please complete questions H13 & H14.*
H13	What was the dose of the platelets given during the period 24 hours following the transfusion of first pack of platelets?
H14	What was the child's weight?
H15	Were platelets HLA matched?
H16	If yes, were they requested specifically as HLA matched for this patient?
H17	If yes, did the patient have documented HLA antibodies?
H18	Was a pre-transfusion platelet count done?
H19	If yes, what was the pre-transfusion platelet count?
H20	What was the date of this count?
H21	Was a post-Transfusion platelet count done?

H22	If yes, what was the post-transfusion platelet count?
H23	What was the date of this count?
H24	If transfusion was prophylactic (to prevent bleeding in a patient with very low platelet count), what was the reason? **Routine prophylaxis or to raise the platelet count prior to a procedure**
H24.1	Was platelet transfusion given to raise the platelet count prior to any of the following procedures?
	Hickman Line Non-tunnelled subclavian line Femoral line PICC line Lumbar puncture Broncho-alveolar lavage Transbronchial lung biopsy Open lung biopsy Liver biopsy Splenic biopsy Bone marrow biopsy
H24.2	If platelet transfusion given for bone marrow biopsy did the patient have also have a trephine biopsy?
H24.3	Was platelet transfusion given to raise the platelet count prior to upper GI endoscopy?
H24.4	If yes to H24.3, was a biopsy taken?
H24.5	If the patient had an endoscopy for upper GI bleed, did the patient have any other procedure?
H24.6	Was platelet transfusion given to raise the platelet count prior to sigmoidoscopy?
H24.7	If yes, was a biopsy taken?
H24.8	Was platelet transfusion given to raise the platelet count prior to colonoscopy?
H24.9	If yes, was a biopsy taken?
H24.10	If yes, was a resection of polyp carried out?
H24.11	Was platelet transfusion given to raise the platelet count prior to any other procedure? *Please state*
H25	If platelet transfusion was given to treat bleeding manifestation, was it: **Petechial rash OR Bruising OR Bleeding?**
	If Bleeding, please specify site:
	Nose Mouth Gastrointestinal tract Respiratory tract Central Nervous System Venepuncture site Site of bone marrow biopsy Site of central venous catheter (Hickman line) Obstetric bleed Haematuria Other (please state)

H26	Did the patient have clotting screen checked in the 24 hours before platelet transfusion?
H26.1	*If yes, what was the*
	Prothrombin time (in seconds)
	Control time (seconds)
	INR
	APTT ratio
	APTT value in seconds
	Fibrinogen level
H27	Did patient also receive any of the following blood components during or within 24 hours of transfusion of first pack of platelets
	Cryoprecipitate - If yes, how many packs / bags were given?
	Fresh Frozen Plasma - If yes how many units (packs) were given?
	Packed red cells - If yes how many units were given?
H28	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion?
H28.1	If yes, please give brief description

ITU dataset

Data item	**Question**
ITU1	Is the patient male or female?
ITU2	Patient's Date of Birth
ITU3	What is the primary diagnosis or the main underlying condition?
ITU4	What was the reason for admission to ITU?
	Trauma Sepsis Respiratory failure Other
ITU5	What was the date of the platelet transfusion?
ITU6	What time did the platelet transfusion start?
ITU7	Is the patient adult or child (<16 y)?
ITU8	How many platelet packs/bags were transfused during the period 24 hours following the transfusion of first pack of platelets?
Rubric text	*If for a child the platelets were prescribed in mls as opposed to packs, please complete questions ITU9 & ITU10.*

ITU9	What was the dose of the platelets given during the period 24 hours following the transfusion of first pack of platelets?
ITU10	What was the child's weight?
ITU11	What was the pre-transfusion platelet count?
ITU12	What was the date of this count?
ITU13	What was the post-transfusion platelet count?
ITU14	What was the date of this count?
Data item	**Question**
ITU15	Was platelet transfusion given to raise the platelet count prior to any of the following procedures?
	Arterial line insertion Tracheostomy Broncho-alveolar lavage Lumbar puncture Liver biopsy Other invasive procedure (*Please state)* No procedure but low platelet count
ITU16	If platelet transfusion was given to treat bleeding manifestation, was it: Petechial rash OR Bruising OR Bleeding?
ITU17	If Bleeding, please specify site:
	Nose Mouth Gastrointestinal tract Respiratory tract Central Nervous System Venepuncture site Site of bone marrow biopsy Site of central venous catheter (Hickman line) Obstetric bleed Haematuria Other (please state)
Rubric text	*Was the patient on any of the following anticoagulants at the time of the platelet transfusion?*
ITU18	Heparin (in any form)
ITU18.1	If yes, what was the daily dose?
ITU19	Warfarin?
ITU20	Did the patient have clotting screen checked in the 24 hours before platelet transfusion?
Rubric text	*If yes, what was the*
ITU21	INR?
	Prothrombin time (in seconds)?
	Control time (seconds)?
	APTT ratio?
	APTT value in seconds?
	Fibrinogen level?
ITU22	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?
	Clopidogril (Plavix)

	Aspirin Dipyridamole (Persantin) Abciximab (ReoPro) None of the above
ITU23	Did patient also receive any of the following blood components during or within 24 hours of transfusion of first pack of platelets
	Cryoprecipitate - If yes, how many packs / bags were given?
	Fresh Frozen Plasma - If yes how many units (packs) were given?
	Packed red cells - If yes how many units were given?
ITU24	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion?
	If yes, please give brief description

Miscellaneous dataset

Data item	**Question**
M1	Is the patient male or female?
M2	Patient's Date of Birth
M3	Where was the patient at the time of the transfusion?: Medical ward Surgical ward Theatre Other (please state)
M4	What was the primary medical or surgical diagnosis?
M5	If the patient underwent surgery, what surgical procedure was carried out?
M6	What was the date of this procedure?
M7	Was platelet transfusion given to raise the platelet count prior to any of the following procedures?
	Lumbar puncture Insertion of chest drain Other invasive procedure (*Please state)*
M8	If platelet transfusion was given to treat bleeding manifestation, was it: Petechial rash OR Bruising OR Bleeding?
M9	If Bleeding, please specify site:
	Nose Mouth Gastrointestinal tract Respiratory tract Central Nervous System Venepuncture site Site of bone marrow biopsy Site of central venous catheter (Hickman line) Obstetric bleed Haematuria Other (please state)
M10	Did the patient receive any of the following anti-platelet drugs in the 5 days prior to transfusion?
	Clopidogril (Plavix) Aspirin Dipyridamole (Persantin) Abciximab (ReoPro) None of the above
Rubric text	*Was the patient on any of the following anticoagulants at the time of the platelet transfusion?*
M11	Heparin (in any form) -
M11.1	If yes, what was the daily dose?
M12	Warfarin?
M13	What was the date of the platelet transfusion?
M14	What time did the platelet transfusion start?
M15	Is the patient audit or child (<16 y)?
M16	How many platelet packs/bags were transfused during the period 24 hours following the transfusion of first pack of platelets?
Rubric text	*If for a child the platelets were prescribed in mls as opposed to packs, please complete questions M17 & M18.*
M17	What was the dose of the platelets given during the period 24 hours following the transfusion of first pack of platelets?
M18	What was the child's weight?

M19	What was the pre-transfusion platelet count?
M20	What was the date of this count?
Data item	**Question**
M21	What was the post-transfusion platelet count?
M22	What was the date of this count?
M23	Did the patient have clotting screen checked in the 24 hours before platelet transfusion?
Rubric text	*If yes, what was the*
M24	Prothrombin time (in seconds)?
M25	Control time (seconds)?
M26	INR?
M27	APTT ratio?
M28	APTT value in seconds?
M29	Fibrinogen level?
Rubric text	*Did patient also receive any of the following blood components during or within 24 hours of transfusion of first pack of platelets*
M30	Cryoprecipitate - If yes, how many packs / bags were given?
M31	Fresh frozen plasma (FFP) - If yes how many units (packs) were given?
M32	Packed red cells - If yes how many units were given?
M33	Did the patient suffer from an adverse reaction during or within 24 hours of transfusion?
M34	If yes, please give brief description

Appendix B – Hospitals participating in the audit

Addenbrookes Hospital
Airedale General Hospital
Alder Hey Children's Hospital
Alexandra Hospital
Arrowe Park Hospital
Ashford Hospital
Barnet Hospital
Barnsley District General Hospital
Basildon University Hospital
Bassetlaw District General Hospital
Belfast City Hospital
Birmingham Heartlands Hospital
Bishop Auckland General Hospital
Blackpool Victoria Hospital
BMI Bath Clinic
BMI Blackheath Hospital
BMI The Clementine Churchill Hospital
BMI The London Independent Hospital
BMI The Princess Margaret Hospital
BMI The Priory Hospital
BMI The Ridgeway Hospital
Borders General Hospital
Bradford Royal Infirmary
Bristol Royal Infirmary
Bronglais General Hospital
Broomfield Hospital
BUPA Hospital Norwich
BUPA Hospital Southampton
Calderdale Royal Hospital
Central Middlesex Hospital
Charing Cross Hospital
Chase Farm Hospital
Chelsea and Westminster Hospital
Cheltenham General Hospital
Chesterfield Royal Hospital
Christie Hospital
City Hospital
Clatterbridge Centre for Oncology
Colchester General Hospital
Conquest Hospital
Countess of Chester Hospital
County Hospital
County Hospital Louth
Crawley Hospital
Cumberland Infirmary

Darent Valley Hospital
Darlington Memorial Hospital
Derbyshire Royal Infirmary
Derriford Hospital
Dewsbury and District Hospital
Diana, Princess of Wales Children's Hospital
Diana, Princess of Wales Hospital
Doncaster Royal Infirmary
Dorset County Hospital
Dumfries & Galloway Royal Infirmary
Ealing Hospital
East Surrey Hospital
Eastbourne District General Hospital
Epsom General Hospital
Fairfield General Hospital
Freeman Hospital
Frenchay Hospital
Friarage Hospital
Frimley Park Hospital
Furness General Hospital
George Eliot Hospital
Glenfield Hospital, Leicester
Gloucestershire Royal Hospital
Good Hope Hospital
Grantham & District Hospital
Guy's & St. Thomas' London
Guy's Hospital, London
Halton General Hospital
Hammersmith Hospital
Harefield Hospital
Harrogate District Hospital
Heatherwood Hospital
Hemel Hempstead General Hospital
Hexham General Hospital
Hinchingbrooke Hospital
Hope Hospital
Huddersfield Royal Infirmary
Hull Royal Infirmary
Ipswich Hospital
James Paget Hospital
Kent & Sussex Hospital
Kent and Canterbury Hospital
Kettering General Hospital
King George Hospital
King's College Hospital

Kings Mill Hospital
Kingston Hospital
Leicester General Hospital
Leicester Royal Infirmary
Leighton Hospital
Lincoln County Hospital
Lister Hospital
London Bridge Hospital
London Chest Hospital
Macclesfield District General Hospital
Maidstone Hospital
Manchester Royal Infirmary
Manor Hospital
Mayday University Hospital
Medway Maritime Hospital
Morriston Hospital
Nevill Hall Hospital
New Cross Hospital
Newcastle General Hospital
Newham General Hospital
Ninewells Hospital,
Noble's Hospital
Norfolk & Norwich University Hospital
North Manchester General Hospital
North Middlesex University Hospital
North Tyneside General Hospital
Northampton General Hospital
Northern General Hospital
Northwick Park Hospital
Nottingham City Hospital
Nuffield Orthopaedic Centre
Oldchurch Hospital
Ormskirk & District General Hospital
Papworth Hospital
Pembury Hospital
Peterborough District Hospital
Pilgrim Hospital
Pinderfields General Hospital
Pontefract General Infirmary
Poole Hospital
Prince Charles Hospital
Princess Alexandra Hospital
Princess of Wales Hospital
Queen Alexandra Hospital
Queen Elizabeth Hospital
Queen Elizabeth Hospital

Queen Elizabeth II Hospital
Queen Elizabeth the Queen Mother Hospital
Queen Mary's Hospital
Queen Victoria
Queen's Hospital
Rochdale Infirmary
Rotherham General Hospital
Royal Albert Edward Infirmary
Royal Berkshire Hospital
Royal Bolton Hospital
Royal Brompton Hospital
Royal Devon & Exeter Hospital (Heavitree)
Royal Devon and Exeter Hospital (Wonford)
Royal Free Hospital
Royal Glamorgan Hospital
Royal Group of Hospitals
Royal Hallamshire Hospital
Royal Hospital Haslar
Royal Lancaster Infirmary
Royal Liverpool University Hospital
Royal Manchester Children's Hospital
Royal Marsden Hospital
Royal National Orthopaedic Hospital
Royal Oldham Hospital
Royal Preston Hospital
Royal Shrewsbury Hospital
Royal Surrey County Hospital
Royal United Hospital
Royal Victoria Infirmary
Russells Hall Hospital
Salisbury District Hospital
Sandwell General Hospital
Sheffield Children's Hospital
Shotley Bridge Hospital
Solihull Hospital
South Tyneside District Hospital
Southampton University Hospital
Southmead Hospital
Southport & Formby District General Hospital
St. Anthony's Hospital
St. George's Hospital
St. Helens Hospital
St. Helier Hospital
St. James University Hospital
St. Mary's Hospital
St. Mary's Hospital
St. Peter's Hospital

St. Richard's Hospital
Staffordshire General Hospital
Stepping Hill Hospital
Stoke Mandeville Hospital
Sunderland Royal Hospital
Tameside General Hospital
Taunton and Somerset Hospital
The Beaumont Hospital
The BMI Alexandra Hospital
The Cardiothoracic Centre, Liverpool
The General Infirmary at Leeds
The Great Western Hospital
The Hillingdon Hospital
The Hospital for Children
The James Cook University Hospital
The John Radcliffe Hospital
The Leicester Nuffield Hospital
The Lister Hospital
The Luton & Dunstable Hospital
The Manor Hospital (Nuffield Hospital)
The North Hampshire Hospital
The Portland Hospital
The Princess Grace Hospital
The Princess Royal Hospital
The Princess Royal University Hospital
The Queen Elizabeth Hospital
The Royal Bournemouth Hospital
The Royal Hospital of St. Bartholomew
The Royal London Hospital
The Royal Marsden Hospital
The Royal Sussex County Hospital
The Wellington Hospital
The Whittington Hospital
The Wolverhampton Nuffield Hospital
Torbay Hospital
Trafford General Hospital
University Hospital Aintree
University Hospital of Hartlepool
University Hospital of North Durham
University Hospital of North Staffordshire
University Hospital of North Tees
University Hospital of Wales
University Hospital, Lewisham
Walsgrave Hospital
Wansbeck General Hospital
Warrington Hospital

Warwick Hospital
Watford General Hospital
West Cumberland Hospital
West Middlesex University Hospital
West Suffolk Hospital
Weston General Hospital
Wexham Park Hospital
Whipps Cross University Hospital
Whiston Hospital
William Harvey Hospital
Worcestershire Royal Hospital
Worthing Hospital
Wrexham Maelor Hospital
Wycombe Hospital
Wythenshawe Hospital
Yeovil District Hospital
York District Hospital
Ysbyty Gwynedd Hospital

Appendix C - Evaluation of the web-based audit tools

Hospitals participating in the audit of the use of platelets were asked to rate certain aspects of the web-based tools, and the support available to them during the audit. Of the 247 hospitals taking part, 32% (79/247) responded.

Summary

Overall, users found it easy to access the web tools and most found the guidance notes helpful. Most downloaded the datasets and found them useful. The majority found it easy to navigate around the site, but one user found their computer so slow that she requested assistance with data entry. Users were divided over the ease with which they could find the data items required, with some reporting they could only do the audit prospectively, thus completing a paper tool and entering it later online, which took more effort. For others, the perennial problem of poor record keeping recurred. Some had problems entering data onto the web tool, which were due in part to the operation of their local web browser, which would not allow the audit tool to function as intended. Others had problems because they were not used to computers or because they had not read the online guidance, as we advised.
Most found it easy to save and commit data, and only one disagreed that it was not useful to see the status of the audits. Almost all found it easy to contact the National Comparative Audit staff and found they could do so when they wished, with many users feeling they had a response about when or sooner than they had expected. No one reported finding the support unhelpful, and 33 commented that using a web tool made the audit easier for them, although 7 disagreed with this. The majority thought that having the paper alternative was useful, but there was limited support for the view that having a web tool made data more complete and accurate. 8 of the respondents thought it took more time using the web tools than it would have had they used paper, and 8 could not agree that web tools are, overall, better than paper-based tools.