Guideline on the Administration of Blood Components

British Committee for Standards in Haematology

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INTRODUCTION

The guideline group was selected to be representative of UK based medical experts and patients representatives. Medline, Embase, Cinah and the Cochrane library were searched systematically for publications in English until June 2009 using key words: blood, transfusion, administration, documentation, patient identification, prescription, monitoring, observations (see appendix 1). The writing group produced the draft guideline which was subsequently revised by consensus by members of the Transfusion Task Force of the British Committee for Standards in Haematology. The guideline was then reviewed by a sounding board of approximately 50 UK haematologists, the BCSH (British Committee for Standards in Haematology) and the British Society for Haematology Committee and comments incorporated where appropriate. Criteria used to quote levels and grades of evidence are as outlined in appendix 2. The objectives of this guideline are laid out below. In all cases individual patient circumstances may dictate an alternative approach.

GUIDELINE UPDATE

This guideline updates the previous British Committee for Standards in Haematology (BCSH) guideline for administration of blood and blood components and the management of transfused patients (1999).

1. PURPOSE AND OBJECTIVES

- This guideline updates the previous British Committee for Standards in Haematology (BCSH) guideline for administration of blood and blood components and the management of transfused patients (1999).
- It takes into account the Blood Safety and Quality Regulations (BSQR (2005) Statutory Instrument 2005/50 as amended), the National Patient Safety Agency (NPSA) Safer Practice Notices, SHOT recommendations and the NHS Quality Improvement Scotland (QIS) 2006 Clinical Standards for Blood Transfusion.
- The purpose of this guideline is to provide national guidance on pre-transfusion blood sampling and the prescription, requesting, collection and administration of blood components to adults, children and neonates in order to provide a basis for the development of standardised local guidelines and practice.

  The clinical management of transfusion reactions is not included. This will be the subject of separate BCSH guidelines.
- This guideline has been formatted to indicate the major changes since the last guideline followed by a summary of key recommendations. The evidence base and rationale for the recommendations are discussed in sections 8 to 17. Finally, appendices 3 to 6 provide more detailed technical information or 'toolkits' that we hope will prove useful to practitioners developing and disseminating local policies underpinned by this guideline.

2. MAJOR CHANGES SINCE LAST GUIDELINES

Attention is drawn to the following changes since the 1999 BCSH Guidelines were published:

- Increasing experience of the effectiveness of information technology (IT) solutions, currently based on electronically readable bar-codes or radiofrequency identification (RFID), to improve positive identification of patients, blood samples and blood components throughout the 'transfusion process' is reflected in our recommendations relating to patient identification at sampling and transfusion and the traceability of components to meet the requirements of BSQR (SI 2005 No.50 as amended).
- We recommend that a unique national identification number (such as the National Health Service (NHS) number in England and Wales, Community Health Index (CHI) number in Scotland, or Health and Social Care (HSC) number in Northern Ireland) is used as a core identifier on the patient identification band, blood

samples, request forms and transfusion ‘prescriptions’ (written authorisation to administer blood components).

- The NPSA Safer Practice Notice 14 (2006) ‘Right patient, right blood’ stipulates three yearly competency assessments for all staff involved in the blood transfusion process in the clinical area. The BSQR (SI 2005 No.50 as amended) also requires ‘regular’ competency assessment for the collection and distribution of blood components. This guideline reflects these requirements, and also emphasises the need for regular training. We now recommend all staff involved in the blood transfusion process in the clinical area should receive regular (minimum 2 yearly) training and be assessed as competent in accordance with the relevant regulations, standards and notices.
- Blood components are excluded from the current legal definition of medicinal products and the requirement for prescription by a registered medical practitioner. This guideline emphasises the need for institutions to develop clear policies to extend the authorisation of administration of blood components safely and conveniently to other appropriately trained and competent practitioners.
- Our recommendations for *minimum* patient observations during transfusion episodes now include baseline measurement of respiratory rate. The importance of an early (15 minute) check on pulse rate, blood pressure and temperature with each component administered, repeated not more than 60 minutes after the transfusion is completed, and regular visual observation throughout the transfusion is re-emphasised. It is now recognised that adverse reactions may manifest many hours after the transfusion is completed. We recommend that patients, such as day cases, discharged within 24 hours of transfusion are issued with a *contact card* giving 24-hour access to clinical advice (as commonly used for outpatient chemotherapy).

3. SUMMARY OF KEY RECOMMENDATIONS

- **The systems and processes involved in the transfusion pathway are very complex. Organisations should focus on simplifying procedures and concentrate on key steps, especially patient identification.**

Patient identification:

- **A patient identification band (or risk assessed equivalent) must be worn by all patients receiving a blood transfusion. The minimum patient identifiers**

are - last name, first name, date of birth and unique patient identification number. This information must be legible and accurate. This is best done by printing the identification band directly from the organisations computerised patient administration system (PAS).

- **Whenever possible, the unique patient identification number should be a national unique identification number, such as the NHS number in England and Wales, the CHI number in Scotland, or the HSC number in Northern Ireland.**
- **Positive patient identification is essential at all stages of the blood transfusion process:**
  - **Blood sampling**
  - **Collection of blood from storage and delivery to the clinical area**
  - **Administration to the patient**

  At sampling and administration, whenever possible, the patient must be asked to state their full name and date of birth. This information must match exactly the information on the patient's identification band.
- **Patient identification is clearly enhanced by using robust IT systems incorporating, for example, bar-coded or radiofrequency identification (RFID). Organisations should explore, and where appropriate, implement IT systems to control the clinical transfusion process, in particular the positive patient identification check as well as identification of samples, blood components and staff. Such systems should meet the specifications developed by the NPSA (Safer Practice Notice 14 (2006) 'Right patient, right blood') which includes information relating to Electronic Clinical Transfusion Management Systems and the BCSH guideline (2007) on Specification and use of information technology systems in blood transfusion practice.**
- **The healthcare professional administering the blood component must perform the final administration check. This check must be performed at the patient's side immediately before administering the blood component by matching the patient details attached to the blood component with the details on the patient's identification band (or equivalent).**

Documentation:

- **Full and complete documentation, governed by local policies and guidelines, is required at every stage of the blood transfusion process to provide an assured and unambiguous audit trail. All paperwork relating to**

the patient must include, and be identical in every detail with, the minimum patient core identifiers contained on the patient's identification band.

- **Organisations should have a local policy or guideline detailing how transfusion traceability or 'fate of unit' (in accordance with the BSQR (SI 2005 No.50 as amended) must be achieved using robust electronic or manual systems.**

Communication:

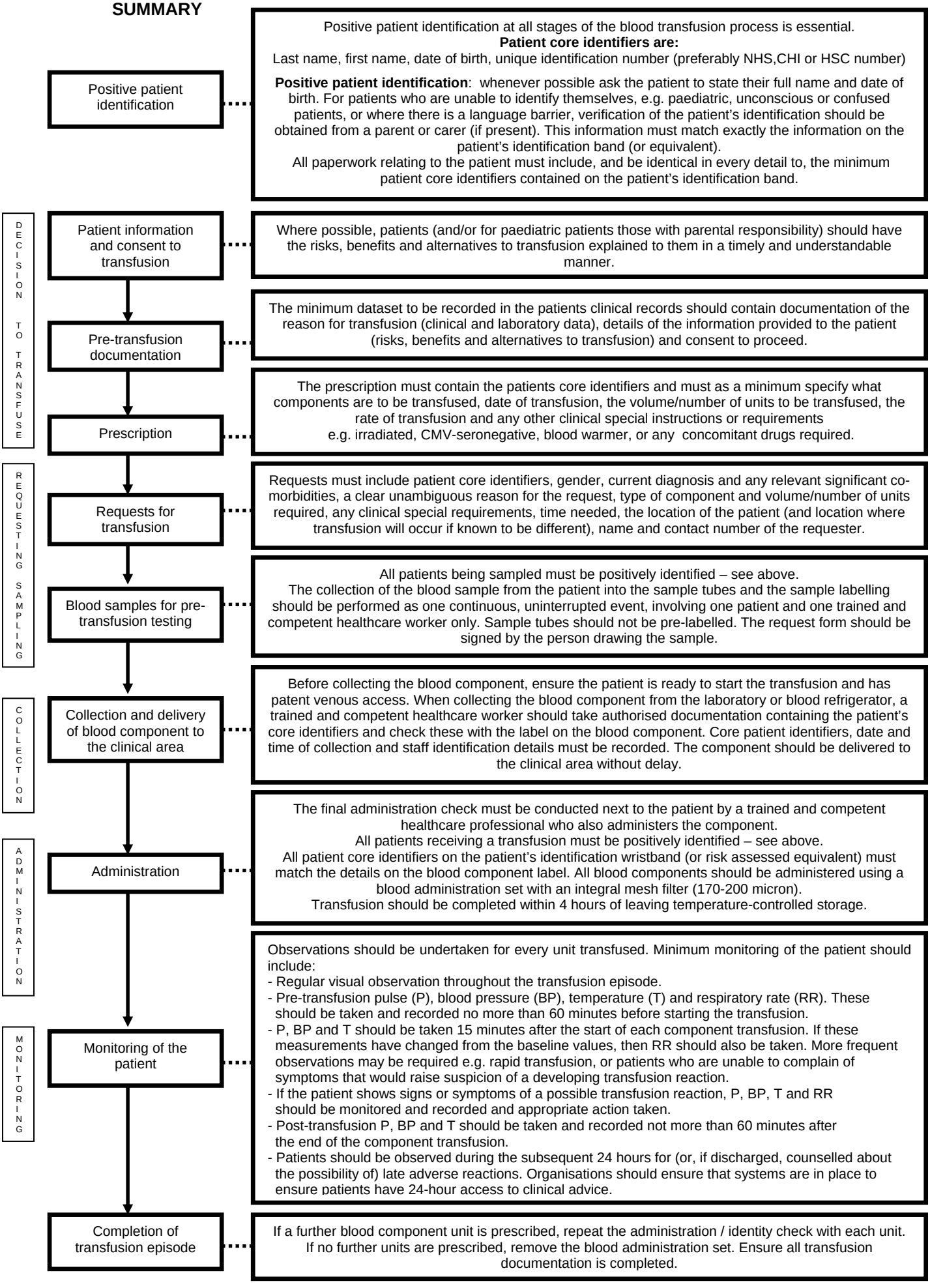
- **Clear and unambiguous communications between all staff involved in the transfusion process, including all clinical and laboratory staff and any other support staff, is essential. Organisations should have local policies and guidelines to minimise the risk of misinterpretation or transcription errors in all communications relating to transfusion, whether written, verbal or electronic.**

Training and Competency Assessment:

- **All staff involved in the blood transfusion process should receive regular (minimum 2 yearly) training and be assessed as competent (in accordance with NPSA SPN 14 (2006), or, for Scotland, with NHS QIS (2006)) Clinical Standards for Blood Transfusion) for the tasks they are involved in. Where activities fall under the remit of the BSQR (SI 2005 No.50 as amended) competency must be assured in line with the requirements of the competent regulatory authority (currently the Medicines and Healthcare Products Regulatory Agency (MHRA)). Only staff who are trained and competent should participate in the blood transfusion process.**

See also diagram 1: Administration of blood components - key action point summary

DIAGRAM 1: THE ADMINISTRATION OF BLOOD COMPONENTS – KEY ACTION POINT SUMMARY



4. BACKGROUND

- Errors in the requesting, collection and administration of blood components (red cells, platelets and plasma components) lead to significant risks for patients.
- Since its launch in 1996, the Serious Hazards of Transfusion (SHOT) scheme has continually shown that 'wrong blood into patient' episodes are a frequently reported transfusion hazard. These wrong blood incidents are mainly due to human error leading to misidentification of the patient during blood sampling, blood component collection and delivery or administration, and can lead to life-threatening haemolytic transfusion reactions and other significant morbidity.
- SHOT (2008) indicates that of the 47 'administration of wrong blood' incidents reported that year, the root cause in 29 was the collection of the incorrect unit from storage, followed by failure of all subsequent checks to prevent the administration of the wrong blood. In particular, failure of the pre administration bedside check (component against patient identification).
- The National Comparative Audits (NCA) of bedside transfusion practice in England and North Wales (2003, 2005 and 2009) show that patients continue to be placed at risk of avoidable complications of transfusion through misidentification and inadequate monitoring of the patient.
- These NCAs demonstrated that whilst most organisations had policy documents for the administration of blood, compliance with these standards was poor.

5. METHODS

- This guideline was drafted by a working party of the BCSH Transfusion Task Force.
- Information was gathered from a wide range of sources. See appendix 1 for search strategies employed.

6. CLASSIFICATION OF EVIDENCE LEVELS AND GRADES OF RECOMMENDATIONS

- There is little high quality evidence to prove the efficacy of specific interventions and procedures in improving the safety of the blood component administration process.

- Unless otherwise stated the recommendations within this guideline are based on professional experience and expert opinion. Therefore, unless otherwise stated, recommendations in this guideline are Grade C, based on Level IV evidence (see appendix 2 for classifications of levels of evidence).
- This guideline indicates the *minimum* requirements for the safe administration of blood transfusions. These are intended to provide the foundations for institutions to build on when developing their local policies and guidelines. However, it should be recognised that the more complex procedures are, the more open to error they become.

Recommendation:
The systems and processes involved in the transfusion pathway are very complex. Organisations should focus on simplifying procedures and concentrate on key steps, especially patient identification.

7. DEFINITIONS

- For the purpose of this guideline, the following definitions apply:
  Must: refers to a recommendation or action which is required to comply with a legal obligation (e.g. BSQR (SI 2005 No.50 as amended) or where the Writing Group regards the evidence for the recommendation or action to be unequivocal.
  Should: refers to a recommendation or action that is based on expert opinion. Individual organisations may consider converting 'should' to 'must' within their own local policies/guidelines.
- A *glossary of terms* is included in appendix 3.

8. KEY PRINCIPLES OF SAFE BLOOD ADMINISTRATION

- There are 3 key principles which underpin **every stage** of the blood administration process:
  - Patient identification
  - Documentation
  - Communication

8.1 Patient Identification

Patient identification band

- SHOT reports (1996 – 2008) have identified that 'patient identification band missing, defaced or hidden' is a significant contributory factor to wrong blood incidents.
- For the purpose of this guideline, the term 'patient identification band' will be used to denote all other forms of risk assessed identification mechanisms e.g. photo ID.
- In 2007 the NPSA produced a Safer Practice Notice 'Standardising Wristbands Improves Patient Safety'. This notice states that only the following core identifiers should be used on patients identification bands:
  - last name
  - first name
  - date of birth
  - NHS number (if the NHS number is not immediately available, a temporary unique identification number should be used until it is).
  - In Wales, the first line of the patients address is also required.
- The routine use of a national unique identification number, such as the NHS number in England and Wales, the CHI number in Scotland, or the HSC number in Northern Ireland, as a primary core identifier should reduce the confusion caused by multiple hospital numbers and case records for the same patient (SHOT 2006 report). Organisations where such a unique national identification number is not currently being used should ensure that all patients are issued with an alternative unique patient identification number. These organisations should make every effort to use the unique national numbers as soon as their technology allows.
- It is imperative that all spelling and number sequences on the patient identification band are correct.
- The information on the identification band must be legible and accurate. This is best done by printing the identification band directly from the institution's computerised patient administration system (PAS).
- Core identifiers may also appear on the identification band in electronically readable form such as bar-coding and radiofrequency identification (RFID). Electronic systems offer improved security and safety in the identification of blood components and patients and remove elements of human error from the system. In line with the NPSA, the writing group strongly encourages further development

and introduction of electronic systems to enhance the identification process and notes that such systems have already been successfully introduced into a number of healthcare facilities. In the UK, professionals from Oxford have particular experience in this field (Turner et al 2003, Davies et al 2006, Staves et al 2008, Murphy et al 2009).

- IT-based solutions should be designed and implemented to meet the specific safety requirements of transfusion medicine. The Electronic Clinical Transfusion Management System (developed as part of NPSA SPN 14 'Right Patient Right Blood' 2006) provides the specification for the introduction of electronic systems. These systems can also generate 'on demand' patient ID labels ***at the patient's side*** – these are acceptable as an alternative to hand-written labels when taking blood for pre-transfusion blood sampling. Ideally, bedside electronic identification systems should be linked to systems for blood tracking and control of the issue of blood components to produce integrated 'vein to vein' control of the transfusion process. All systems may have unintended risks, as well as benefits, and the consequences of human/system interaction may be unpredictable. Therefore it is important that all significant adverse events and errors associated with their use are reported to SHOT and/or the appropriate regulatory authority.
- The NPSA SPN 24 'Standardising wristbands improves patient safety' (2007) did not include the patient's gender as a core identifier on the patient's identification band. This is an area where there is difference of opinion amongst professionals and advisory bodies. In Scotland the patient's gender must also be included (NHS QIS (2006) Clinical Standards for Blood Transfusion). The NPSA SPN 24 (2007) states that if additional identifiers are thought to be necessary, they should be formally risk assessed.
- It may be difficult to use traditional 'wristbands' in certain patient groups, for example neonates or patients undergoing surgery' where access to the upper limbs is restricted. The writing group strongly recommends that <u>all</u> patients receiving a transfusion are positively identified using an accessible identification band (or risk assessed equivalent) securely attached to the patient (for example, to the upper or lower limb).
- If the identification band is removed, for example to insert a cannula, it should be the responsibility of the person removing the identification band to replace it immediately.
- All organisations should have a patient identification policy addressing the above points.

Recommendations:

A patient identification band (or risk assessed equivalent) must be worn by <u>all</u> patients receiving a blood transfusion. The minimum patient identifiers are - last name, first name, date of birth and unique patient identification number. This information must be legible and accurate. This is best done by printing the identification band directly from the institution's computerised patient administration system (PAS).

The writing group strongly recommends that whenever possible, the unique patient identification number should be a national unique identification number, such as the NHS number in England and Wales, the CHI number in Scotland, or the HSC number in Northern Ireland.

Patient identification is enhanced by using robust IT systems based on bar-code or radiofrequency identification (RFID). *Level III Grade B*

Organisations should explore, and where appropriate, implement IT systems to control the clinical transfusion process, in particular the positive patient identification check.

Unidentified/unknown patients

- In emergency situations, or situations where the patient cannot be immediately identified, the patient's core identifiers may be unknown.
- Where the patient's core identifiers are unknown, at least one unique identifier, usually a temporary identification number (e.g. accident and emergency or trauma number), and the patient's gender (i.e. unknown male/female) must be used.
- The use of temporary numbers increase the risk of confusion and errors in patient identification and should only be used when absolutely necessary.
- Local organisational policies and guidelines should be in place to ensure safety in all aspects of patient identification including the issue of unique identification numbers, the issue and withdrawal of temporary identification numbers, and the merging of patient clinical and transfusion laboratory records.

Patient identification in Major Incidents

- An area of concern identified in the review of a major incident is the lack of robust patient identification with the potential to cause serious transfusion errors (CMO's National Blood Transfusion Committee for England and North Wales 2006).
- Caution should be exercised with the issue of *consecutive* Major Incident numbers to casualties that, because of their similarity, have the potential to cause identification errors.
- All relevant staff must be familiar with the Major Incident numbering system used in that organisation. There should be regular drills to ensure familiarity with emergency processes.

Recommendations:
In emergency situations, or situations where the patient cannot be immediately identified, the patient's core identifiers may be unknown. At least one unique identifier, usually a temporary identification number (accident and emergency or trauma number) and gender must be used.

All organisations should have a risk-assessed policy for patient identification in emergency situations and major incidents.

Positive patient identification

- It is imperative that patient identification is checked and confirmed as correct at each stage of the transfusion process.
- All patients should, whenever possible, be asked to **state** their full name (first and last name) and date of birth. This must match exactly the information on the patient's identification band (or equivalent) and any other associated paperwork required at that stage of the transfusion process. This is the positive patient identification check.
- Some experts recommend that, whenever possible, patients should also be asked to spell their name to ensure that there is an exact match.
- For paediatric transfusions, it is acceptable to ask the child to positively identify themselves if the child is deemed able to respond competently.
- For patients who are unable to identify themselves, for example children who are unable to respond competently, unconscious or confused patients or where there is a language barrier, verification of the patient's identification should be obtained

from a parent or carer (if present at the patient's bedside) and checked against the patient's identification band.

- In circumstances where the patient cannot state their details and no parent/carer is available, the patient's identification band will be the only means of positive patient identification. Organisations should have a robust policy or guideline detailing the completion and application of patient identification bands.

Recommendations:

Positive patient identification is essential at all stages of the blood transfusion process. Whenever possible, the patient must be asked to state their full name and date of birth. This information must match exactly the information on the patient's identification band.

In patients who are unable to identify themselves, for example small children, unconscious or confused patients or where there is a language barrier, verification of the patient's identity should be obtained from a parent or carer (if present at the patient's bedside) and checked against the patient identification band.

If there are patient identification discrepancies at any stage of the transfusion process, the information must be verified and the discrepancies investigated and corrected before proceeding to the next stage of the process. They must never be assumed to be clerical errors.

All organisations should have a risk-assessed policy for all patients including the identification of incompetent or unconscious patients.

8.2 Documentation

- All organisations where blood transfusions occur should have a local policy or guideline which outlines every step in the transfusion process. This document should be readily available in the clinical environment and include a risk-assessed system for patient identification. The document should state:
  - which members of staff are authorised to perform pre-transfusion blood sampling and to request, prescribe, collect or administer blood components

- the training and competency assessment requirements of all staff involved in the transfusion process (see section 9)
- the required documentation for each step in the transfusion process

- Patient clinical records should be available within the clinical area at the time of the transfusion. Minimum documentation of transfusion episodes in the patient clinical records should include:

  Pre transfusion

  - the clinical indication for transfusion
  - relevant pre transfusion indices (e.g. full blood count, coagulation screen)
  - the date the decision for the transfusion was made and the date the transfusion should be administered (if different)
  - blood components to be transfused and their volume/dose
  - the risks, benefits and possible alternatives of transfusion as explained to the patient (or those with parental responsibility) and consent to proceed (see section 10.1)
  - any clinical special requirements for transfusion such as irradiated or CMV-seronegative components or use of blood warmer

  Administration

  For each component transfused:

  - date and time transfusion commenced
  - the unique donation number of the component transfused
  - the volumes administered (in mls)
  - identification details of member of staff commencing the transfusion
  - record of observations undertaken before, during and after the transfusion
  - date and time transfusion completed

  Post transfusion

  - the blood component prescription, patient observations and any additional transfusion record or report forms
  - an indication of whether or not the transfusion achieved the desired effect (for example post transfusion increment in haemoglobin or improvement in patient's symptoms)
  - the management and outcome of any transfusion reactions or adverse events
- The use of specifically designed transfusion care pathways or combined transfusion prescription and monitoring charts to record this information is encouraged.
- All transfusion records should contain the patient core identifiers.

Recommendations:
Full and complete documentation, governed by local policies and guidelines, is required at every stage of the blood transfusion process to provide an assured and unambiguous audit trail.

All paperwork relating to the patient must include, and be identical in every detail with, the minimum patient core identifiers contained on the patient's identification band.

8.3 Communication

- SHOT reports (1996 – 2008) confirm that errors in the transfusion process often result from poor communication. Problems may occur at all stages of the process, including identification of patients to be sampled, requests to the transfusion laboratory, transmission of laboratory results to clinical areas, collection of components from the blood bank and communication of orders between members of the clinical team. Verbal communication is particularly susceptible to misinterpretation or transcription errors. Wherever possible, written or electronic communications should be used, ideally using purpose designed forms or charts. All institutions should have risk-assessed policies in line with relevant BCSH guidelines.

Recommendations:
Clear and unambiguous communications between all involved in the transfusion process, including all clinical and laboratory staff and any other support staff, is essential. Organisations should have local policies to minimise the risk of misinterpretation or transcription errors in all communications, whether written, verbal or electronic.

9. TRAINING AND COMPETENCIES

- Training is the instruction or teaching of a skill or task, whereas competency involves an individual demonstrating that they are capable and proficient in performing a particular task.
- The Health Service Circular 2007/001 Better Blood Transfusion, Safe and Appropriate use of Blood advocates regular documented transfusion training and states that Continuing Professional Development (CPD) programmes for relevant staff should include blood transfusion.
- The NPSA SPN 14 (2006) stipulates three yearly blood transfusion competency assessments for staff performing the following functions:
  - obtaining a venous blood sample
  - collecting blood/blood components for transfusion
  - organising the receipt of blood/blood components for transfusion
  - preparing to administer blood/blood components to patients and administering a transfusion of blood/blood components

  Details of the NPSA blood transfusion competency assessments can be found at www.npsa.nhs.uk .
- The BSQR (SI 2005 No.50 as amended) requires that all staff involved in the collection and distribution of blood components undertake regular competency assessments. The Medicines and Healthcare products Regulatory Authority (MHRA), who are responsible for monitoring hospital compliance with these regulations, have stated that assessments should be undertaken in a manner that are commensurate with the level of risk associated with the process but should be at least every two years. Where activities fall under the remit of the BSQR (SI 2005 No.50 as amended), for example, the collection and distribution of blood components, this requirement will take precedence over the three yearly NPSA competency requirements.
- In Scotland, only staff that have completed the Better Blood Transfusion Programme continuing education programme (or equivalent) appropriate to their role can participate in the clinical transfusion process (NHS QIS (2006) Clinical Standards for Blood Transfusion).
- During induction to an organisation, all staff involved in the blood transfusion process should receive training and be assessed as competent. Subsequently, staff should be competency assessed (in accordance with NPSA SPN 14 (2006) and BSQR (SI 2005 No.50 as amended) requirements, or, for Scotland, in accordance with NHS QIS (2006) Clinical Standards for Blood Transfusion) for the specific tasks which they undertake.

- It is difficult for staff to retain knowledge and skills that may not be used on a daily basis and have to be reproduced without warning (Wang et. al. 2008). It was the consensus opinion of the writing group that there should be at least one update training episode in-between the 3 yearly NPSA required competency assessments (thus an individual receives training and/or a competency assessment at least every 2 years). Update training may be performed using a variety of methods including face-to-face, self-directed or e-learning. Organisations should justify the frequency and type of training for the individual by performing risk and/or impact assessments.
- There are a number of resources available to assist with blood transfusion training and competency assessment. Various initiatives are available at the Department of Health Better Blood Transfusion Toolkit and from the CMO's National Blood Transfusion Committee for England and North Wales (NBTC) NPSA Safer Practice Notice 14 Support group (both available at www.transfusionguidelines.org.uk). E-learning programmes have also been developed, for example, Learnbloodtransfusion, which is available to all organisations in the UK at www.learnbloodtransfusion.org.uk
- Organisational policies and guidelines should include the documentary evidence and training records required and the actions to be taken if a member of staff fails to meet the required competency assessment standards.

Recommendations:
All staff involved in the blood transfusion process should receive regular (minimum 2 yearly) training and be assessed as competent (in accordance with NPSA SPN 14 (2006), or, for Scotland, with NHS QIS (2006) Clinical Standards for Blood Transfusion) for the tasks they are involved in. Where activities fall under the remit of the BSQR (SI 2005 No.50 as amended), competency must be assured in line with requirements of the competent regulatory authority (currently the Medicines and Healthcare Products Regulatory Agency (MHRA)).

10. DECISION TO TRANSFUSE

- The decision to transfuse must be based on a thorough clinical assessment of the patient and their individual needs.
- Information relating to the appropriate use of blood components is not included in this guideline. For more detailed guidance refer to the following BCSH guidelines:

- The clinical use of red cell transfusion (2001)
- Guidelines for the use of platelet transfusions (2003)
- Guidelines for the use of fresh-frozen plasma, cryoprecipitate and cryosupernatant (2004) and erratum (2007)
- Transfusion guidelines for neonates and older children (2004) and erratum (2007)
- Guidelines for management of massive blood loss (2006)

Advice is also available in the Handbook of Transfusion Medicine (4th Edition, McClelland (ed) 2007).

- The decision process leading to transfusion should be documented in the patient's clinical record.
- There is limited evidence (Friedman and Elbrahim 2006), that when the decision or reason for transfusion is documented there is a lower rate of inappropriate transfusion. In transfusions that could not be justified by the pre-transfusion haemoglobin alone, only 9% of those with adequate documentation were deemed inappropriate. For intermediate documentation 50% were inappropriate and for inadequately documented transfusions, 73% of transfusions were inappropriate.

Recommendations:
The rationale for the decision to transfuse and the specific components to be transfused should be documented in the patient's clinical records.

10.1 Patient Consent

- Wherever possible, a trained and knowledgeable practitioner should inform the patient (and/or for paediatric patients those with parental responsibility) of the reason for and the risks, benefits and alternatives to transfusion. This should be done in a timely manner and in a way that they can understand**,** as recommended by the Health Service Circular HSC 2007/001 Better Blood Transfusion *Safe and Appropriate Use of Blood*. Informed consent, either verbal or written, should be obtained (wherever possible) and documented in the patient's clinical notes.
- Signed written consent by the patient for transfusion is not, at present, a legal requirement within the UK, although individual local policies may require this. The Advisory Committee for the Safety of Blood, Tissues and Organs (SaBTO) is currently reviewing patient consent for blood transfusion.

- Patients should be informed that they have received a blood component transfusion prior to discharge. This is particularly important where the patient may not be aware of the transfusion (e.g. transfused during surgery or emergency situations).
- The provision of a blood transfusion information leaflet is recommended. Information leaflets (translated into several languages) for adults, children and parents are available from the UK Blood Services and many organisations or specialist departments have developed their own patient information resources. In elective surgical patients, the pre-operative assessment clinic is an ideal opportunity to initiate this process.
- All information, written and verbal, should be clearly documented in the patient's clinical records.
- Patients vary in how much information they wish to receive. There is always an element of clinical judgement in determining what level of information a patient should be given. However, the presumption must be that the patient wishes to be well informed about the significant risks and benefits of the proposed transfusion and any alternatives. Where the patient makes clear that they do not wish to be given this level of information, this should be documented in the patient's clinical records.
- Valid consent implies that the patient has the opportunity to refuse treatment or change their mind about prior consent. Where transfusion of all, or specific blood components is refused, or an *Advance Directive* exists, this should be documented in the patient's clinical records and communicated to all relevant healthcare professionals.
- In emergencies, the clinician has a duty of care and should act to preserve life. Unless the patient explicitly refuses transfusion or carries an *Advance Directive*, transfusion that is considered to be in their best interests should be carried out and the decision documented in the patients clinical records.
- Organisations should have a clear written policy for consent to medical treatment and for the refusal of blood components in adults and children.
- Further guidance relating to patient consent is available from the Department of Health, the General Medical Council and the Royal College of Nursing.

Recommendations:

Patients (and/or those with parental responsibility for children) who may require a transfusion should have the reasons for and the risks, benefits and

alternatives to transfusion explained to them. All information given, written and verbal, and consent to proceed, should be clearly documented in the patient's clinical record.

10.2 Prescription

- The prescription of blood components is the written authorisation to administer a blood component and is different to the request (see section 11).
- Blood components should only be prescribed by an appropriately trained, competent and locally authorised registered practitioner, using an approved prescription sheet for intravenous fluids or on a special transfusion documentation chart.
- Section 130 of the 1968 Medicines Act has been amended by regulation 25 of the BSQR (SI 2005 No.50 as amended). The effect of this amendment is to exclude whole human blood and blood components from the legal definition of medicinal products and thus incapable of 'prescription' by any practitioner. Therefore, although the prescription of blood components has traditionally been regarded as the responsibility of a medical practitioner, there are no legal barriers to other appropriately trained competent registered practitioners ordering, authorising and administering blood. A national consultation has been undertaken to develop a framework that will allow practitioners who undertake this role to practice safely (Pirie and Green 2009). Further progress on this work will be reported to BCSH Transfusion Task Force.
- Since it has become 'custom and practice' to refer to blood components as being 'prescribed', the term prescription has been used throughout this guideline. In this context 'prescription' means the written authorisation or instruction to administer blood components.
- Ideally, to prevent communication or transcription errors, blood components should be prescribed by the registered healthcare professional making the decision to transfuse.
- The prescription should include the following information:
    - patient core identifiers
    - date (and time if appropriate) the blood component transfusion is required
    - type of blood component to be administered
    - any clinical special transfusion requirements e.g. irradiated, CMV-seronegative, blood warmer required

- volume or number of units to be transfused (exact number in mls for paediatric transfusions)
- time over which each unit is to be transfused (rate or exact length of time over which the specified volume is to be transfused for paediatric transfusions)
- any special instructions e.g. concomitant drugs required, such as furosemide
- signature of the prescriber

- Local policies and guidelines should detail what terminology or abbreviations are permissible on the prescription e.g. Packed red cells, PRCs or red cells; not "blood".

Recommendations:
Blood components should only be prescribed by an appropriately trained and competent practitioner as defined by local organisational policies/guidelines.

The prescription must contain the patients core identifiers and must, as a minimum, specify what components are to be transfused, date of transfusion, the volume/number of units to be transfused, the rate of transfusion and any other clinical special instructions or requirements e.g. irradiated or CMV-seronegative components, need for blood warmer or any concomitant drugs to be administered.

11. REQUESTS FOR BLOOD TRANSFUSION

- The 'request' constitutes the mechanism of communication with the transfusion laboratory, asking them to prepare and issue the component for administration and is different to the prescription (see section 10.2).
- Clinical staff should be encouraged to discuss transfusion indications and requirements with the transfusion laboratory scientific staff. Advice should also be available from haematology medical staff or Transfusion Practitioners when required.
- Massive transfusion situations should be discussed directly with the transfusion laboratory and local protocols activated (BCSH 2006 Guidelines on the Management of Massive Blood Loss).

11.1 The Requester

- Requesting of blood components may only be carried out by an appropriately trained, competent and locally authorised practitioner in possession of the relevant information about the patient, according to local policies and guidelines.
- The name of the person making the request should be clearly indicated on the written or electronic request form or, if a telephone request, this should be documented in the transfusion laboratory record. A contact number should also be documented to allow the transfusion laboratory to contact the requester if further questions or problems arise.
- SHOT reports show a significantly increased risk of errors if pre-transfusion testing is performed during 'out of hours' working. Requests for transfusion should only be sent 'out of hours' when clinically necessary. Organisations planning '24/7' (all day, every day) working should risk assess their processes and deploy adequate numbers of appropriately trained laboratory staff to ensure transfusion safety (SHOT report 2006).

11.2 The Request

- The details on the blood component request form and the sample tube are the only direct contact between the clinical area and the blood transfusion laboratory. The accuracy and completeness of this information is therefore of vital importance.
- Providing it contains the required information and complies with local policies and guidelines, the request for components for transfusion may be made on an approved written request form, an electronic-requesting system or, if an appropriate blood sample is already available in the laboratory, may be telephoned.
- Where blood samples are sent to the transfusion laboratory for initial blood grouping and antibody screening or to crossmatch red cells, the request should be written or electronic (even if preceded by an explanatory telephone call or discussion).
- Where electronic requesting is used, there must be a mechanism to alert the transfusion laboratory to the presence of the request in the system. Further advice can be found in BCSH (2007) guideline 'The specification and use of information technology systems in blood transfusion practice'.
- Telephoned requests are susceptible to transcription errors and should be underpinned by clear local institutional policies and guidelines.

- As a minimum, the request should:
  - contain the patient's core identifiers (see section 8.1). Gender should also be included as it is important for component selection purposes. Other unique identifiers (such as patient's address) may be required in line with local policies
  - contain information on the patient's diagnosis and any significant co-morbidities of relevance to transfusion
  - provide a clear, unambiguous reason for transfusion. Terms such as 'Pre-op', 'Anaemia' or 'Low Hb' alone are not acceptable and provide inadequate information for audit purposes. The CMO's National Blood Transfusion Committee for England and North Wales (2009) has produced standardised 'Indication Codes' for transfusion which may be incorporated into the request process
  - state when the transfusion will take place and the urgency of the transfusion
  - state the location of the patient at the time of the request, and where the blood will be transfused (if known to be different)
  - include relevant information on other factors which influence transfusion requirements, including:
    - known blood group antibodies
    - any previous reactions to blood components
    - any known pregnancies
  - state what type of blood component is required and the number of units (exact volume in ml for paediatric transfusions)
  - contain information on any clinical special requirements for blood components e.g. irradiated, CMV-seronegative. Organisations may consider how to communicate clinical special requirement needs to the transfusion laboratory for long term patients without needing to state this on every request.
- Organisations should have local policies or guidelines detailing the requirements for requests for transfusion in both routine and urgent situations, and the action to be taken by the transfusion laboratory if minimum requirements are not met. Transfusion laboratories should not allow the core patient identifiers on the request form to be amended or added to. We recommend that organisations adopt a 'zero tolerance' policy in this regard.

Recommendations:

Organisations should have local policies/guidelines detailing the minimum

data required on requests for transfusion in both routine and urgent situations, and the action to be taken in the transfusion laboratory if these requirements are not met.

12 PRE-TRANSFUSION BLOOD SAMPLING

- Incorrect or inadequate patient identification, leading to a sample for blood grouping being taken from, or labelled for, the wrong patient may result in fatal ABO-incompatible transfusions (SHOT annual reports 1996-2007). Inadequately or mislabelled samples are up to 40 times more likely to contain blood from the wrong patient (Lumadue et al 1997)

12.1 Patient Identification

- All patients having a blood sample taken must be positively identified (see section 8.1).
- All inpatients must wear an identification band (or risk assessed equivalent).
- In outpatient departments (or in the community setting) where identification bands may not be used, the patient (or parent/carer if the patient is unable to respond) should be asked to state their full name (first and last name) and date of birth (some organisations also require address). It must be ensured that these details are the same as on the request form(s).

Recommendations:
All patients having a blood sample taken must be positively identified.

12.2 Sample collection (phlebotomy)

- The collection of the blood sample from the patient and the subsequent labelling of the sample tubes should be performed as one continuous, uninterrupted event at the patient's (bed)side, involving one patient and one member of staff only.
- All staff involved in sample collection should be competency assessed to NPSA SPN 14 (2006) or NHS QIS (2006) standards. Local policies or guidelines should clearly identify which staff are authorised to collect blood samples for pre-transfusion compatibility testing.

Recommendations:

Pre-transfusion blood sampling should only be undertaken by staff who are trained and competency assessed (to NPSA (2006) or, for Scotland, NHS QIS (2006) standards).

12.3 Sample labelling

- The sample tube must be completed with the patient core identifiers (see section 8.1). These core identifiers must exactly match the request form and patient identification band (or equivalent).
- Date and time of sampling and the identity of the person taking the sample (e.g. initials or signature, according to local policy) should be recorded on every sample tube and request form to provide a full audit trail.
- These minimum labelling requirements apply to both adult and paediatric/neonatal blood samples.
- Sample tubes should never be pre-labelled.
- Pre-printed labels (pre-printed away from the patient or taken from the patient's notes e.g. '*addressograph'* labels) should not be used to label pre-transfusion blood sample tubes for compatibility testing. Only labels that are printed 'on demand' and attached to the sample tube next to the patient at the time of phlebotomy are acceptable (BCSH 2004 Guidelines for compatibility procedures in blood transfusion laboratories).
- All hand-written sample labels should be completed legibly and accurately (in ball point pen to avoid washing out or smudging).
- Organisations should have a clear policy on the rejection of pre-transfusion blood samples which do not meet minimum labelling requirements. There should be no changes or amendment of patient core identifiers once samples have been sent to the laboratory. It is suggested that organisations should adopt a 'zero tolerance' policy.
- For further information relating to sample requirements and timing of sample collection in relation to previous transfusions please refer to the BCSH Guidelines for compatibility procedures in blood transfusion laboratories (2004).

Recommendations:

Sample tubes must be labelled at the patient's side by the individual who took the sample.

Organisational policies/guidelines should define the actions to be taken by the hospital transfusion laboratory if minimum sample labelling requirements are not met. Samples received by the transfusion laboratory should not be allowed to have patient core identifiers amended or added to. Organisations should adopt a 'zero tolerance' policy with respect to this recommendation.

12.4 Delivering samples to the transfusion laboratory:

- Local policies or guidelines should detail how samples should be transported to and received by the transfusion laboratory in a timely manner.
- If using an 'air-tube' system to deliver samples, staff should ensure they have been correctly trained in their use and that there is an appropriate delivery protocol for emergency samples.
- For emergency or urgent samples, the hospital transfusion laboratory staff should be contacted to alert them to imminent receipt of the sample. If the transfusion laboratory staff are aware that an urgent sample is in transit, they can make further enquiries if it is not received. Local policies or guidelines should ensure that any staff member transporting urgent samples to the laboratory are aware of the urgency of the situation and know where/who in the transfusion laboratory they should deliver it to.

13. COLLECTION AND DELIVERY OF BLOOD COMPONENTS TO THE CLINICAL AREA

- Removal of blood components from their storage location continues to be identified as a major source of error in the transfusion process (SHOT reports 1996-2008). Many collection errors occur when the patient details on the laboratory produced label attached to the blood component pack are not checked against the patient's identification details.
- All staff involved in the collection and delivery of blood components from the storage area to the clinical area should be competency assessed to NPSA SPN 14 (2006) or NHS QIS (2006) and BSQR (SI 2005 No.50 as amended) standards (see section 9). Organisations should have a policy or guideline for the collection of blood components from the storage location and their delivery to clinical areas. Policies should identify the staff who are authorised to collect and deliver blood components.

- Organisations should develop systems to restrict access to blood refrigerators/storage locations so that only authorised, trained and competent staff may collect blood. Electronic systems are available to support the control of this process.
- The use of specifically designed, dedicated and validated blood transport containers is recommended. Blood components should only be packaged for transport by trained and competent personnel. The time the blood was placed into the transport container should be recorded.
- There must be a clear audit trail of the collection, delivery, receipt (and return) of all blood components.
- Blood must only be stored in designated temperature controlled refrigerators, not in ward or domestic refrigerators.

13.1 Pre-collection considerations

- Before collecting the blood component, the following should be ensured by clinical staff:
  - the patient is wearing an identification band (or equivalent) (section 8.1).
  - the reason for the transfusion has been documented in the medical notes (sections 8.2 and 10).
  - wherever possible, the reason for the transfusion has been explained to patient (and/or for paediatric patients those with parental responsibility) and consent obtained and documented in the patient's clinical records (section 10.1).
  - the blood component has been prescribed on an approved prescription chart (section 10.2).
  - there is appropriate and patent intravenous access (appendix 6).
  - there are suitably trained and competent staff available for the duration of the transfusion (sections 9 and 14)
  - the patients baseline observations have been completed (section 15)
- Unless rapid transfusion of large quantities is needed, or if blood is being transported to remote areas in specifically designed validated blood transport containers, only one unit should be collected for each patient at a time.

13.2 Patient identification required for the collection of blood components

- The staff member removing the blood component from the storage location should carry documentation (blood component collection form, prescription chart or the patient's notes, according to local policies), containing the patient's core identifiers (see section 8.1). These details must be checked against the patient identification details on the laboratory produced label attached to the blood component pack.
- Because of the potential for transcription errors, telephone requests for the collection of blood components should only be permitted following a formal risk assessment.
- Other details required are:
  - location of the patient
  - degree of urgency

13.3 Documentation of blood component collection

- The BSQR (SI 2005 No.50 as amended) require that, for all blood components, the 'cold chain' must be maintained and the relevant storage and cold chain documentation be available. This can be achieved through paper based or IT systems.
- When a blood component is removed from the designated storage location the following information should be retained for each individual unit:
  - identity of the person taking the component from blood refrigerator/issue area
  - date and time component taken.
- Storage and cold chain records must be kept for 15 years (BSQR (SI 2005 No.50 as amended)).

13.4 Receipt in the clinical area

- When the blood component is delivered to the clinical area, an appropriately trained and competent member of staff should check that the correct blood has been delivered.
- To allow audit of the cold chain, the following information should be recorded for each individual component unit when it arrives at the clinical area:
  - identity of the person who received the component
  - date and time the component arrived in the clinical area

- If a blood collection slip is used, organisations should define how this documentation record is retained and stored.

13.5 Return of blood components

- If a blood component is returned from a clinical area to a designated blood refrigerator/storage location, the following information should be recorded for each individual unit:
  - identity of the person returning the component
  - date and time component placed in the blood refrigerator/storage location
- All unused components should be returned as soon as possible and the clinical areas should inform the laboratory of the circumstances of the return.
- If red cell units are out of temperature controlled storage for more than 30 minutes they should not be put back into storage for re-issue. If an IT tracking system is being used it should be able to immediately highlight to laboratory staff the presence of any returned units that need withdrawal from stock.

13.6 Collection of 'emergency' red cells

- In emergency situations, it may sometimes be necessary to provide emergency group O blood which is not specifically labelled for the patient. The issue of emergency stock should be controlled and documented so that patient safety and audit trails are not compromised.
- The protocol for emergency stock issue should state that the transfusion laboratory must be informed immediately when emergency units are removed from the blood refrigerator. This assists traceability and ensures rapid replacement of emergency units so that future demands are not compromised.
- To reduce the risk of mistransfusion, blood designated as emergency stock should be clearly identified as such and separated from matched and patient labelled blood units in the same refrigerator. Storage and transport condition requirements are the same as for any other unit of red cells.

Recommendations:

Access to blood fridges should be controlled by robust electronic or manual systems so that blood components can only be collected by authorised staff who are trained and competency assessed to NPSA SPN 14 (2006) standards

(in Scotland to NHS QIS standards) and BSQR SI 2005/50 requirements.

Authorised documentation containing the patient's core identifiers must be used in the blood component collection checking procedure.

There must be a clear audit trail of the collection, delivery, receipt (and return) of all blood components.

14. ADMINISTRATION OF BLOOD

- Failure to correctly undertake the formal identity check of the blood component with the patient prior to administration puts patients at risk of receiving the wrong blood (SHOT reports 1996-2008).
- Blood components must be administered by a registered healthcare professional.
- Staff involved in administration of blood should be competency assessed to NPSA SPN 14 (2006) or NHS QIS (2006) standards (see section 9). Local policies and guidance should clearly identify which staff are authorised to administer blood components.
- Transfusion must only take place when there are enough staff available to monitor the patient and when the patient can be readily observed. Overnight transfusions should be avoided unless clinically essential.

14.1 Administration Check

- The final administration check should always be conducted next to the patient (not in a remote clinical room or at the nursing station). Once all checks have been successfully completed, the transfusion should be started immediately. If the checking process is interrupted, the entire process (as detailed in table 1) should re-start from the beginning.
- The healthcare professional who is going to administer the unit should undertake all these checks.
- Documents used in the checking process must contain all of the patient's core identifiers (see section 8.1).
- All patients receiving a transfusion must be positively identified (see section 8.1) and must wear an identification band (or equivalent).

- Transfusion should only take place if the patient identification details on the blood component pack and the patient identification band (or equivalent) match. If they do not, the transfusion laboratory should be informed and the component must not be transfused until there has been an investigation and any discrepancies resolved. A repeat pre-transfusion blood sample may be required.
- If the practitioner is unsure that the blood component issued is correct, for example an unexplained difference between blood groups in the donor and recipient or whether special requirements have been met, they should check with the hospital transfusion laboratory before starting the transfusion.
- The compatibility report form and patient's clinical records should **not** form part of the final bedside patient identification check (NPSA SPN 14 (2006)).
- IT or electronic systems, incorporating for example bar-coding or RFID, used to control the bedside checking process, offer improved security and safety in the identification of blood components and patients and can prevent incompatible transfusions (Turner et al 2003, Davies et al 2006, Staves et al 2008, Murphy et al 2009). The NPSA SPN 14 (2006) recommended that hospitals risk assess and examine the feasibility of using electronic clinical transfusion management systems. Experience with these systems in hospital practice is accumulating and field trials are in progress to determine the effectiveness and relative merits of the different IT systems available.
- The prescription (and any other associated paperwork) must be signed by the person administering the component.
- The unique component donation number and the date, start and stop time and volumes (mls) of all blood components administered and the name of the person administering the component should be recorded in the patients' clinical notes.
- Table 1 lists the final checks that should be carried out at the patient's (bed)side before transfusion. It is divided into Patient Checks and Blood Component Checks.

Table 1 – Pre-administration checks

Patient Checks
Ask the patient to state their full name (first and last name) and date of birth. For patients who are unable to identify themselves, e.g. paediatric, unconscious or confused patients, or where there is a language barrier, verification should be obtained from a parent or carer (if present).
These details (full name and date of birth) must match exactly those on the patient's identification band (or equivalent).
In circumstances where the patient cannot state their details and no parent/carer is available, the patient's identification band will be the only means of positive patient identification.
All details on the patient's identification band (full name, date of birth and unique patient identification number) must match exactly the details on the prescription chart/dedicated transfusion record and the laboratory generated label attached to the blood component pack.
Blood Component Checks
Check the expiry date of the component - unless a specific expiry time is stated, the component expires at midnight of the date shown.
The unique component donation number and the blood group on the blood component pack label must be the same as on the laboratory produced label attached to the blood component.
Check the blood component pack label to ensure that any clinical special requirements have been met e.g. irradiated, CMV-seronegative.
Inspect the blood component pack for any signs of leakage or damaged packaging. Inspect the blood component for unusual colour, turbidity or clumping of the contents. If any defect is suspected contact the blood transfusion laboratory for advice before starting the transfusion.

14.2 Emergency red cells

- If emergency group O red cells, not specifically labelled for the patient, have been administered, the laboratory must be provided with patient information details and confirmation of transfusion as soon as possible to maintain traceability.

14.3 One or two person checks

- A systematic review (Watson et al 2008) found no unequivocal evidence to support either a one or two person checking procedure.
- As a minimum, one registered healthcare professional, competency assessed to NPSA SPN 14 (2006) standards (or for Scotland to the NHS QIS (2006) Clinical Standards for Blood Transfusion) must perform the checking/administration procedure.
- Organisations should risk assess their checking procedures.
- If local policy requires a two person checking procedure, each person should complete all the checks independently (double independent checking).

14.4 Blood Component Administration

- See tables in appendices 4 and 5. The dosage and administration rates given in these tables are for guidance only and will depend on the clinical status of the patient and laboratory results.
  - detailed recommendations on the indications for and dosage of blood components are outside the scope of this guideline. For more detailed guidance refer to other BCSH guidelines as listed in section 10.

  Advice is also available in the Handbook of Transfusion Medicine (4th Edition, McClelland (ed) 2007).
- The Handbook of Transfusion Medicine (4th Edition) recommends that all blood component transfusions are completed within 4 hours of removal from a controlled temperature environment. This limit is designed to reduce the risk of bacterial growth and transfusion-transmitted infection and is based on data relating to the 'lag phase' before bacteria begin to proliferate after removal from refrigeration. The *4 hour rule* has entered most hospital guidelines. Although the evidence for a strict 4 hour rule falls short of that required for a 'must' recommendation, the Writing Group feels strongly that this rule should continue to be applied in clinical practice, wherever possible, until there is clear scientific evidence that extension of the timescale is safe (research is ongoing). Nonetheless, it is recognised that on neonatal units the transfusion itself may take four hours if the maximal top-up red cell transfusion volume (20mls/kg) is given at recommended safe infusion rates. Therefore, additional time is required to allow for the preparation of the transfusion in the clinical area and the final administration check. In this situation, we recommend that there should be no more than 30 minutes between removing the component from the temperature

controlled environment and starting the transfusion (the use of validated blood transport containers is recommended), and the transfusion itself should be completed within four hours in all cases. Organisations should risk assess situations where transfusions may not be completed within four hours of removal from a temperature controlled environment when establishing their local protocols.

- See appendix 6 for 'technical aspects of blood component administration'.

Recommendations:

Blood components must only be administered by a registered healthcare professional who should be trained and competency assessed to NPSA SPN 14 (2006) standards (in Scotland to NHS QIS (2006) Clinical Standards for Blood Transfusion).

Transfusion should only take place if there are sufficient staff available to monitor the patient and the patient can be readily observed.

All patients receiving a transfusion must be positively identified and must wear an identification band (or risk assessed equivalent) (see section 8.1).

The healthcare professional who administers the blood component must perform the final administration check.

The final administration check must be performed at the patient's side immediately before administering the blood component by matching the patient details attached to the blood component with the details on the patient's identification band (or equivalent).

Transfusion should be completed within four hours of removal from temperature-controlled storage.

The unique component donation number and the date, start and stop time of all blood components administered and the name of the person administering the component should be recorded in the patients' clinical notes.

14.5 Traceability

- To ensure compliance with the BSQR (SI 2005 No.50 as amended) requirements for traceability, positive evidence of the transfusion of each component unit must be fully documented in accordance with local policies and guidelines using electronic or manual systems. This information must be kept for a minimum of 30 years.
- Organisations should have a local policy or guideline detailing how transfusion documentation and traceability (in accordance with the BSQR (SI 2005 No. 50 as amended)) must be maintained.
- Compliance with traceability procedures should be subject to regular audit and corrective action.

Recommendations:

Organisations should have a local policy or guideline detailing how transfusion traceability or 'fate of unit' (in accordance with the BSQR (SI 2005 No. 50 as amended)) must be achieved by robust electronic or manual systems.

15. MONITORING THE PATIENT

- Observation and monitoring of the patient during a transfusion is essential if adverse reactions to the transfusion are to be quickly identified and managed.
- Transfusion must only take place when there are enough staff available to monitor the patient and when the patient can be readily observed.
- Many serious reactions are apparent within 30 minutes of starting the transfusion of a blood component unit (SHOT 2006), and close observation during this period is essential.
- The National Confidential Enquiry into Patient Outcome and Death (NCEPOD 2005) reported that in critically ill medical patients, the respiratory rate is an early and important indicator of deterioration. Dyspnoea and tachypnoea may both be features of serious transfusion reactions, and while routine monitoring of respiratory rate is unnecessary during a transfusion, a baseline measurement before the transfusion starts is recommended.
- Observations should be undertaken and documented for every unit transfused. Minimum monitoring of the patient should include:

- pre-transfusion pulse rate, blood pressure, temperature and respiratory rate. These should be taken and recorded no more than 60 minutes before the start of the component transfusion.
- pulse rate, blood pressure and temperature should be taken 15 minutes after the start of each component transfusion. If these measurements have altered significantly from the baseline values, then respiratory rate should also be taken. For rapid infusions, more frequent observations may be required.
- if the patient shows any signs or symptoms suggestive of a transfusion reaction, observations (pulse rate, temperature, blood pressure and respiratory rate) should be monitored and recorded and appropriate action taken.
- post-transfusion pulse rate, blood pressure and temperature should be taken and recorded not more than 60 minutes after the end of the component transfusion.

NB any routine patient observations should be continued.

- Deterioration in the patient's condition, or development of symptoms suggesting a transfusion reaction should prompt more frequent observations, dictated by the clinical situation.
- Patients should be informed about possible adverse effects of transfusion, and the importance of reporting immediately any potential symptoms of an adverse event e.g. shivering, rashes, flushing, shortness of breath, pain at transfusion site or loin pain.
- Special care should be taken in patients who are unable to complain of symptoms that would raise suspicion of a developing transfusion reaction, because they are unconscious, too young, confused or there is a language barrier. More frequent observations may be required.
- According to SHOT (2006), 34% of reactions occur more than 30 minutes after the transfusion starts. Therefore there should be regular visual monitoring of the patient throughout the transfusion episode with additional observations as needed. The 2008 SHOT report emphasises that, on occasion, transfusion reactions can occur many hours after the transfusion is completed and recommends that patients are observed during the subsequent 24 hours. Clearly, for transfusions administered as *day cases*, continued direct observation is not possible. However, such patients should be counselled about the possibility of late adverse reactions and organisations should ensure that mechanisms are in place that give patients access to clinical advice at all times. We recommend that day case and short-stay transfusion patients are issued with a *contact card*

facilitating 24-hour access to appropriate clinical advice (as commonly used for patients receiving outpatient chemotherapy).

- Further research is needed to ascertain the optimal frequency of transfusion observations.

Recommendations:

Observations should be undertaken and documented for every unit transfused.

Minimum monitoring of the patient should include:

- ***Regular visual observation throughout the transfusion episode.***
- ***Pre-transfusion pulse, blood pressure, temperature and respiratory rate. These should be taken and recorded no more that 60 minutes before the start of the transfusion.***
- ***Pulse, blood pressure and temperature should be taken 15 minutes after the start of each component transfused. If these measurements have altered significantly from the baseline values, then respiratory rate should also be measured.***
- ***If the patient develops signs or symptoms suggestive of a transfusion reaction, observations (pulse, temperature, blood pressure and respiratory rate) should be monitored and recorded and appropriate action taken.***
- ***Post-transfusion pulse, blood pressure and temperature should be taken and recorded not more than 60 minutes after the end of the component transfusion.***

More frequent observations may be required e.g. rapid infusion, or patients who are unable to complain of symptoms that would raise suspicion of a developing transfusion reaction.

Transfusion observations must be clearly distinguished from other routine observations and filed in the patients' clinical notes.

Inpatients should be observed for late reactions during the subsequent 24 hours. Day case and short-stay transfusion patients should be counselled about the possibility of late adverse reactions and organisations should ensure that systems, such as contact cards, are in place giving patients access to immediate clinical advice.

Management of Adverse Incidents

- The clinical management of acute transfusion reactions is to be the subject of a separate BCSH guideline (in preparation). Detailed clinical advice can also be found in the 4th edition of the Handbook of Transfusion Medicine (McClelland 2007).
- Any adverse events or reactions related to the transfusion should be appropriately investigated and reported to local risk management, SHOT and the Medicines and Healthcare products Regulatory Agency (MHRA) via the Serious Adverse Blood Reactions and Events (SABRE) system.

16. COMPLETION OF THE TRANSFUSION EPISODE AND POST TRANSFUSION DOCUMENTATION

- The time each unit was completed should be recorded.
- The empty blood component bag should be discarded according to organisational policy for the disposal of clinical waste (see appendix 6).
- If a further blood component unit is prescribed, repeat the administration and patient identity check (as detailed in section 14.1 and table 1) for each unit.
- If no further units are prescribed, remove the blood administration set. If any other IV fluids are prescribed, they should be administered using a new IV administration set appropriate for that solution.
- It is not necessary to 'flush' the blood administration set after transfusion. However, if this is done, only isotonic (0.9%) saline should be used. Local policies or guidelines should determine how saline used to prime or flush administration sets is prescribed and documented.
- Monitor and record observations as detailed in section 15.
- An indication of whether or not the transfusion achieved the desired effect (either post transfusion increment rates or improvement in patient symptoms) and details of any reactions to the transfusion should be documented in the patient's clinical records.

Recommendations:

The time each unit was completed should be recorded.

An indication of whether or not the transfusion achieved the desired effect (either post transfusion increment rates or improvement in patient symptoms) and details of any reactions to the transfusion should be documented in the patient's clinical records.

17. TRANSFUSIONS OCCURING OUTSIDE THE ACUTE HOSPITAL SETTING

- Transfusions may occasionally occur in community hospitals or in the patient's home.
- All recommendations made in this guideline apply to these out-of-acute hospital transfusions, which must be carried out to the same standards.
- Local policies and guidelines should define the staff responsible for the various aspects of the transfusion, including overall responsibility for the service. There must be a clear plan of action to be followed in the event of an adverse incident or reaction.
- Additional guidance can be found in a 'Framework for the development of an out of acute hospital blood transfusion service' (Green and Pirie 2007).

18. RECOMMENDED AUDITS

- There should be regular reviews of all aspects of the blood transfusion process and internal audits to ensure compliance.
- HSC 2007/001 *Better Blood Transfusion: Safe and Appropriate Use of Blood* requires Hospital Transfusion Teams to carry out regular (at least annual) local audits of key steps in the transfusion process, including sample labelling and the pre-transfusion bedside check, and to participate in national audits of the transfusion process.

Recommendations:
There should be regular reviews of all aspects of the blood transfusion process and internal audits to ensure compliance with policies and guidelines.

19. FURTHER RESEARCH

- As indicated in section 6, there is currently little evidence to demonstrate the efficacy of specific procedures to improve the safety of the blood component administration process.
- It is recommended that further research to improve the safety of blood transfusion processes should be undertaken.
- Recommended areas for research include improving the bedside checking process (e.g. the relative merits of one or two person checking procedure and the optimum use of IT systems in clinical practice), the optimum monitoring of patients receiving a blood transfusion and whether systematic documentation of the decision to transfuse helps to reduce inappropriate transfusions.

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APPENDIX 1 – SEARCH STRATEGIES

- Searches for relevant publications were carried out (April 2006 and June 2009) on Medline, Embase, Cinahl and The Cochrane library including the following terms:
    - Blood, transfusion, administration, documentation, patient identification, prescription, monitoring, observations.
- References known to Writing Group members and guidelines published by international organisations were consulted.

APPENDIX 2 – CLASSIFICATION OF EVIDENCE / RECOMENDATIONS

- Criteria used for the levels of evidence and recommendations are as outlined in appendix 7 of the Procedure for Guidelines Commissioned by the BCSH (http://www.bcshguidelines.org/process1.asp)

CLASSIFICATION OF EVIDENCE LEVELS:

Level	Description
Ia	Evidence obtained from meta-analysis of randomised controlled trials.
Ib	Evidence obtained from at least one randomised controlled trial.
IIa	Evidence obtained from at least one well-designed controlled study without randomisation.
IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study*.
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

* refers to a situation in which implementation of an intervention is outwith the control of the investigators, but an opportunity exists to evaluate its effect.

CLASSIFICATION OF GRADES OF RECOMMENDATIONS:

Recommendation grade	Evidence
A	Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing specific recommendation. *(Evidence levels 1a, 1b)*
B	Requires the availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation. *(Evidence levels IIa, IIb, III)*
C	Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates an absence of directly applicable clinical studies of good quality. *(Evidence level IV)*

APPENDIX 3 – GLOSSARY OF TERMS

Apheresis – a process in which whole blood is collected from a donor and separated into components. Some of these components are retained and the remainder returned to the donor. Also known as blood component donation.

Bedside – for the purpose of this guideline, bedside refers to the patient's side – whether the patient is in bed, on a trolley, or sitting in a chair.

Blood component – a therapeutic constituent of human blood, as defined by BSQR (SI 2005 No.50 as amended), i.e. red cells, platelets, fresh frozen plasma (FFP), cryoprecipitate, and granulocytes.

Blood product – any therapeutic substance derived from plasma (BSQR (SI 2005 No.50 as amended)) e.g. human albumin solution, clotting factor concentrates, anti-D immunoglobulin, and therapeutic immunoglobulins.

Blood Safety and Quality Regulations (2005) Statutory Instrument 2005/50 - (BSQR SI 2005 No.50 as amended) - these regulations became transposed into UK law in 2005, and were derived from two EU directives (2002/98/EC and 2004/33/EC). These regulations set standards for quality and safety for the collection, testing, processing, storage and distribution of human blood and blood components, and apply to the UK Blood Services and Hospital Blood Banks.

Clinical special requirements – any special requirement (e.g. irradiated or CMV-seronegative) which is a patient-specific clinical requirement (defined by the patients underlying clinical condition) as opposed to either a special requirement carried out automatically during component processing (e.g. irradiating granulocytes) or a special requirement for components issued for a particular age group (e.g. MB FFP for under 16 year olds).

Cold chain - a cold chain is a temperature-controlled supply chain. An unbroken cold chain is an uninterrupted series of storage and distribution activities which maintain a given temperature range.

Compatibility form – refers to any transfusion laboratory generated form, containing patient core identifiers and blood component specifications that may be delivered to the clinical area with the blood component unit (not directly attached to the blood component).

Competency – a demonstration that an individual is capable and proficient of performing a particular task.

Incorrect Blood Component Transfused (IBCT) – where a patient was transfused with a blood component that did not meet the patients specific requirements or that was intended for another patient. According to SHOT this is a common adverse transfusion event reported and is almost always due to human error.

Medicines and Healthcare products Regulatory Agency (MHRA) - monitors compliance with the Blood Safety and Quality Regulations (2005) Statutory Instrument 2005/50 and carries out inspections of blood establishments and hospital blood banks.

Must – refers to a recommendation or action which is required to comply with the Blood Safety Quality Regulations (UK law) or where the evidence for the recommendation or action is unequivocal.

Patient's clinical records – the organisation's patient records, either paper or electronic, which document all clinical care received by the patient.

Patient core identifiers – all patients should be identified by (minimum requirements) last name, first name, date of birth and a unique patient identification number. In some organisations, the first line of the patients address may also be classed as a minimum requirement. In the emergency setting, or in situations where the patient cannot be immediately identified, it may only be possible to identify the patient by gender (e.g. unknown male/female) and an emergency identification number. This has the potential to lead to increased confusion and error, and policies should be in place to ensure positive patient identification.

Patient identification band – all patients receiving a blood component transfusion must be positively identified using a patient identification band, which contains the patient core identifiers. In some organisations, alternative methods of patient identification are being used e.g. patient photo ID cards. These alternative methods should be risk assessed and approved before use.

Positive patient identification – verification of a patient's identification. Wherever possible, the patient must be asked to state their full name and date of birth. This must match exactly the information on the patient's identification band. For patients

who are unable to identify themselves, e.g. paediatric, unconscious or confused patients, or where there is a language barrier, verification of the patient's identification should be obtained from a parent or carer (if present at the patient's bedside) and checked with the patient's identification band.

Pre-printed labels – any labels that have been pre-printed (not on demand at the patient's bedside). Often these pre-printed labels are stored in patient's clinical records (e.g. addressograph labels).

Serious Adverse Blood Reactions and Events (SABRE) - The requirements of the BSQR (SI 2005 No.50 as amended) are that Blood Establishments and Hospital Blood Banks must report to the Secretary of State for Health all Serious Adverse Reactions (SARs) attributable to the safety or quality of blood, and all Serious Adverse Events (SAEs) related to the collection, testing, processing, storage and distribution of blood and blood components which may have an influence on their quality and safety. The MHRA have developed a haemovigilance reporting system called SABRE for this purpose.

Serious Hazards of Transfusion (SHOT) - a UK-wide confidential, voluntary, anonymised scheme for reporting any serious adverse reactions or events related to the transfusion of any blood components. SHOT was launched in 1996, and aims to build an evidence base of transfusion hazards and make recommendations that improve patient safety.

Should - refers to a recommendation or action that is based on expert opinion and endorsed by the BCSH Blood Transfusion Task Force. Individual organisations may consider converting 'should' to 'must' within their own local policies/guidelines.

Training – the instruction or teaching of a skill or task.

Unique patient identification number – all patients should be issued with a unique patient identification number at their initial contact with the hospital / organisation. Whenever possible, a national unique identification number, such as the National Health Service (NHS) number in England and Wales, the Community Health Index (CHI) number in Scotland, or the Health and Social Care (HSC) number in Northern Ireland, should be used.

APPENDIX 4 – BLOOD COMPONENT ADMINISTRATION (ADULTS)

Component	Comment
All blood components	- All blood components should be administered using a blood component administration set which incorporates a 170 – 200 micron filter
Red Cells Volume: 180-350ml (mean 282 ml)	- Storage: designated temperature controlled refrigerator 4 ±2 ^{o}C - Shelf life: 35 days - Dose: 4ml/kg (equivalent to 1 unit per 70kg adult) typically raises Hb concentration by about 10g/l - All red cell units should be transfused within 4 hours of removal from designated temperature controlled storage - For routine administration, there is extensive experience of safely administering a red cell unit over 90-120 minutes per unit - Patients less tolerant of increased blood volume should be transfused more slowly with careful haemodynamic monitoring. For some patients it may be appropriate to give a diuretic (e.g., furosemide 20 to 40mg orally), though this is not necessary as a routine - During major haemorrhage, rapid infusion (1 unit over 5-10 minutes) may be required (with appropriate clinical and haemodynamic monitoring)
Platelets Volume: Apheresis: 180-300ml (mean 215ml) Pooled: 250-400ml (mean 310ml)	- Storage: temperature controlled 22 ±2 ^{o}C – with continuous gentle agitation - Platelets must not be refrigerated - Shelf life: 5 days (In certain controlled circumstances 7 day platelets may be supplied) - Dose: 1 adult therapeutic dose (ATD) typically increase the platelet count by at least 20-40x10^{9}/l - Platelet concentrates should not be transfused through administration sets which have already been used to administer other blood components - The infusion should be commenced as soon as possible after the component arrives in the clinical area - Typically administered over 30-60 minutes per adult therapeutic dose (ATD)
FFP (Fresh Frozen Plasma) Volume: 240-300ml (mean 273ml)	- Storage: designated temperature controlled freezer. Core temperature -30 ^{o}C - Shelf life: 24 months (frozen) - Prior to the transfusion FFP must be thawed under controlled conditions using specifically designed equipment. Thawing usually takes approximately 15-30 minutes - Once thawed, FFP must not be re-frozen and should be transfused as soon as possible. Post-thaw storage will result in a decline in the content of labile coagulation factors - If stored at 22 ±2 ^{o}C post thawing, the transfusion must be completed within 4 hours of thawing - If stored at 4 ±2 ^{o}C post thawing (in a designated temperature controlled refrigerator), the transfusion must be completed within 24 hours of thawing (NBS 2007) - Pooled solvent-detergent treated plasma is also commercially available - Dose: typically 10-15ml/kg. This dose may need to be exceeded in massive haemorrhage depending on the clinical situation and its monitoring (BCSH 2004) - Typical infusion rate 10-20ml/kg/hr (approximately 30 minutes per unit) - Rapid infusion may be appropriate when given to replace coagulation factors during major haemorrhage There is anecdotal evidence that acute reactions may be more common with faster administration rates
Cryoprecipitate Volume: 100-250ml (pooled unit) (mean 152mls) (NBS 2007)	- Storage: designated temperature controlled freezer. Core temperature -30 ^{o}C - Shelf life: 24 months (frozen) - Prior to the transfusion cryoprecipitate must be thawed under controlled conditions using specifically designed equipment. Thawing usually takes approximately 15-30 minutes - Once thawed, cryoprecipitate must not be re-frozen and should be used immediately. If delay is unavoidable, the component must be stored at ambient temperature and used within 4 hours - Dose: typical adult dose is two five-donor pools (equivalent to 10 single donor units) which would raise the plasma fibrinogen level by about 1g/l - Typically administered at 10-20ml/kg/h (or 30-60 minutes per 5 unit pool)
Granulocytes Volume: Variable	- Storage: granulocytes should be administered as soon as possible after their preparation. If storage is unavoidable, the component must be stored, without agitation, at a core temperature of 22 ±2 ^{o}C - Shelf life: 24 hours - Specialist component: use must be discussed with the Hospital Transfusion Laboratory and Blood Service - Must be irradiated - Typically administered over 1-2 hours (NBS 2006)

Blood component volumes and dosage are for guidance and are taken from the Handbook of Transfusion Medicine (McClelland (ed) 2007) unless otherwise stated.

APPENDIX 5–BLOOD COMPONENT ADMINISTRATION (NEONATES, INFANTS AND CHILDREN)

Component	Comment
All Blood Components	- All blood components should be administered using a blood component administration set which incorporates a 170 – 200 micron filter. A paediatric blood administration set may be used.
Packed Red Cells for neonates and infants Volume: 324ml (mean) Volume: 294ml (mean) Volume: depends on size of paedipak split	<u>All red cell transfusions:</u> - All red cell units should be transfused within 4 hours of removal from designated temperature-controlled storage (4 ±2 ^{o}C) <u>Neonatal Exchange transfusion:</u> - Plasma reduced whole blood in citrate phosphate dextrose (CPD) anticoagulant - Haematocrit 0.5-0.6 (NHSBT, England 0.5-0.55) - Irradiated (unless this would unduly delay transfusion and there has been no prior intrauterine transfusion) - < 5 days old, 24 hrs post-irradiation - Typical dose: 80-100ml/kg (for anaemia), 160-200ml/kg (for hyperbilirubinaemia) - Administration rate: depends on stability of baby, discuss with Neonatal Intensive Care consultant - Local units should have their own exchange transfusion guidelines <u>Large-volume transfusion:</u> - Red cells in additive solution (SAG-M – a saline solution containing adenine, glucose and mannitol)* - Hct 0.5-0.6, - < 5 days old - Typical dose: - emergency neonatal transfusion: 10-20ml/kg - surgery (e.g. cardiac) consult local guidelines for volumes and transfusion rates <u>Top-up transfusions</u> - Red cells in additive solution (SAG-M), - Hct 0.5-0.7, shelf-life 35 days - Use of 'Paedipaks' should be discussed with the hospital transfusion laboratory in order to allocate packs appropriately - Typical dose - 10-20ml/kg, or Vol (mls) = desired Hb rise (g/dl) x weight (kgs) x 3 - Typical administration rate: 5ml/kg/h
Packed Red Cell transfusion for children Volume: 180-350ml (mean 282ml)	- Typical dose: Vol (mls) = desired Hb rise (g/dl) x weight (kgs) x 3 - Typical administration rate 5 ml/kg/h (usual max rate: 150ml/hr)
Platelets Volume: Neonatal (apheresis): 55mls (mean) Full packs: Apheresis: 180-300ml (mean 215ml) Pooled: 250-400ml (mean 310)	- Apheresis platelets should be used for all children < 16 yrs where possible to reduce donor exposure - Typical dose: Children < 15 kg: 10-20 mls/kg Children > 15 kg: single apheresis concentrate (approx 300mls; actual volume recorded on pack label) - Typical administration rate 10-20ml/kg/h - Platelet concentrates should not be transfused through administration sets which have already been used to administer other blood components
FFP (Fresh Frozen Plasma) Volumes of MB FFP: Neonatal 56ml (mean) Paediatric 233ml (mean)	- Methylene-blue (MB) treated, single donor FFP, sourced from 'low prevalence BSE regions' such as the USA for all children < 16 years of age (MB FFP) - Pooled solvent-detergent treated plasma is also commercially available - Typical dose: 10-20 mls/kg - Typical administration rate 10-20ml/kg/h
Cryoprecipitate Volume of MB Cryo: 1 unit 38ml (mean)	- Methylene-blue (MB) treated, sourced from 'low prevalence BSE regions', such as the USA for all children < 16 years of age - Typical dose is 5-10ml/kg. Transfusion of this volume of MB cryoprecipitate is estimated to raise the plasma fibrinogen by approximately 0.5-1.4g/l. Fibrinogen levels should be measured post transfusion to confirm the outcome. 1-2 pools of 5 single-donor units (approx volume 190 mls, actual volume recorded on pack) may be used for larger children as appropriate for their weight - Typical administration rate 10-20 ml/kg/h - i.e. over approximately 30 mins

Granulocytes Volume: variable	- Granulocytes should be administered as soon as possible after their preparation - Specialist component: must be discussed with the Hospital Transfusion Laboratory and Blood Service - Must be irradiated - Administration rate: dependant on volume of the component and the weight of the child. Discuss with specialist consultant

*Some hospitals use neonatal red cells (in CPD) for particular indications for large volume neonatal transfusions, but this practice is decreasing in the UK due to the theoretical increased risk of transfusion transmission of vCJD (see BCSH Transfusion Guidelines for Neonates and Older Children (2004) erratum (2005)).

Notes:

- For storage details see adult table appendix 4.
- Component volumes are for guidance and taken largely from the NBS (2007) Portfolio of Blood Components.
- Dosage and transfusion rates are for guidance and mostly from McClelland (2007)
- Components for younger children are often available in smaller volume neonatal and paediatric packs. Please refer to your Hospital Transfusion Laboratory or UK Blood Service for further details.

APPENDIX 6 – TECHNICAL ASPECTS OF BLOOD COMPONENT ADMINISTRATION

Venous Access

- Blood components can be administered through peripheral intravenous cannula or most central venous access devices (according to manufacturer's specifications).
- The size of the peripheral cannula depends on the size and integrity of the vein and the speed at which the blood component is to be transfused.
- Peripherally inserted long central catheters (PICC lines) with narrow lumen diameter may lead to slower flow rates.
- When multi-lumen central venous access devices are used it is generally safe to co-administer other therapeutic solutions through a different lumen as rapid dilution occurs in the bloodstream.
- There should be a local guideline regarding the use of umbilical catheters as some neonatologists have expressed concerns that the administration of blood components through umbilical catheters (venous or arterial) may increase the risk of developing necrotising enterocolitis (Rao et al 2004, Agwu and Narchi 2005).

Administration Equipment

Adult Administration

- All blood components should be transfused through a blood component administration set with an integral mesh filter (170-200 micron).
- The use of additional bedside leucodepletion filters is unnecessary, as the pre-storage leucodepletion of all blood components has been implemented by the UK Blood Services since 1999.
- Platelet administration sets are available though it is not essential that these are used and platelets can be given through a standard blood administration set. Platelet administration sets contain the same integral mesh filter (170-200 micron) as a blood administration set, but have a smaller lumen and thus a smaller priming volume. Platelets should not be transfused through an administration set which has previously been used for other blood components.
- The administration set should be changed at least every 12 hours (or in accordance with manufacturer's instructions). This is intended to reduce the risk of bacterial growth occurring. A systematic review (Blest et al 2008) indicated a wide variation in the frequency of changing blood administration sets internationally. There is currently no primary evidence available to challenge the previous BCSH recommendations (1999) to change the set at least 12 hourly.

- A new administration set should be used if another infusion is to continue after the transfusion. This is intended to reduce the risk of incompatible fluids or drugs causing haemolysis of residual red cells in the administration set or drip chamber.

Paediatric Administration

- Paediatric blood administration sets (with a smaller prime volume) are appropriate for small volume transfusions. Neonatal blood administration systems are also available which allow blood components to be delivered via a syringe driver. These systems should incorporate an integral three-way system allowing the blood component bag to remain attached throughout the transfusion. The transfer of patient and blood component details to a syringe label is not advised due to the risk of transcription errors.
- All administration systems should incorporate a 170-200 micron filter.
- A new syringe and administration set should be used when administering different components.
- Blood components from more than one donation should not be mixed in a syringe. Instead it should be given sequentially using a new syringe in order to be able to identify the relevant donation in case of a reaction.

Infusion Devices

- Individuals using any type of infusion device should be able to demonstrate competency in their use.
- Only use a blood component administration set that is compatible with the infusion device (check manufacturers recommendations).
- Administration sets used with infusion devices should incorporate an integral mesh filter (170-200 micron).
- The pre-administration checking procedure should include a check of the device and device settings.
- Infusion devices should be regularly maintained in accordance with manufacturers and/or organisational guidelines.
- Any adverse outcome as a result of using an infusion device to transfuse red cells should be reported to the appropriate authorities.

Infusion rate devices

- Either gravity or electronic infusion devices may be used for the administration of blood and blood components and allow a precise infusion rate to be specified.
- Rapid infusion devices may be used when large volumes have to be infused quickly, as in massive haemorrhage. These typically have a range of 6 to 30 litres/hour and usually incorporate a blood warming device.

- Infusion devices should only be used if the manufacturer verifies them as safe for this purpose and they are CE marked.
- The volume delivered should be monitored regularly throughout the infusion to ensure that the expected volume is delivered at the required rate.

Pressure Devices

- External pressure devices make it possible to administer a unit of red cells within a few minutes. They should only be used in an emergency situation together with a large gauge venous access cannula or device.
- External pressure devices should:
  - exert pressure evenly over the entire bag
  - have a gauge to measure the pressure
  - not exceed 300mm Hg of pressure
  - be monitored at all times when in use

Blood Warmers

- There has long been concern that the rapid infusion of red cells soon after their removal from the storage refrigerator (4^{o}C) can lead to hypothermia and deleterious effects such as arrhythmias or cardiac arrest, or impaired coagulation in surgical or trauma patients. This may be a particular concern when blood is rapidly infused through a central venous catheter terminating in or near the right atrium, or in neonates and small infants undergoing large volume transfusions (BCSH (2004) Transfusion Guidelines for Neonates and Older Children). However, there is little clinical data on which to base recommendations.
- Most published guidelines only recommend the routine use of blood warmers in adult patients undergoing rapid or high volume transfusion of red cells in the context of major haemorrhage. However, recent guidance from the National Institute for Health and Clinical Excellence on *Inadvertent perioperative hypothermia – The management of inadvertent perioperative hypothermia in adults* (NICE Clinical Guidance E5, April 2008) recommends that, in all adults undergoing elective or emergency surgery (including surgery for trauma) under general or regional anaesthesia, 'intravenous fluids (500ml or more) and *blood products* (sic) should be warmed to 37^{o}C'. It is clear that NICE is actually referring to *blood components*, such as red cells, in this context. The evidence for this statement appears to be Level III or IV. Any benefit will mainly accrue from the controlled warming of red cells (stored at 4^{o}C) rather than platelets (stored at 22+/-2^{o}C) or FFP/cryoprecipitate (thawed to 37^{o}C) but there is no evidence to suggest that infusion of platelets or FFP through a blood warmer is harmful. NICE guidelines are only applicable to England and Wales and healthcare

professionals are expected to take these guidelines into account when exercising their clinical judgement, and developing institutional policies.

- Blood warmers are also appropriate in the transfusion of patients with clinically significant cold antibodies.
- In most other clinical situations where there is concern, it is sufficient to allow blood to come up to ambient temperature before transfusion. Each patient should be assessed and the risks of potential heat loss considered. Special consideration should be given when rapidly transfusing large volumes to neonates, paediatrics, elderly patients, and patients susceptible to cardiac dysfunction.
- Blood should only be warmed using approved, specifically designed and regularly maintained blood warming equipment with a visible thermometer and audible warning. Settings should be monitored regularly throughout the transfusion.
- Some blood warmers operate up to 43 ^{o}C but are safe provided they are used and serviced according to manufacturers' instructions.
- Blood components should never be warmed using improvisations, such as putting the pack in warm water, in a microwave or on a radiator.

(Level III/IV)

Compatible Intravenous Fluids

- It is generally advised that no other intravenous fluids should be co-administered via an infusion line that is being used for a blood component (when multi-lumen central venous access devices are used it is generally safe to co-administer other therapeutic solutions through a different lumen as rapid dilution occurs in the bloodstream).
- Intravenous solutions which contain calcium, such as Ringer Lactate, and calcium-containing colloids, such as Haemaccel™ or Gelofusine™ may antagonise citrate anticoagulant and allow clots to form in the blood component.
- Hypotonic intravenous solutions, such as 5% dextrose in water, may cause haemolysis of red cells. The relevance of this in clinical practice is uncertain as the *in vitro studies* reported in the literature involved prolonged exposure of red cells to dextrose solutions at room temperature. Although a slight degree of visible haemolysis has been observed in the intravenous tubing when 5% dextrose is infused following red cell transfusion, no clinical adverse events have been reported (Klein and Anstee 2005).
- The practice of priming or flushing administration sets used for the transfusion of blood components with isotonic (0.9%) saline is not evidence based and, we

believe, unnecessary. No other intravenous fluids should be used for this purpose. If used, local policies or guidelines should determine how saline used to prime/flush administration sets should be prescribed/documented.

Co- administration of Drugs with Blood Components

- The addition of a drug to an intravenous line containing blood or blood components raises concerns about compatibility of the drug and its carrier with the blood component and any preservatives or additives.
- A break in the integrity of the infusion line may also increase the risk of bacterial contamination of the component.
- Historically, desferrioxamine has been co-administered with red blood cells, and the British National Formulary (British Medical Association and Royal Pharmaceutical Society of Great Britain (BNF) 2008) states that this is acceptable provided that the desferrioxamine is not added to the blood and is not given through the same line as the blood (but the two may be given through the same cannula). However, there are doubts about the efficacy of administering desferrioxamine intravenously with red blood transfusion (BCSH (2003) Guidelines for the diagnosis and therapy of adult myelodysplastic syndromes).
- Patient-controlled analgesia (PCA) devices to deliver opioids are invaluable in the management of postoperative pain, terminal care and sickle cell crisis. Many of these patients have poor peripheral venous access and it may be considered convenient to administer opioids via the same venous access device/administration line as red cell transfusions. Recent studies show that standard concentrations of morphine, hydromorphone or meperidine given by continuous infusion or single or multiple boluses have no significant deleterious effects on co-administered red cells (Yousef 2006).
- A systematic review (Murdock et al 2008) has concluded that there is insufficient evidence to guide a policy change on the co-administration of drugs and red blood cells due to the lack of clinical applicability of *in-vitro* experiments and diversity of clinical outcome measures used. Further evidence from clinical studies is required to inform clinical practice on the efficacy and safety of the co-administration of drugs and red blood cells.
- In the case of opioids via PCA, each organisation should adopt their own policy on co-administration through a venous line for transfusion. In patients with adequate access, a second venous access device would be the preferable option. For the administration of any other drugs, wherever possible drugs should be timed to be administered between transfusions, or administered via a second

venous access device. If this is not possible, the transfusion should be stopped and the line flushed with normal saline, the drug administered, then the line flushed again with saline before restarting the transfusion (Australian and New Zealand Guidelines for the administration of blood components 2004). This manoeuvre should not result in the transfusion exceeding four hours from removal from temperature controlled storage.

- Under no circumstances should drugs be directly added to a blood component bag (Level IIb, Grade B).

Disposal of Equipment

- If there is any suspicion of a transfusion reaction the component pack should be returned to the transfusion laboratory with full clinical details.
- If a transfusion is completed uneventfully, the empty blood component pack and administration set should be discarded according to the organisation's policy for disposing of clinical waste.
- Previously the retention of empty blood component packs for a period of 48 hours was recommended to aid investigation of any severe post transfusion reactions, which occur, or are recognized, after the transfusion is completed. The benefits of this practice are unproven and is associated with both practical and health and safety concerns.
- If, in accordance with local policy, any paperwork required for the traceability of blood components is attached to the blood component for completion in the clinical area, this must be actioned as required before disposal of the unit.

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