Blood Essentials

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START

Patient Blood Management

NHS Blood and Transplant

v1.0 April 2024

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All information is current and accurate at the time of publication and will be regularly reviewed.

Any concerns or queries can be directed to the NHSBT PBM team at: PBM.team@nhsbt.nhs.uk

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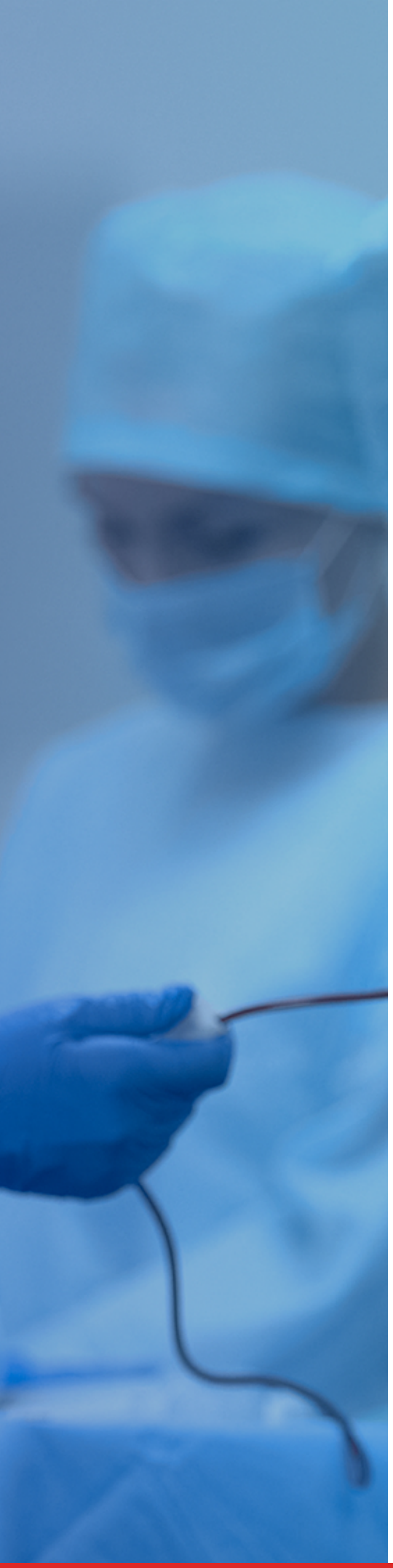


Introduction

Blood Essentials follows on from the success of A Drop of Knowledge and A Wealth of Knowledge in providing transfusion practitioners and those with an interest in transfusion, a fundamental understanding of the essentials of transfusion medicine. It merges the information into one succinct electronic and printable document to make accessing the knowledge and guidance you need in practice, quick and easy. This document provides the essential information and signposts you to further reading, resources and guidance to support best practice and education.

This update was compiled as the Transfusion 2024 report was published: a five-year plan highlighting key priorities for transfusion practice including patient blood management, laboratory safety, technology and information and the needs of patients in the NHS. This document is one of many resources we provide to support transfusion practitioners and clinicians in implementing Patient Blood Management in practice. The NHS England endorsed recommendations laid out by the National Blood Transfusion Committee in 2014 remain key themes throughout the document.

Your feedback is invaluable to support updates of this document, and guide future and further support in practice. Please feel free to contact us on **PBM.team@nhsbt.nhs.uk** or follow us on Twitter **@PBM_NHS**.

Written and compiled by S.Timmins, K. Maynard, S. Turkovic, D. Gaskin, T. Johnston, C. Longhorn and S. Cooke on behalf of the NHSBT Patient Blood Management team.

Ten Key Considerations for Transfusion

1

A Patient Who is Not Informed, Cannot Give Consent

For consent to be valid it must be voluntary and informed, meaning the decision must be made free from pressure and influence and with all relevant information provided including risks and benefits. The Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) provide guidance specifically for consent in transfusion, recommending that the verbal consent obtained is documented in patient records, and transfusions and any side effects are recorded in the patients discharge summary. The National Institute for Health and Care Excellence (NICE) Quality Standard 138 recommends the provision of both written and verbal information to support informed consent.

2

Positive Patient Identification

Positive Patient Identification is essential at each stage of the process to ensure patient safety. It should be confirmed by the four minimum identifiers, first name, surname, date of birth and unique identification number. Hospital policy and process should enforce and support the need for Positive Patient Identification at every stage..

3

Use a Checklist!

The 2017 Medicine and Healthcare Products Regulatory Agency (MHRA) Central Alerting System (CAS alert) recommends the implementation of a robust bedside checklist.

4

Consider Appropriate Alternatives

Transfusion should not be given where other safer and less invasive treatments are available and appropriate, such as correcting iron deficiency with appropriate iron therapy to treat anaemia in stable patients.

5

Don’t Give Two Without Review

National Institute for Health and Care Excellence (NICE) Quality Standard 138 recommends that patients are clinically reassessed and have their haemoglobin levels checked after each unit of red blood cells they receive, unless they are bleeding or are on a chronic transfusion programme.

6

Appropriate Use of Emergency Red Blood Cells

The National Blood Transfusion Committee (NBTC) guidance on appropriate use of red blood cells suggests considering using group O D positive for adult men and women over 50 years of age in emergency situations, where the patients' blood group is unknown. The risk of adverse outcome is likely to be low, and this helps conserve precious O D negative red blood cells for patients for whom there is no alternative.

7

Platelet Use and Considerate Stock Holding

Group AB D negative platelets should only be requested for named patients. If you need to keep platelets as a stock component, consider group A D positive to reduce demand pressure on A D negative donations. An amendment to the BSH guidelines for management of major haemorrhage supports the use of ABO incompatible platelet unit's where group is unknown. D negative units should be selected for specific patient groups.

8

Using Data to Guide Regular Reviews of Red Cell Inventory

Analysing stock levels and adjusting accordingly will ensure efficient stock holding of blood components, reduce wastage, and save money. Help accessing your Blood Stocks Management Scheme (BSMS) data is available through your Regional Transfusion Committee Administrator or Regional PBM Practitioner.

9

Delays Cost Lives

Delays are defined by SHOT as transfusions that are "clinically indicated but not undertaken, not available, or delayed impacting patient care". Poor communication between clinical teams and the laboratory and staffing issues are common contributory factors. A review of delayed transfusions reported to SHOT between 2010 and 2020 found a total of 809 reports. In this period, transfusion delays contributed to 54 potentially preventable deaths accounting for 25.5% of all transfusion deaths reported to SHOT. The increase in reports of delayed transfusion, with twelve deaths in 2020, prompted the MHRA to release a CAS Alert in January 2022.

10

Use Recommended Transfusion Thresholds to Guide Practice

In NG24, NICE recommends the use of restrictive transfusion thresholds unless a patient has a major haemorrhage, acute coronary syndrome, or requires regular transfusions for chronic anaemia. The NBTC provides indication codes to further guide transfusion thresholds for various scenarios.

Governance

There are various organisations and committees involved in governing and guiding transfusion practice, each working together at various strategic levels to ensure best practice and patient safety.

Select a section from the list below:

1.1 National

Blood Safety and Quality Regulations (BSQR 2005)

The UK Blood Safety and Quality Regulations (BSQR 2005) transpose 2 EU directives into UK law. This legislation sets the standards for quality and safety for the collection and testing of human blood and blood components, their processing, storage, and distribution where components are required for transfusion. The regulations also cover the collection and testing of autologous blood, therefore covering the process from donor to patient.

Medicines and Healthcare products Regulatory Agency (MHRA)

The Medicines and Healthcare products Regulatory Agency (MHRA) is responsible for the controls and authorisations that apply to Blood Establishments (BE) and controls that apply to hospital blood banks (HBBs). BE's are sites that collect, test, and supply human blood or blood components intended for transfusion.[1] The MHRA is responsible for reviewing compliance reports from BEs and HBBs by carrying out regular inspections to monitor compliance. The Serious Adverse Blood Reactions and Events (SABRE) reports are monitored and reviewed by MHRA as part of their overall role in haemovigilance. Ultimately, the MHRA is primarily responsible for regulating compliance with BSQR 2005.Select the following link to access a copy of the Hospital Blood Bank Compliance report.

Safety of Blood, Tissues and Organs (SaBTO)

The Advisory Committee on the Safety of Blood, Tissues and Organs, responsible for advising UK ministers and health departments on the most appropriate ways to ensure the safety of blood, cells and tissues for transfusion or transplantation. Membership includes specialists from transplantation, transfusion, haematology, virology, and other related fields. The Committee provides annual reports as well as specific guidance and reports on topics such as consent, donor selection, and risk reviews.

NHS England and NHS Improvement (NHSI)

In 2019 NHS England and NHS Improvement merged to form one single operational unit, to support overall governance, service delivery and improvement across the seven integrated regions and the healthcare systems within. Patient Safety now sits within NHSE so Central Alerts and issues that would have been raised and reported by The National Patient Safety Agency (NPSA), all now sit within the one organisation. NHSE works with NHSBT and the NBTC to support safe and appropriate blood transfusion, fully endorsing the PBM recommendations and the Five-Year Plan set out in Transfusion 2024.

National Institute for Health and Care Excellence (NICE)

The role of the National Institute for Health and Care Excellence (NICE) is to improve outcomes for people using the NHS and other public and social care services, through the production of evidence-based guidance, and the development of quality standards and performance metrics. NICE has provided both guidance (NG24) and quality standards (QS138) to support safe and appropriate blood transfusion. There are various other resources provided by NICE that support a number of PBM initiatives such as cell salvage and anaemia management.

British Society for Haematology (BSH)

The British Society for Haematology (BSH) aims to be the UK hub for haematology professionals and transform patient care through their research, guidance and good practice papers and educational resources. BSH provides over 20 guidelines supporting clinical and laboratory transfusion practice and patient blood management, from the appropriate use of specialised components, through to administration of blood components, anti-D prophylaxis and maternal anaemia management.

SHOT / Serious Adverse Blood Reactions and Events (SABRE)

Serious Hazards of Transfusion (SHOT) is the UK's independent professionally led haemovigilance scheme, established in 1996. Reporting to SHOT is professionally mandated alongside the legal requirement to report adverse transfusion reactions and events to the MHRA via SABRE. The SHOT reports are collated and analysed to identify potential risks and issues, for which SHOT make recommendations to improve patient care. In addition to the annual report, SHOT produces numerous resources to support practice and education. For more information around transfusion safety see section 6.

NHS Blood and Transplant (NHSBT)

NHS Blood and Transplant (NHSBT) is a specialist health authority responsible for the supply of blood, organs, tissues and stem cells in England, and transplant services across the UK. NHSBT provides safe and effective blood services for donors, the NHS, and its patients, through component and cord blood collection and processing, blood donation, transfusion research and support for transfusion patients. NHSBT works closely with hospital laboratories and transfusion committees via the customer service, joint clinical roles and PBM team to ensure a safe and adequate blood supply. For more information about blood donation see section 2.

National Blood Transfusion Committee (NBTC)

The National Blood Transfusion Committee (NBTC) was established in 2001, with a remit to promote safe and appropriate transfusion practice. The committee provides a forum to discuss national transfusion issues and to channel information to and from Regional Transfusion Committees (RTCs) to provide support and share information and good practice. The committee consists of representatives from NHSE, key royal colleges and societies, patient representatives, RTC chairs and key organisations such as SHOT and MHRA. It has an executive working group to curate the activities of the committee and manage its meetings and commitments. Minutes of the meetings can be found on the Committee website.

National Comparative Audit (NCA)

The National Comparative Audit (NCA) of blood transfusion is a programme of clinical audits exploring the use of blood components in NHS and independent hospitals in England and North Wales. The aim of the audit programme is to evidence the appropriate use of components and safe administration of blood and highlight any deviations and areas for improvement. The audit programme is fully funded by NHSBT and is one of the largest independently funded programmes in the UK.

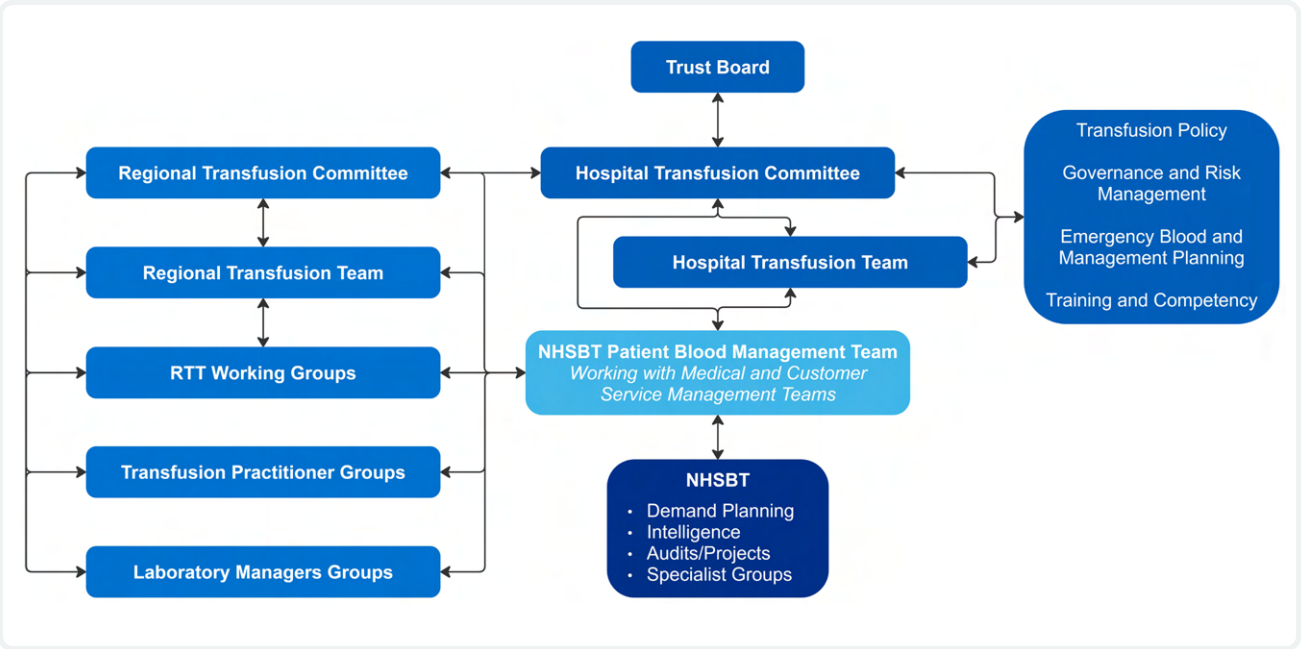
Patient Blood Management (PBM) Team

The Patient Blood Management (PBM) team is made up of Consultant Haematologists, Nurses, Biomedical Scientists and Administrators, and is tasked with providing clinical support and to promote optimising the care of patients who may require a blood transfusion. The Consultants often have a dual role, supporting NHSBT alongside their core work within an NHS Trust. The PBM Practitioners support healthcare providers with all aspects of transfusion safety and PBM initiatives, through education, resource development and working closely with hospital staff to identify areas that require support. The cornerstones for the work of the team are formed by the PBM recommendations, NICE quality standards and guidance. Both the Consultant and the Practitioner form part of the regional NHSBT team alongside the Customer Service team. For more information on PBM initiatives see section 8.

Blood Stocks Management Scheme (BSMS)

The Blood Stocks Management Scheme (BSMS) was set up in 2001 to understand and improve blood inventory management across the supply chain. The scheme is hosted by NHSBT, but is funded by the UK forum (NHSBT, Welsh Blood Service, Northern Ireland Blood Transfusion Service). Participation in the scheme is voluntary but the hospital must be directly supplied by one of the above blood services. The BSMS provides support within NHSBT across the Customer Service teams and works in partnership with hospitals to record, understand and improve blood inventory management throughout the blood supply chain. The team uses blood service, hospital component & logistics data to provide objective reporting and monitoring of blood component use and wastage and works to support hospital transfusion teams in benchmarking and to make data driven change. For more information on the Blood Stocks Management Scheme, see section 8.5.

1.2 Regional



Regional Transfusion Committee (RTC)

The RTCs are responsible for implementing actions of the NBTC in England. The RTCs support the implementation of actions of the NBTC in England and provide support to Hospital Transfusion Committees (HTCs).

An RTC is usually made up of representatives from:

- The region's HTCs (including NHS and private hospitals);
- The NHSBT regional Team;
- Some RTCs also have a patient representative.

RTCs meet up to four times each year; minutes and actions are disseminated to Chairs of all HTCs in the region. The work of an RTC is co-ordinated by the Regional Transfusion Team (RTT).

RTCs may have subgroups or working groups to support regional activity, networking, and support teams. These include regional educational groups, transfusion practitioner groups, and Transfusion Laboratory Manager groups.

Information on RTCs can be accessed at the JPAC website.

Information on individual RTCs and their activities can be accessed at UK Transfusion Committees.

Hospital Transfusion Committee (HTC)

Every Trust involved in blood transfusion should have an established HTC as stated by the Department of Health in the Health Service Circular 2007/001: Better Blood Transfusion - Safe and Appropriate use of Blood with an aim to improve transfusion practice.[2] This includes providing policies and Standard Operating Procedures (SOPs) to govern safe and appropriate blood use and ensuring they are maintained and up to date, perform audits to monitor compliance and look for areas of improvement, provide education and support to staff involved in transfusion and review blood stock holding and wastage to ensure prudent management. In addition, HTCs should work to support the implementation of patient blood management (PBM) initiatives and participate in regional activity and events.

It is suggested that HTC membership include:

- Chair
- Transfusion Laboratory Manager (TLM)
- Transfusion Practitioner (TP)
- Haematologist with responsibility for transfusion
- Senior nursing and midwifery representation
- Representatives from clinical high users of blood components
- Anaesthetist
- Member of risk management
- Representative from finance
- Representative from Primary Care or an equivalent organisation

The HTC should aim to meet at least three times each year and have mechanisms in place to feedback progress and escalate concerns to senior management teams.

Hospital Transfusion Team (HTT)

The formation of a HTT is also stated within the same Department of Health in the Health Service Circular 2007/001: Better Blood Transfusion - Safe and Appropriate use of Blood. Its role is to plan, oversee and support the work of the HTC.

The Team should include but not be exclusive to:

- Lead Consultant for Transfusion
- Transfusion Practitioner
- Transfusion Laboratory manager
- Clerical support

1.3 Training

Training and competence are essential in transfusion to ensure compliance with national regulations and standards, for quality assurance and to ensure patient safety. Various organisations provide standards of requirement or guidance around training. This section provides a summary of the key recommendations.

Good Manufacturing Practice (as imposed by BSQR 2005):

Clinical staff:

- must receive training on positive patient identification (PPI) and correct sample labelling requirements to fulfil quality and safety specifications.
- who are required to collect blood must receive the training and have documented evidence of completion.
- must understand that it is a legal requirement to report adverse events to the transfusion laboratory for investigation.
- must be aware of the storage requirements of each component and the process for returning unused units.
- are responsible for ensuring traceability and should be fully aware of the process involved to achieve this.

Laboratory Staff:

- must receive training in all procedures supporting the application of the organisation's Standard Operating Procedures, and have documented evidence of training.

Phlebotomists:

- must receive training and have documented evidence on positive patient identification and correct sample labelling requirements to fulfil quality and safety specifications.

Porters:

- involved in collecting blood must be officially trained to do so and have documented evidence of completed training.

Managers:

- must be aware of their responsibility to investigate traceability non-conformities and apply appropriate corrective and preventative actions.
- must support training and competency assessments.

To learn more about the regulatory requirements for blood transfusion, access the Good Manufacturing Practice module on the Blood Transfusion Training e-learning package via e-learning for health (e-LfH) or Electronic Staff Record (ESR).

NBTC Requirements for Training and Assessment in Blood Transfusion:

The NBTC outlines necessary requirements for training and assessment.

Training:

- All staff involved in the transfusion process should receive training no less than every three years, or every two years for blood collection.
- Training can be in the form of face-to-face sessions, e-learning, or a workbook.

Porters:

- Following training a one-off practical competency assessment must be undertaken for collection and administration, or every two years for blood collection.
- Practical assessments need not be repeated unless there are concerns with practice due to incidents, errors or an absence of practice greater than one year.[3]

The full guidance can be accessed from the JPAC document library.

British Society for Haematology (BSH)

The Guidelines for the Administration of Blood Components (2018) provide a table of training recommendations for each of the devolved nations in the UK, which can be found here. The recommendations for England are taken from National Bloood Transfusion Committee guidance and are summarised below.[8]

England

Theory Training and Knowledge Assessment

All staff involved in the transfusion process should receive training no less frequently than three yearly (two yearly for blood collection).

3 Years

Knowledge and understanding assessment should be performed at least every three years (two years for blood collection).

Practical observed competency assessment

Following an individual's initial training, a one-off practical competency assessment must be undertaken.

This practical assessment need not be repeated if there is ongoing satisfactory performance but should be repeated if there is a period of greater than one year out of a workplace where transfusion routinely takes place.

SaBTO recommends that training in consent for transfusion is included in all relevant undergraduate healthcare practitioners' training, followed by continuous, regular knowledge updates (minimum 3-yearly) for all healthcare practitioners involved in the consent for transfusion process.

UK Transfusion Laboratory Collaborative (UKTLC)

The United Kingdom Transfusion Laboratory Collaborative (UKTLC) was formed in 2006 in response to 30-40% of the wrong blood events reported to SHOT originating in the hospital transfusion laboratory. The Collaborative involves all major transfusion organisations within the UK including the Institute of Biomedical Scientists, Royal College of Pathologists, British Blood Transfusion Society and UKNEQAS (The National Quality Assessment Scheme for Transfusion). The UKTLC published the minimum standards for staff qualifications, training, competency and the use of information technology in hospital transfusion laboratories in 2023.[5]

The recommendations are available via the link below:

UKTLC - Serious Hazards of Transfusion (shotuk.org)

Nursing and Midwifery Council (NMC)

The NMC has published standards of proficiency for Nurses and Midwives, respectively. The standards make general reference to the application of human factors, patient assessment, legislation, risk assessment and communication which are all vital for safe and appropriate blood transfusion. They specifically identify that at the point of registration, nurses and midwives should be able to demonstrate proficiency in managing and monitoring blood component transfusion in line with local policy.[6,7]

The full standards are available via the links below:

Future Nurse: Standards of proficiency for registered nurses

Standards of proficiency for midwives

The NHSBT PBM team has developed a range of e-learning modules covering various aspects of blood transfusion practice and patient safety, relevant for laboratory and clinical staff. The Blood Transfusion Training e-learning package is available via e-learning for health (e-LfH) or Electronic Staff Record (ESR).

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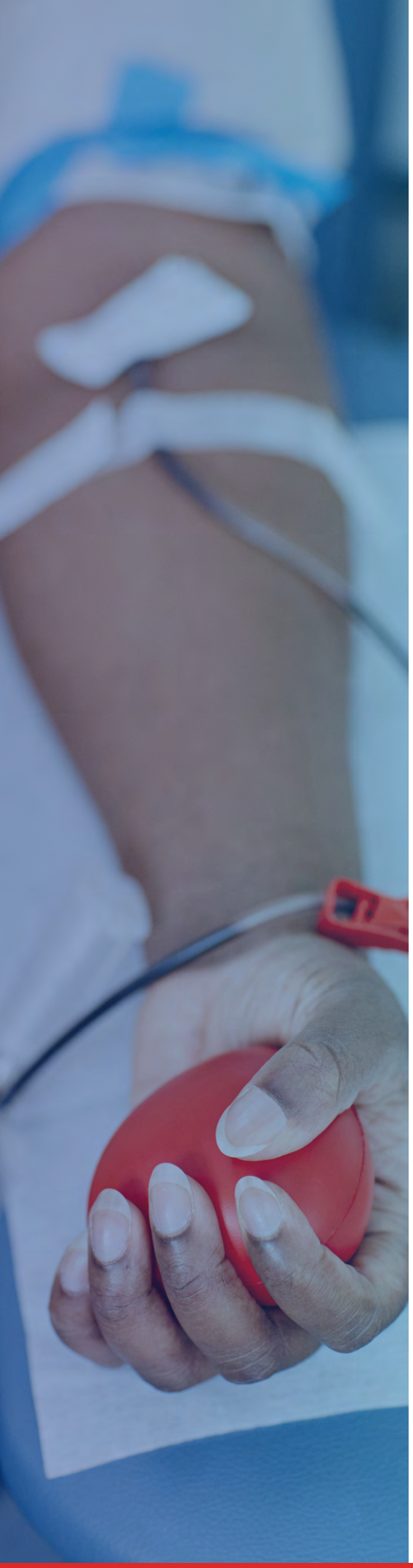
Blood Donation

There are several organisations and committees involved in governing and guiding transfusion practice, each working together at various strategic levels to ensure best practice and patient safety.



2.1 Introduction

Each year approximately 2 million blood donations are collected from volunteers across England. Around 5,000 donations are required each day to meet the needs of patients across the country.

There are around 1.3 million registered donors in England. Every year the blood service must recruit approx 150,000 new donors to meet demand, to ensure there is sufficient diversity of blood groups and to replace those who are no longer able to donate.

NHS Blood and Transplant holds a blood establishment authorisation to undertake blood donation and is monitored and regulated by the Medicines and Healthcare Products Regulatory Agency (MHRA).

Blood Donation Teams are required by law to report Serious Adverse Events (SAE) and Serious Adverse Reactions (SAR) to the MHRA using the SABRE reporting system. It is professionally mandated that SAEs and SARs are also reported to Serious Hazards of Transfusion (SHOT) haemovigilance scheme.

NHS Blood and Transplant's 2022 Strategy outlines the organisation's plans to continue building on its successes and achievements and provide direction to achieve the goal of saving and improving more lives.

This strategy is available via the link below:
NHSBT Strategy August 2022

Give blood

2.2 Donation Process

Blood is made up of a number of components, including red blood cells, platelets and plasma. Each of these can be used to treat many different conditions.

Blood donations are usually separated into their individual components or parts, so a patient can be given the particular component they need. This makes the most of every blood donation, as the components in one unit of blood (or one donation) can be used to treat different patients.

There are certain pre-requisites for donors to ensure their health and wellbeing:

Donor age

- 17 years and above, as long as the donor remains fit and well and veins permit.
- Regular and returning donors may continue to donate after their 66th birthday under the authorisation of a blood donor physician.
- It is usual practice to set an upper age limit for new donors (this is usually around 60), but older first-time donors may be accepted at the discretion of a donor physician.

Donor Weight

- Minimum weight for donors is 50kg.
- Female donors weighing less than 65kg or under 21 years of age should have their estimated blood volume calculated, ensuring that no more than 15% of this volume is donated.

Screening process

Upon arrival donors receive a welcome pack, including the donor consent booklet, which is essential reading in order for the donor to give their informed consent to proceed. Every donor undertakes a screening questionnaire in a private booth to assess their past medical history, current and recent medications, lifestyle risk factors and a screening test to ensure an adequate haemoglobin (minimum 135 g/L for men and 125 g/L for women).

Donors are issued with a unique donor ID and each individual donation is allocated a unique Donation Identification Number to allow for traceability from donor to recipient. Men can donate whole blood every 12 weeks and women every 16 weeks. Platelet donors are encouraged to attend every 2-4 weeks; however, they cannot give more than 24 donations in a 12-month period. Plasma donations can be made as frequently as every 2 weeks, but this is currently only offered at certain locations in England

For further information see:

The JPAC Donor Selection Guidelines (DSG)

Blood.co.uk - Demand for different blood types

Blood.co.uk - Can I give blood?

2.3 Testing and Manufacturing

Whole blood donations are transported to NHSBT manufacturing sites, where each donation will undergo testing and processing. Manufacturing of components, in common with blood donation, is governed under Blood Quality and Safety Regulations, and overseen by the MHRA, with a duty to report adverse events and incidents to SHOT and SABRE.

The first 20ml to 30ml of every donation is diverted into a pouch, which acts as a mechanism for separating blood containing the skin plug created by venepuncture, and therefore reduces the risk of skin contaminants infecting the donated blood. Three samples are taken at the point of donation, which are used for the following mandatory tests.

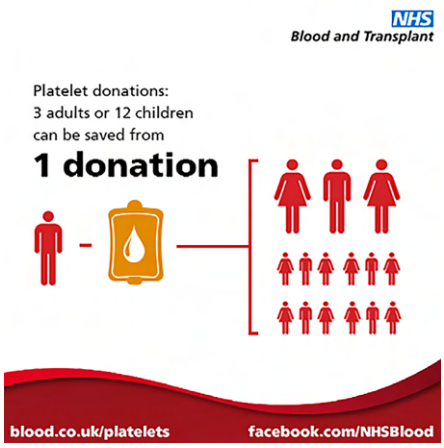
Infectious agent	Minimum test requirements
Human Immunodeficiency Virus (HIV) 1+2	Anti-HIV 1+2 or HIV 1+2 Ag/Ab
Hepatitis C Virus (HCV)	Anti-HCV HCV RNA
Hepatitis B Virus (HBV)	HBsAg
Hepatitis E Virus (HEV)	HEV RNA
Syphilis	Anti-treponemal Ab
Human T-Lymphotropic Virus I/II (HTLV)	Anti-HTLV I/II

There are many additional tests that are performed when specific risks or requirements are identified.

For more information see Section 9.1 of the Guidelines for Blood Transfusion Services.

Whilst samples are being processed, blood is leucocyte-depleted (white blood cells are filtered out from the donations). Samples will be sent for leucocyte counting to make sure they meet requirements. Donations will be ABO grouped and Rh typed (C, D, E, c, e). The whole blood donation is then centrifuged into its component parts, red blood cells, plasma, and platelets. Each unit is then labelled and barcoded accordingly and sent to their respective holding areas until all the relevant tests are completed. Once testing is complete and a negative microbiology result has been recorded, the donations are moved into controlled storage, ready for delivery to hospitals.

2.4 Platelet Donation



Platelets can be donated as a standalone unit, via an apheresis machine, or from pooling platelets from four whole blood donations. An adult therapeutic dose (ATD) should be greater than 240 x 10^9 platelets. A single apheresis procedure can provide 2-3 ATDs. Platelets collected from whole blood donation are pooled by passing the platelets from 4 donations of the same blood group through a leucocyte-depletion filter into a special platelet pack that allows gaseous exchange. A sample from every platelet unit is monitored for bacteria during their shelf life. If a positive sample is found the corresponding unit is recalled, if the positive test is found after the platelets (or associated components) have been issued, confirmatory tests are performed. Most alerts are false positives or clinically insignificant bacteria.

The shelf life for platelets is 7 days; they require storage at 22°C on a platelet agitator to ensure that the platelets are continuously oxygenated.

2.5 Plasma Donation

Fresh Frozen Plasma (FFP) is obtained from whole blood or apheresis from male donors and frozen to maintain activity of labile coagulation factors. FFP from female donors is not currently used because it is more likely to contain antibodies that could cause a serious reaction when given to a patient. Apheresis plasma is also being collected in the UK from male and female donors for plasma for medicine. By combining all the donations and extracting the antibodies (immunoglobulins) these can be used to treat many conditions. See section 9.5 for further details on immunoglobulins

Cryoprecipitate contains high levels of fibrinogen and is the main source of fibrinogen in the UK. It is obtained by thawing FFP at 4°C ± 2°C resulting in the formation of the cryoprecipitate. Following centrifugation, the supernatant plasma is removed, and the cryoprecipitate is then rapidly frozen to ≤-25°C.

For more information on the manufacture of blood components and NHSBT portfolio of products follow the links below.

SPN223 - NHSBT Portfolio of Blood Components and Guidance for their Clinical Use

NHSBT Blood Centre Tour

The 'Red Book' - Guidelines for the Blood Transfusion Services in the UK

For information on balancing supply and demand, see section 8.5 & 7.2

Laboratory Facts

Hospital Transfusion Laboratories (HTLs) are responsible for the pre-transfusion testing and issuing of blood components to clinical areas. In some hospitals they may also provide certain blood products. They often operate and provide 24-hour support, seven-days a week, all year round. See **glossary** for definitions for blood products and blood components.

A tour of your local laboratory can be really useful to understand local practice and systems. HTLs are regulated by the Medicines and Healthcare products Regulatory Agency (MHRA), against the Blood Safety and Quality Regulations (BSQR 2005), ensuring procedures are in place to maintain the highest standards of quality and safety for the collection, testing, processing, storage and distribution of human blood and blood components.

3.1 Blood Groups

Blood groups are determined by inherited genes, which dictate the presence of certain antigens on red blood cells and antibodies in the plasma. Often the antibodies we come across in transfusion are allogeneic which are not naturally occurring, instead they develop following sensitisation from a foreign red cell antigen. Examples of exposure to these are pregnancy, donor transfusions and transplants. There are a total of 45 different blood group systems recognised by the International Society for Blood Transfusion (ISBT), nine of these are classified as clinically significant.

3.1.1 ABO Blood Group System

The ABO blood group system was the first to be discovered, it consists of four major groups A, B, AB, and O. A person's ABO group is classified by the expression, or absence, of A or B antigens on their red blood cells, and by the anti-A or anti-B antibodies in their plasma. When an antigen is **NOT** present on a patient's red cell the corresponding antibody can be found in their plasma, this is known as Landsteiner's Law (see table below).

ABO Blood Group	ABO Red cell antigens	ABO Plasma antibodies
A	A	Anti-B
B	B	Anti-A
AB	A and B	Neither
O	Neither	Anti-A and Anti-B (Anti-A,B)

Developing in early childhood, these antibodies are naturally occurring and are the most clinically significant (see section 3.1.4). A transfusion of an incompatible ABO group can cause fatal reactions within minutes, the patient's ABO antibodies attack the donor red blood cells and cause intravascular haemolysis via complement activation. This is the reason an ABO incompatible transfusion is classed as a never event by the Department of Health and Social Care (see section 6 for more information on transfusion safety).

Establishing the ABO group of a patient is one of the core pre-transfusion tests completed in the Hospital Transfusion Laboratory (HTL). This is covered in section 3.2.

3.1.2 Rh Blood Group System

The Rh blood group system is incredibly complex, the most clinically significant antigen is D as it has a propensity to stimulate antibody production (immunogenic) and has strong reactions with its corresponding antibody (antigenic).

The other antigens in the system are C, c, E, and e. They are also clinically significant as they are typically reactive at 37°C and are capable of causing haemolytic transfusion reactions. Therefore, the Rh system is particularly important in pregnancy due to the risk of haemolytic disease of the fetus and new-born (HDFN) (see section 3.1.4).

If a patient develops an Rh antibody, they are more likely to form other blood group antibodies due to sensitisation. It is for this reason that some patient groups require Rh matched red cells, to try to reduce risk of this occurring.

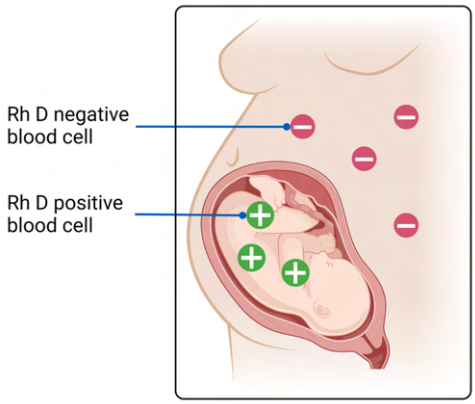
3.1.3 Other blood group systems

Of the 45 blood group systems recognised by the International Society of Blood Transfusion (ISBT), nine are considered to be clinically significant. These are ABO, Rh, Kell, Kidd, Duffy, MNS, P1PK, Lewis and Lutheran. Antibody screening tests (see section 3.2.4) are specifically designed to detect the presence of these antibodies.

3.1.4 Clinically Significant Antibodies

Clinically significant antibodies, defined in the British Society for Haematology (BSH) guidelines for pre-compatibility testing, are capable of the accelerated destruction of a significant proportion of transfused red blood cells.[1] This guidance also states that generally, antibodies that are detected using indirect antiglobulin test at 37°C are usually clinically significant, but there are exceptions to this rule.

Due to the potential of clinically significant antibodies to cause haemolytic transfusion reactions, the HTL is required to select the most appropriate blood for transfusion in these cases, and complete full serological crossmatching to reduce the risk to the patient (see section 3.3.2).



Pregnancy

Pregnancy can cause sensitisation and the production of alloantibodies, therefore antenatal screening tests are recommended at booking and 28 weeks' gestation to detect antibodies. This is due to the potential risk of Haemolytic Disease of the Fetus and Newborn (HDFN).

HDFN occurs when the fetus expresses antigens (+) that the mother lacks (-), therefore meaning maternal antibodies could be produced with the potential to attack the foetal cells. Only certain antibody classifications, IgG, have the capability to cross the placenta, the most clinically significant one being anti-D.

Routine antenatal screening for antibodies is undertaken to identify pregnancies at risk. If antibodies are detected antenatal surveillance is increased, to include repeated antibody titres, ultrasound scans and referral to a foetal medicine specialist and neonatologist.

Testing in pregnancy is covered in section 3.2.9.

More information can also be found in the BSH guideline on blood grouping and antibody testing in pregnancy.

During pregnancy patients have different specific transfusion requirements that are discussed in section 4.7.

Transplantation

It is important to consider blood group antigens in certain types of organ transplants, as incompatibility may result in organ rejection if not managed appropriately. Drug therapies can be useful in reducing antibody titres, and testing should be performed to ensure that these titres are maintained. These tests may be done in the Hospital Transfusion Laboratory, subject to test availability, but most HTLs refer them to the NHS Blood and Transplant Reference Laboratory.

There may also be issues with donor lymphocytes being transplanted with the organs; these can cause haemolysis and other significant complications. Some patients who receive an organ transplant may develop specific transfusion requirements, such as the need for irradiated blood components. Specific requirements are discussed in greater detail in section 4.

3.2 Pre-Transfusion Testing

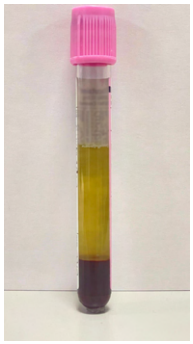
Safe transfusion practice starts with Positive Patient Identification (PPI) and careful sample collection. The sample requirements for HTLs can be found in section 5.4.

Positive Patient Identifiers
First name
Last name
Date of birth
Unique patient identification number

PATIENT SAFETY

It is recommended that HTLs operate a zero tolerance on errors in sample labelling. This is to ensure that the right patient receives the right blood at the right time.

3.2.1 Receipt of Sample in the Hospital Transfusion Laboratory



- Once a request is received in the Hospital Transfusion Laboratory (HTL), laboratory personnel will check the sample to ensure it meets the minimum acceptance criteria and check the urgency of the request, so it can be prioritised appropriately. A request that fails to meet the minimum requirements may be rejected. Accepted requests are booked into the Laboratory Information Management System (LIMS) for processing.
- The patient's records are interrogated to ensure that the patient has only one transfusion record, to understand their transfusion and sampling history, and to ascertain whether they have any known antibodies, specific requirements or any significant medical history.
- The sample is then prepared for examination, which includes centrifugation to separate the individual constituents of the blood (red blood cells, plasma and buffy coat), before testing is performed.

An overall summary of the laboratory processes can be found in appendix 6. Please note this is a generalised overview. For more information contact your hospital transfusion laboratory.

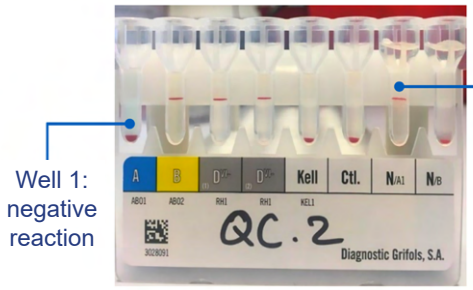
3.2.2 Sample validity

A patient's sample is valid for testing for either seven days or three days, depending on the patient's transfusion and medical history. An event such as a recent transfusion, pregnancy or transplant, may mean that the sample is valid for just three days from the point of collection. This is so that the results generated are an accurate reflection of the patient's current immunological status. Hospital policy for sample validity may vary depending on local risk assessment.

3.2.3 Grouping

The first and most important pre-transfusion test is the blood group, used to determine the patient's ABO and RhD type.

- A patient's red blood cells are tested for the presence of the A, B and D antigens. This is known as the forward group.
- A patient's plasma is also tested to detect the presence of ABO antibodies. This is known as the reverse group.

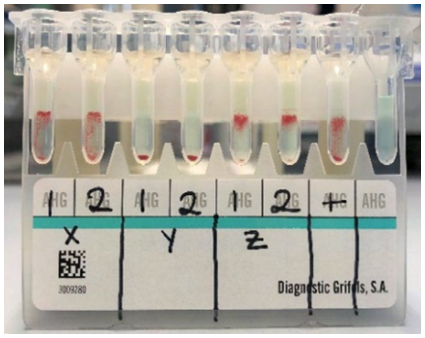


This photograph depicts a typical blood grouping cassette for patient blood group determination. Wells 1-4 establish ABO and Rh D type, well 5 detects Kell antigens, and the last 2 wells identify ABO antibodies in plasma. Well 1 shows a negative reaction, while well 7 shows a positive reaction.

3.2.4 Antibody screening

The purpose of antibody screening is to detect the presence of red cell antibodies that may be of clinical significance. Whilst there are various testing methods for antibody screening, the Indirect Antiglobulin Test (IAT) is recommended.

Detecting clinically significant antibodies is achieved by testing a patient's plasma against reagent cells of known specificity at 37°C and observing the reactions. A positive screen prompts additional tests to identify the specific antibody/antibodies. This helps HTL personnel select appropriate blood units for transfusion. While positive antibody screens may lead to delays in obtaining compatible blood, it is important to note that no patient should be put at risk due to a delay in receiving blood. Suitable blood should be transfused in the interim if clinically necessary.



This photograph depicts three patient samples (Patient X, Patient Y, and Patient Z) being tested against two sets of donor cells (Donor Cells 1 and Donor Cells 2). Patient Y does not require further testing, as both Y1 and Y2 are negative, indicating no unexpected blood group antibodies. Patient X requires additional testing, as both X1 and X2 are positive, indicating the presence of unexpected blood group antibodies. Patient Z also needs further testing, as both Z1 and Z2 are positive, indicating unexpected blood group antibodies. The additional testing will help to determine the specificity of the antibodies.

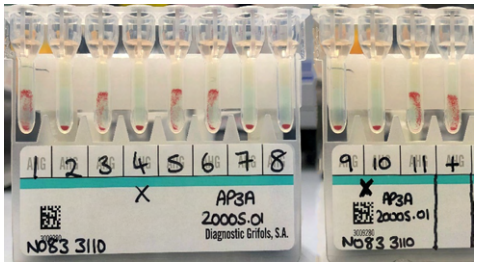
3.2.5 Antibody identification

When an alloantibody is identified during the screening process, its specificity must be established, and its potential clinical significance should be evaluated. It is possible that one or more antibodies from different blood group systems can be present. The patient's plasma should be tested against an identification panel of reagent red blood cells with known specificity, typically 10 or more cells, by IAT.

The specificity of any antibodies identified must be considered by the HTL when selecting appropriate blood units for transfusion.

Some specific antibodies require close monitoring during pregnancy due to their ability to cause haemolytic disease of the fetus and newborn. Once detected, this will result in the patient undergoing monitoring throughout the pregnancy.

HTLs utilise a wide range of technologies and reagents to aid the identification of antibodies, for example enzyme panels and phenotyping tests (you can learn more about these in section 3.2.6.



This photograph depicts a typical anti-human globulin cassette used for an antibody identification panel. Each well contains a reagent red cell of known specificity to be tested against the patient's plasma. Wells 1, 3, 5, 6, 11 and the quality control well demonstrate a positive reaction, while wells 2,4,7,8,9, and 10 demonstrate a negative reaction.

3.2.6 Phenotyping and Genotyping

Phenotyping is a process used to determine the blood group antigens present on a patient's red blood cells. It assists in selecting appropriate blood for patients with complex serological requirements and aids in the identification of antibodies (section 4.4).

There are certain scenarios where it isn't possible to perform a phenotype on a patient sample, for example, after recent transfusion. In this scenario there is no way to differentiate between the donor and patient cells accurately. In these cases, genotyping maybe indicated. This often involves referring the sample to the International Blood Grouping Reference Laboratory (IBGRL) at NHSBT Filton.

More information can be found on the red cell genotyping page of the IBGRL website.

3.2.7 Direct Antiglobuilin Test

The direct antiglobulin test (DAT) is used to detect the presence of in vivo-coated red blood cells (RBCs) with immunoglobulin, complement, or both. It is primarily useful in the investigation of haemolytic transfusion reactions, haemolytic disease of the fetus and newborn (HDFN), autoimmune haemolytic anaemia (AIHA), and drug-induced immune haemolysis. The clinical significance of a DAT result should consider the patient's medical history, previous transfusion, and other lab tests. The DAT is often referred to as the Coombs test or the Direct Coombs test. However, this is outdated terminology, and the correct name of the test is the DAT. As many as 15% of hospital inpatients will have a positive DAT which is of no clinical significance in the absence of haemolysis or recent transfusion

3.2.8 Red Cell Immunohaematology Laboratories

Red Cell Immunohaematology (RCI) laboratories are located at various NHS Blood and Transplant centres across the country. Having a wider repertoire of tests and reagents at their disposal, they are able to perform more complex tests that ordinary hospital laboratories may not offer. With access to 24/7 support, hospital laboratories might refer a sample to the RCI laboratory for confirmatory or complex testing, such as antibody identification, confirmation of blood group, crossmatching and assessment of fetomaternal haemorrhage (FMH). The RCI laboratory, and other reference laboratory services within NHSBT, offers a wide range of support, and you can find more information about their services on the NHSBT diagnostic services website.

3.2.9 Antenatal Serology

Blood group and antibody testing should be completed at booking and 28-week antenatal appointments. The patient's RhD type will determine whether prophylactic anti-D is required during the pregnancy and the antibody screen is to detect any clinically significant red cell antibodies that may affect the fetus.[2]
If antibodies are detected, samples will be sent to the RCI laboratory for quantification or titration testing for an accurate level calculation. The laboratory can then suggest further pregnancy monitoring. This can include paternal testing, support from foetal maternal units, or the need for cord samples at delivery.

If pregnant women who are identified as RhD negative are involved in a potentially sensitizing event (PSE, something that may cause the mother to develop antibodies against the D antigens on the fetus' red cells) they require a Kleihauer Betke test when they are 20 weeks pregnant or more. Quantification of the foetal maternal haemorrhage may be confirmed with a flow cytometry test which can guide the appropriate dose of prophylactic anti-D. It is important to be aware that women who are RhD negative may need anti-D at any gestation if they have a PSE. Refer to section 9 for full guidance. Administration of anti-D is not dependant on a positive result of a Kleihauer Betke test. Doses given for a PSE are always in addition to routine antenatal anti-D prophylaxis given at 28 weeks (and in some areas again at 34 weeks).

More information can be found in the guidelines for blood grouping and antibody testing in pregnancy.

Foetal RhD Screening
The purpose of this test is to predict foetal RhD type by detecting cell free foetal DNA (cffDNA) in maternal blood samples. The results can be used to guide anti-D prophylaxis treatment in RhD negative pregnancies. It is designed to reduce the requirement for prophylaxis if the fetus is predicted RhD negative; this should always be done within the remit of the local transfusion policies.

Samples can be taken after 11+2 weeks, ideally at routine antenatal appointments. The samples are processed at IBGRL, at NHSBT's Filton centre. Please note this service isn't available for all hospital trusts, check with your transfusion laboratory.

More information can be found on the IBGRL website.

Post Delivery
Following delivery by RhD negative women, a maternal sample and a cord blood sample should be obtained and sent to the transfusion laboratory for testing. The cord blood sample should be used to determine the baby's D group, which helps us to identify women who require post-delivery prophylactic anti-D Ig. If the baby is RhD positive, a Kleihauer Betke test (often referred to as "a Kleihauer") must be performed on the maternal sample to assess for fetomaternal haemorrhage. This is usually managed by the laboratory. If the Kleihauer Betke test is positive, further anti-D Ig may be needed in addition to the standard dose, which should be administered within 72 hours after delivery. Dosing depends on the estimated volume of the bleed. Further laboratory testing, such as flow cytometry, may be required to quantify the scale of the bleed and guide dosing.

All babies born to women who have clinically significant antibodies should be closely observed for evidence of HDFN. A DAT should be performed on a cord blood sample, and haemoglobin and bilirubin concentrations should be measured.

3.2.10 Transfusion Reaction Investigation

The HTL will provide support in the management of transfusion reactions. This will include repeat tests such as a group and possible additional testing. Please refer to section 6.5 for more information on the different types of transfusion reactions and their management.

3.3 Blood Selection, Preparation and Issuing

Provision of blood components and products is one of the fundamental roles of the hospital transfusion laboratory. The blood components issued are received from NHSBT and stored in optimal conditions until they are issued to patients. See section 5.7 for information on storage requirements.

HTLs may also have responsibility for storing and issuing blood products, including factor concentrates and prothrombin complex concentrate. However, certain products, like human albumin solution, may be managed by either the HTL or the pharmacy department. It's important to be familiar with the specific arrangements in your local setting.

3.3.1 Preparation and Issuing

The HTL will have undertaken processes to ensure the components or products issued are appropriate and that any specific requirements have been considered. Once issued by the HTL, or remote-issue fridge, a laboratory-generated label is produced and must be attached to the corresponding component or product. The laboratory-generated label must contain specific patient identifiers and component information which is to be used as part of Positive Patient Identification and pre-administration checks (see section 5.8).

These labels may vary in their appearance and registered practitioners should familiarise themselves with their local hospital policy.

3.3.2 Red blood cells

Urgent and emergency blood provision

Most hospital transfusion laboratories have group O red cell units reserved for use in an emergency. Electronic Issue is not suitable for patients who require serological crossmatching, and may not be supported by all hospitals. Located in blood bank issue fridges or satellite fridges in certain clinical areas, they are designed to be incorporated into major haemorrhage protocols and are not allocated to a particular patient. They will be replaced by the laboratory when used or during routine stock rotation procedures.

These units are only appropriate to use in situations where there is no time to perform all pre-transfusion testing. Taking a sample before these units are transfused will reduce the potential for delays in the provision of additional components.

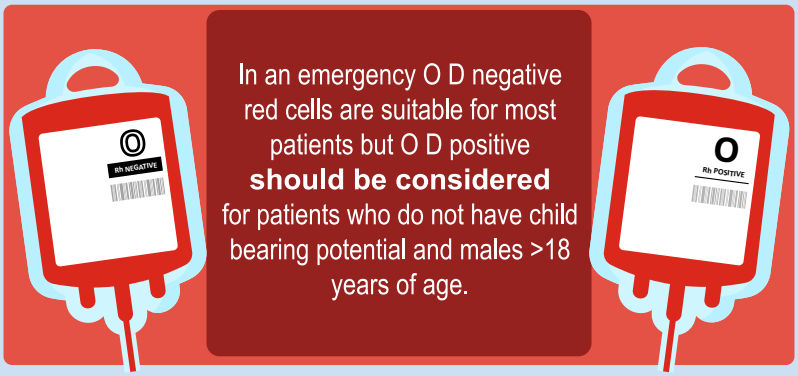
Recommendations are that a designated member of staff collects emergency components from the laboratory. Local policies vary, therefore it is important to familiarise yourself with these in order to get timely transfusion support in emergency situations.[3]

Group specific issue

Group specific blood can be issued in emergency situations in situations where the blood group is confirmed but the antibody screening is not yet complete. This can reduce the reliance on group O and conserve stocks. In these situations the blood is not classified as compatible as the antibody screen results are still outstanding. As soon as the results of the antibody screen are available, further blood will either be electronically issued or serologically crossmatched, depending on the results.

THINK PBM

Around 7% of the UK population are O D negative, but this blood group accounts for 13% of hospital demand.[4]



It is recommended to conserve O D negative for those who need it. More on appropriate use in **section 8.4**

Electronic Issue

Electronic issue (EI) is the selection and issue of red blood cells where compatibility is dictated via the Laboratory Information Management System (LIMS). This means no serological testing of the donor cells against the patient's plasma is performed. The hospital LIMS uses algorithms designed to allocate blood providing no manual intervention has occurred during processes (all testing results must be automatically transferred across without any editing).

Please note: some hospitals are not able to support electronic issue.

More information can be found in the guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories.

Laboratories are advised to have contingency plans in place for any IT failures, with appropriate validated manual techniques.

Remote issue

The use of remote issue is increasing. It works as a point of care application for transfusion, designed as part of a hub and spoke model, whereby the laboratory is the central hub responsible for testing and then spokes have remote issue module fridges. The system can interrogate the LIMS to establish whether patients are eligible for electronic issue and allocate specific units that are compatible for them.

Please note: Remote Issue is not suitable for patients who require serological crossmatching.

Serological Crossmatching

Most hospital transfusion laboratories (HTLs) use the IAT technique for serological crossmatching, as described in antibody screening (see section 3.2.4). It can be performed manually or by automation depending on which technologies the laboratory has available. A sample of donor red blood cells are taken and tested against the intended recipient's plasma to measure compatability.

The results are then entered into the LIMS, which will issue the compatibility labels if the results of the crossmatch were negative.

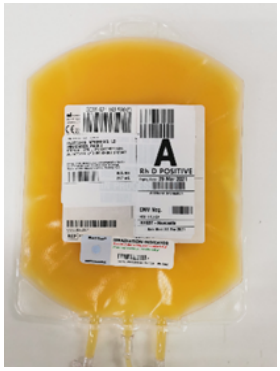
Positive results most likely indicate incompatibility. It is important to investigate positive reactions before issuing units. If blood is required urgently then it should be discussed with medical teams.

RCI crossmatching

Interferences by drug therapies, such as monoclonal antibody therapies like daratumumab, certain disease statuses and other factors may mean that the HTL may not have the required resources to complete full pre-transfusion testing. Such samples may be referred to the RCI laboratory for testing. This will extend the time required to supply the required blood and communication between laboratory and clinical teams is pivitol. For complex results interpretation, NHSBT consultants may liaise with the clinical teams regarding the best course of action for managing the patient.

Units crossmatched by the RCI laboratory will have the NHSBT compatibility label attached to the unit in addition to the hospital's label.

3.3.3 Platelets and plasma components



For standard platelets and plasma components (FFP and Cryoprecipitate) a confirmed blood group is usually sufficient to establish compatibility, with the exception of HLA/ HPA matching for platelets (see section 4.6). The patient's blood group should be established so that an appropriate component can be selected. The HTL may stock platelets for emergency use. The specification of the platelets will depend on available stock and local policy. You can discuss compatibility with the laboratory.

Basic serological 'rules' of compatibility are applicable to both adults and children.The ABO system is the most important blood group system. The Rh system is the second most important and includes the D antigen; red cells carrying the D antigen are D positive. Where possible, the patient's blood group should be established before transfusion to ensure appropriate group selection. Compatibility is different across the different components, and you must check before administering.

A basic compatibility guide can be seen below:

Patient's blood group	Choice priority	Red cells	Platelets	FFP	Cryo
O	1st	O	O	O	O
	2nd		A / B	A	A
	3rd		AB	B	B
A	1st	A	A	A	A
	2nd	O	AB	AB	B%
	3rd		B$	B%	AB
			O$ (adult only)		
B	1st	B	B	B	B
	2nd	O	AB	AB	A%
	3rd		A$	A%	AB
			O$ (adult only)		
AB	1st	AB	AB	AB	AB
	2nd	A / B	A$ / B$	A%	A%
	3rd	O	O$ (adult only)	B%	B%

$ High titre Negative Anti-A and/or Anti-B should be selected where available, lowering the risk of haemolysis.

% Only suitable for emergency use and if unit is tested and found to be negative for high titre ABO antibodies.

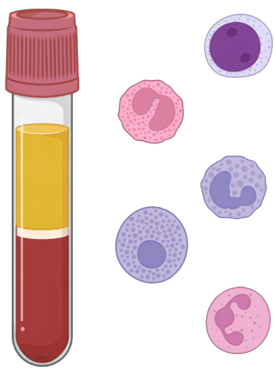
For further information regarding clinical indications see NHSBT clinical guidelines.

For platelets, the laboratory staff must make sure that the components issued are ABO/RhD compatible. There are other factors which are considered when selecting platelets, but it should be noted that if RhD positive components are given to an RhD negative patient with childbearing potential, prophylactic anti-D Ig should be considered. It is not necessary to administer anti-D Ig to D negative females without childbearing potential, to males who receive D positive platelets (see the BCSH guideline for the use of anti-D immunoglobulin for the prevention of haemolytic disease of the fetus and newborn).

When selecting FFP and cryoprecipitate, the Rh type is not significant, only the ABO group must be matched. They are also not required to be CMV negative or irradiated.

Octaplas LG is a solvent detergent FFP product. More details on it can be found in section 9.6.

3.3.5 Granulocytes and buffy coats



Compatibility for granulocytes and buffy coats is the same for red blood cells (section 3.2.2).

Granulocytes and buffy coats are manufactured as required, depending on the notice given to NHSBT, the service may only be able to provide group O. Delivery times may vary and the component will expire at midnight on the day of receipt at the hospital. This is important to note to avoid unnecessary wastage.

See section 7 for information regarding Emergency procedures, section 5.7 for Blood Component Collection and section 5.11 for information about Traceability.

3.4 Biomedical Scientist empowerment and appropriate use

THINK PBM

Part of the Health Service Circular 2007/1 Better Blood Transfusion outlined actions to help avoid unnecessary blood use. This included recommendations for trusts to establish protocols empowering laboratory staff to ensure appropriate clinical information is provided with the request for components, and to query clinicians where requests deviate from local guidelines for blood use.[5] In 2019 SHOT reported 99 cases of avoidable transfusions.[6] Many involved inappropriate use of O RhD negative units, and transfusion for haematinic deficiencies, Querying inappropriate use includes any deviation from guidelines without clear clinical rational, this includes NICE QS138 Quality statement 3: Reassessment after red blood cell transfusions, which advises reviewing patients between transfusing each component.[7] The national indication codes can be a good point of reference for gauging appropriate requests. These can be accessed via the blood components app, or via this link to **the National Blood Transfusion Committee Recommendations & Responses**.

Many regional transfusion committees support BMS empowerment through local education events, available on the regional pages of the NBTC website. There is also a national Biomedical Scientist Education, Empowerment and Discussion Group (BMSEDG), facilitated by the PBM team. This group organises monthly virtual meetings covering important education topics and empowerment issues. Use the following link **to sign up to the BMSEDG**.

Laboratory facts further reading:

- Royal College of Obstetricians and Gynaecologists, The Management of Women with Red Cell Antibodies during Pregnancy https://www.rcog.org.uk/globalassets/documents/guidelines/rbc_gtg65.pdf
- NHSBT Red Cell Immunohaematology User Guide https://hospital.blood.co.uk/diagnostic-services/user-guides/
- NHSBT International Blood Group Reference Laboratory (IBGRL) Molecular Diagnostics Optimising antenatal care https://ibgrl.blood.co.uk/about/about-molecular-diagnostics/

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Specific Requirements

4.1 What are specific requirements?

In addition to the routinely applied specification, additional requirements vary between patients. The Hospital Transfusion Laboratory (HTL) should be notified of any new indication for specific requirements when they arise and then every time a sample is sent, or a component is requested.

The responsibility for ensuring that the HTL holds accurate information for the patient lies with the person requesting blood or sending a sample. Clinical staff should involve patients in decisions about their care, which can be useful in recognising and understanding a patient's specific requirements. Some patients may carry useful documentation that provides information about their specific requirements for blood transfusion (e.g. an antibody card provided by NHS Blood and Transplant or a card indicating the requirement for irradiated components).

Specific Requirements Not Met (SRNM) is a transfusion error reportable to the Serious Hazards Of Transfusion UK haemovigilance scheme (SHOT) via your local reporting system. Patients who have received blood not meeting their specific requirements should be counselled about the consequences of this, and managed appropriately. A local investigation should take place to find out how this happened and measures should be put in place to prevent recurrence.

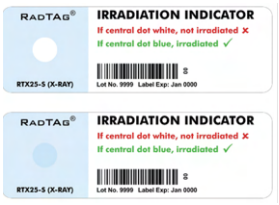
PATIENT SAFETY

BSQR (2005) mandated trusts have standard operating procedures in place to ensure patient specific requirements are added to patient records once identified.(1) Specific requirements should be identified at the point of authorisation. However, the majority of incidents where specific requirements are not met occurs at the point of requesting.(2) If the request is carried out by someone other than the authoriser, it is incumbent upon them to ensure the request form is filled out correctly. If they are unable to ascertain the patient's specific requirements, they must confirm them with the authoriser.

Where staff members who have permission to request but are not authorisers, additional training to support safe and appropriate requesting, including special requirements, will help reduce errors and improve patient safety.

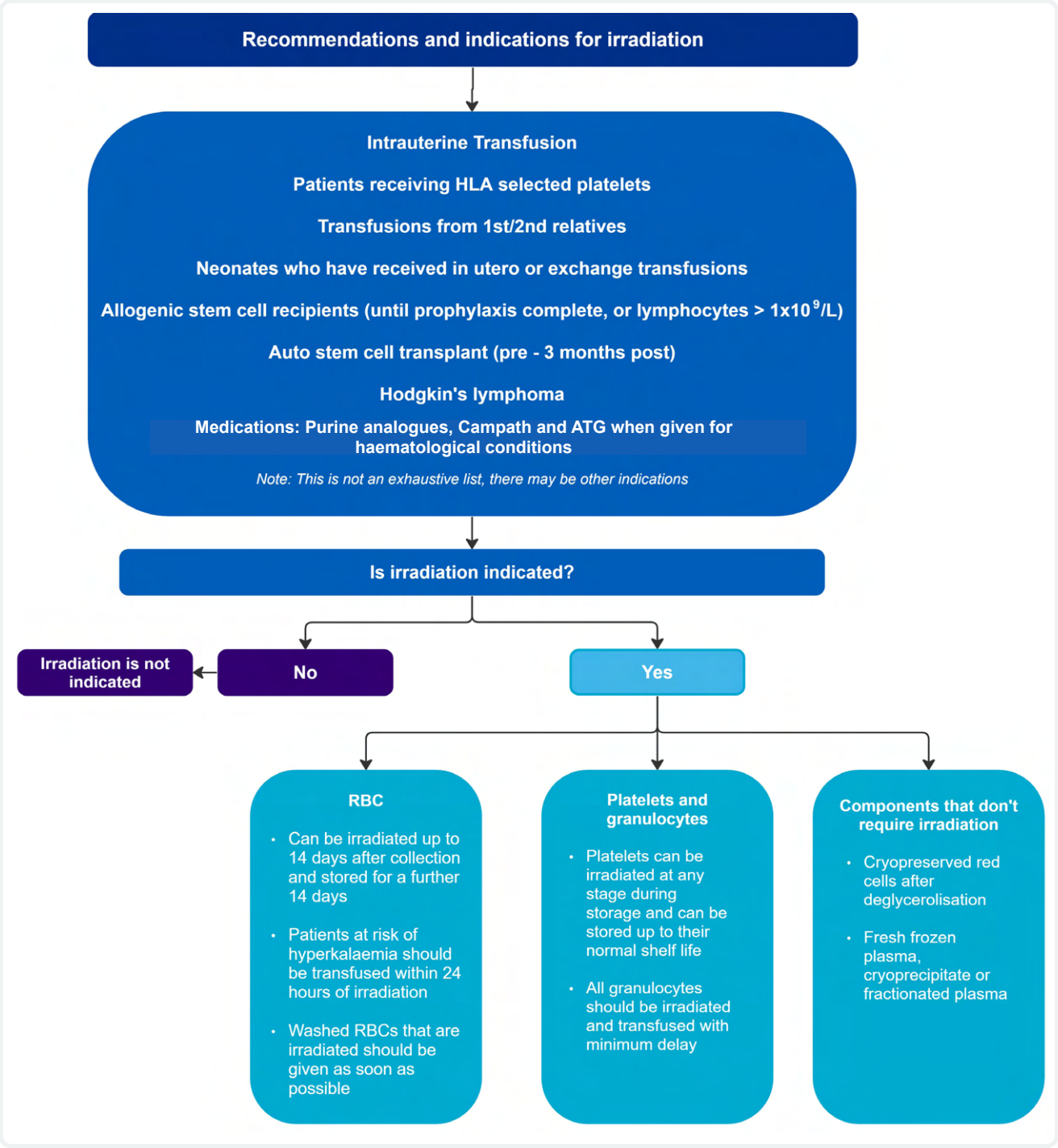
4.2 Irradiated Components

Irradiation of blood components is a commonly seen specific requirement and is important to prevent Transfusion-associated graft-versus-host disease (TA-GvHD). TA-GvHD occurs due to engraftment and a proliferation of donor leucocytes transferred in component transfusion in patients who are immunocompromised. This causes cytokine release and tissue damage, and is often fatal.



Although all NHSBT components (except granulocytes) are leucocyte depleted, in some immunocompromised patients this is insufficient to prevent TA-GvHD, and therefore irradiation is required to deactivate any remaining leucocytes.(9) Components exposed to irradiation do have a slightly shortened shelf life. Irradiated components have a sticker affixed to the front of the bag that indicates whether it has been exposed to irradiation. A white circle on the sticker indicates that the component is not yet irradiated. Once the component has been exposed to sufficient irradiation, the colour of the circle will turn blue, indicating that it is an irradiated component. For further information about interpreting blood labels see appendix 3.

Below is a brief summary of recommendations and indications for irradiation.[3] The following link provides the full guidelines on the use of irradiated blood components.



4.3 Cytomegalovirus (CMV) Negative

Cytomegalovirus (CMV) is a common type of herpes virus that causes asymptomatic infection or a mild glandular fever-like illness in most healthy individuals and is carried lifelong. It is estimated around 50-60% of the adult population are CMV positive. It can be transmitted via blood transfusion from a CMV positive donor and can cause severe and potentially life-threatening illness and complication in immunocompromised patients. It is the most common post-transplant infection and the most common cause of congenital infection in the developed world. CMV positive components transfused to CMV negative recipients may cause a primary infection or cause a new infection. However, the risk of CMV transmission by leucocyte reduced components is extremely low.

In 2012, The Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) issued a position statement for the use of CMV tested components, summarised below.[4] It is important to note that Plasma and cryoprecipitate components do not need to be CMV selected as they are acellular. For patients requiring granulocutes CMV neg patients must receive CMV neg granulocyte components.

Indications and recommendations for CMV negative components

Intrauterine Transfusion (IUT)

- Neonates up to 28 days post expected delivery date
- Pregnancy - elective transfusion (not in labour/delivery)

Pregnancy

- In an emergency, Leukocyte depletion is sufficient if CMV neg unavailable

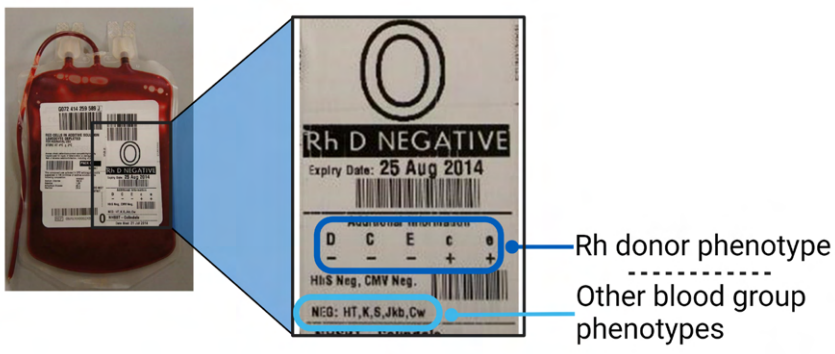
Transplant Patients

- Potential recipients or transplanted patients of stem cells can recieve Leuko-depleted components
- Organ transplant recipients do not need CMV neg components
- Consideration of CMV PCR monitoring post transfusion may be useful in certain patient groups

4.4 Phenotype matched components

To avoid sensitisation some patients require a greater level of antigen matching beyond the routine serological crossmatching process. This is called phenotype matching which is required for:

- Patients with clinically significant antibodies (negative for the antigen).
- Some chronically transfused patients e.g. patients with haemoglobinopathies.



4.5 Washed components

Washed components are supplied by NHSBT upon request, following a discussion between a Hematology consultant and NHSBT. They are indicated for patients who experience recurrent or severe allergic or febrile reactions to red blood cells, and for patients with severe immunoglobulin A (IgA) deficiency who have anti-IgA antibodies, when red blood cells from an IgA-deficient donor are unavailable.

Red blood cells

Cells are washed with normal saline to remove any remaining plasma and are resuspended in 100mL SAG-M

Manual production: 24-hour shelf life

Automated production: 14-day shelf life

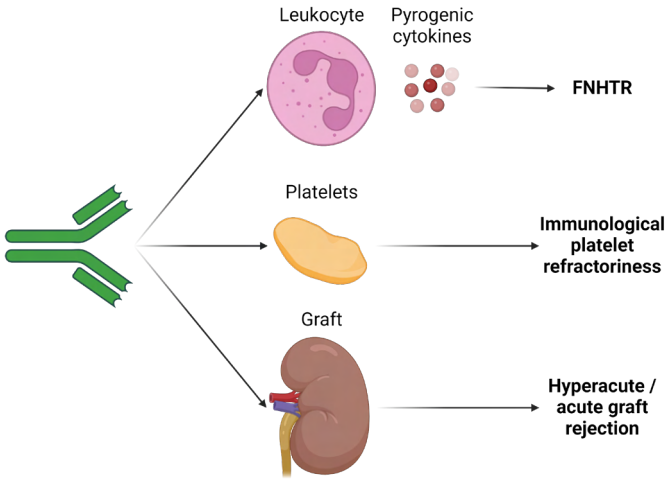
Platelets

Platelets are washed with normal saline, removing the majority of plasma, and resuspended in 200mL Platelet Additive Solution (PAS)

Storage and shelf life may be altered depending on the process used. Further information can be found **here**.Some platelets are lost in the process, and approximately 10mL of plasma is likely to remain.

4.6 HLA/HPA selected components

Human Leukocyte Antigens (HLA) are present on most cells in the body, including platelets. Immune cells interrogate the HLA antigens to recognise self or non self-cells. Patients have the potential to develop HLA antibodies during pregnancy, after transfusion or transplantation. These antibodies can affect the survival of donated platelets and organs and are responsible for Febrile Non-Haemolytic Transfusion Reactions.[5]



HLA matching involves a measure of the unique tissue type of the recipient and to match as closely as possible.

Recommended for:

- Patients with inherited platelet disorders
- Patients demonstrating a poor response to standard platelet transfusions due to HLA or HPA antibodies (Platelet refractoriness)
- Certain solid organ recipients, awaiting or transplanted if HLA antibodies are present
- Human Platelet Antigen (HPA) matching for Neonatal alloimmune Thrombocytopenia (NAIT – occurs due HPA alloimmunisation during pregnancy or labour).[2]

THINK PBM

To support appropriate component selection, the following online resources are available:

- **Laboratory Best Transfusion Practice for Neonates, Infants and Children**
- **Cytomegalovirus (CMV) Negative Blood Components: Information for Healthcare Professionals**
- **Irradiated Blood Components poster**
- **National Blood Transfusion Committee Recommendations & Responses: Appropriate specification for emergency units**

Patient information resources are also available to support communication and consent around special requirements. Use **this link to access these patient resources**.

4.7 Specific Patient Groups

Intrauterine Transfusion

Components for IUT (Intrauterine Transfusion) and exchange transfusion will be ssued by NHSBT with the following specification that is designated for all paediatric components as well as those issued for IUT:

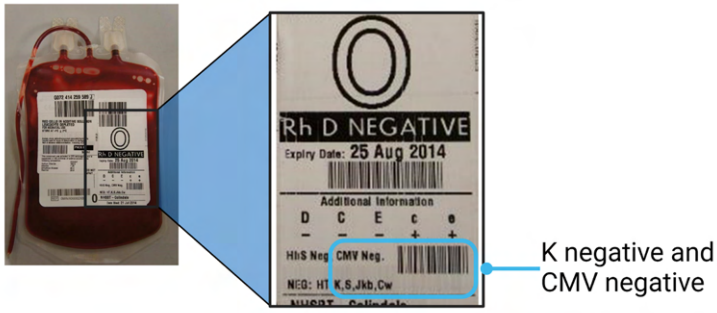
- Less than 5 days old and irradiated (shelf life of 24 hours)
- Haematocrit between 0.7-0.85
- Leucocyte-depleted
- Cytomegalovirus (CMV) negative
- Sickle Screen (HbS) negative
- Usually group O (or ABO identical with the fetus)
- D negative and K negative and red cell antigen negative for maternal alloantibodies
- Indirect Antiglobulin Test (IAT) crossmatch compatible with the mother's plasma.

Recipients of IUT and exchange transfusion should continue to receive irradiated components for 6 months post expected delivery date.[6]

For more information on IUT see **BSH guidelines on transfusion for fetuses, neonates and older children**.

Pregnancy

Hospitals should have local guidelines in place for red cell transfusion in patients who are not actively bleeding. Red cell specification in pregnancy should be ABO, D, K compatible, CMV negative units. If clinically significant red cell antibodies are present, then antigen negative blood should be serologically crossmatched by IAT.



CMV negative red cell and platelet components should be provided for elective transfusions during pregnancy due to the fetal risk associated with the virus. In unplanned or emergency transfusion CMV neg units are not indicated to avoid delays in treatment. Rationale: if you are reading this as a novice or consulting this to answer a clinical query it probably needs to be specified rather than just not acknowledge.

Good communication with the HTL is essential to avoid delays in transfusion, especially in life-threatening haemorrhage, this, along with timely screening and clinical planning, is encouraged when managing pregnant patients with clinically significant antibodies. Unit sourcing delays are a possibility where antibodies are present. Conditions such as placenta praevia, which are high risk for bleeding, also require careful consideration. In these situations, having a valid sample in the laboratory and adequate blood stocks on site ready to issue are key to efficient transfusion support.

For further information about pregnancy and transfusion see section 3.1.4 and Section 3.2.9.

Sickle cell disease

Patients with SCD Sickle cell disease (SCD) are more prone to developing red cell antibodies due to increased exposure to donor blood resulting from frequent transfusions. When selecting components for patients with SCD, therefore, ABO-compatible, Rh (D, C, c, E, e), and K-matched units are necessary. Any red blood cells selected should also be antigen negative for corresponding clinically significant antibodies (current or historical).

Red cell units should also be negative for Haemoglobin S (HbS). Guidelines have recommended units should be less than 10 days old for top up transfusions and less than 7 for exchanges, however in 2023 the UK Thalassaemia Society, Sickle Cell Society, NHSBT and NBTC issued a joint statement removing this requirement. Click here to read the full statement.

For more information see the full BSH guidelines using the links below:

Red Cell Transfusion in Sickle Cell Disease Part I

Red Cell Transfusion in Sickle Cell Disease Part II

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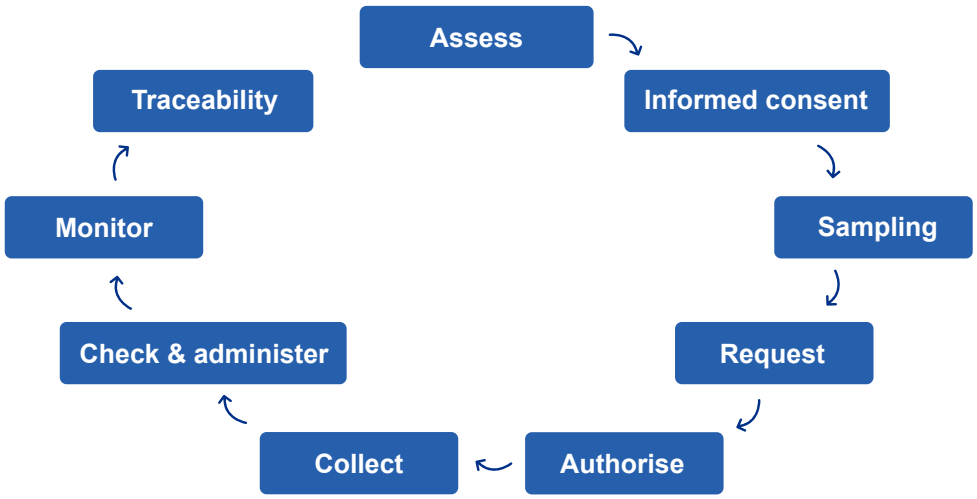
7. British Committee for Standards in Haematology, Milkins, C., Berryman, J., Cantwell, C., Elliott, C., Haggas, R., Jones, J., Rowley, M., Williams, M. & Win, N. (2012). Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories. Transfusion Medicine, 23(1), 3 – 35. https://doi.org/10.1111/j.1365-3148.2012.01199.x

Administration



5.1 Assessment and Decision to Transfuse

The decision to transfuse blood components must be based on a clear clinical assessment and indication, considering any appropriate alternative to transfusion, and the known and potential risk of transfusion and the intended benefit.

THINK PBM

Agreed Hb thresholds and indication can help avoid inappropriate transfusions.

Studies of the use of red cell transfusion in adults suggest that morbidity, mortality, haemodynamic, pulmonary and oxygen transport variables often do not differ between restrictive strategies employing a haemoglobin (Hb) trigger of 70-80g/L and more liberal strategies using triggers of 100g/L.(1)

Laboratory test results should not be the sole deciding factor for transfusing blood components, clinical judgement, understanding of the symptom burden, and individual patient factors should be considered. Clinical judgement and an understanding of the symptom burden and individual patient factors should be considered.

In 2020 The National Blood Transfusion Committee (NBTC) produced an update to the 2016 summary document, “Indication codes for Transfusion - an audit tool”, reviewing the most recent guidelines and evidence around transfusion. The audit tool provides indication codes recommending Hb thresholds and rationale for transfusion in various clinical settings, to support assessment and decision-making. These can be accessed following the links below or on the free Blood Components App.

- National Blood Transfusion Committee Recommendations & Responses
- Blood Components

Further information can be found from The Association of Anaesthetists’ guidelines on the use of blood components and their alternatives.

In addition to restrictive thresholds, NICE (2016) QS138 standard 3 emphasises the need to reassess the patient and recheck the haemoglobin levels after each unit of red cells given. This ensures that patients are not exposed to more components than are required, and therefore associated risk, to treat them and plays a significant role in avoiding Transfusion Associated Circulatory Overload (TACO). The TACO risk assessment should also be carried out at the point of initial assessment and decision-making to ensure any mitigating measures are taken, and the volume of blood authorised is appropriate. For more information on the TACO risk assessment, see Section 6.5.2 and for information on the NICE Quality Standard QS138 see Section 8.4.(2)

5.2 Informed Consent

Informed (or valid) consent can be defined as “an ongoing agreement by a person to receive treatment, undergo procedures or participate in research, after the risks, benefits and alternatives have been adequately explained to them.”[3] Ensuring that consent is obtained for transfusion is enshrined in law. Article 8 of the Human Rights Act (2007) protects this on the most basic level by preventing "a public authority in interference with a person’s right to his private and family life".[4]

THINK PBM

In order to support discussion and consent for transfusion NHSBT has developed patient information leaflets. These should be available in all areas where transfusions take place, however it is important to note that written information should not replace a full conversation with the patient.

Follow this link for access to all available information leaflets

There have since been further developments in consent law and guidance, a significant case being Montgomery vs. Lanarkshire Health Board (2015). This outlined the legal test of what is deemed an appropriate level of information given, no longer being “the reasonable doctor’(s)” interpretation but “the reasonable patient’(s)” interpretation. In practice, relating to blood transfusion this means that the authoriser must ensure that they assess the individual patient’s interpretation of risk.

“A risk is ‘material’ if a reasonable person in the patient’s position would be likely to attach significance to it, or if the doctor is or should reasonably be aware that their patient would be likely to attach significance to it.”[5]

Partly in response to the Montgomery ruling there has been a push in recent years to ensure that consent in healthcare is informed and specific to each individual. NICE (2016) quality standard for Blood Transfusion states that trusts should be able to provide:

THINK PBM

Discussing appropriate alternatives supports patient choice and informed consent for all patients.

“Evidence of local arrangements to ensure that people who may need or who have had a blood transfusion are given verbal and written information about blood transfusion.”[2]

For more information on the quality standards and consent see section 8. In 2020 SaBTO published updated guidelines on consent for blood transfusion, building on the recommendations first laid out in 2011.

The key recommendations are:

- Informed and valid consent for transfusion is completed for all patients who will likely or definitely receive a transfusion. Decision-making discussions should be documented in the patient’s clinical record.
- Patients who have a been given a blood transfusion and were not able to give informed and valid consent prior to the transfusion are informed of the transfusion prior to discharge and provided with relevant paper or electronic information.
- All patients who have received a transfusion have details of the transfusion (type[s] of component), together with any adverse events associated with the transfusion, included in their hospital discharge summary to ensure both the patient and their family doctor are aware. The patient should also be informed that they are no longer eligible to donate blood.
- All UK healthcare organisations who provide blood transfusions employ mechanisms (such as audit) to monitor the implementation and compliance with these SaBTO recommendations, with subsequent improvement plans developed and implemented if indicated.

The full SaBTO recommendations can be viewed here on the website of the Department of Health and Social Care.

Prior to transfusion, the authoriser must ensure that informed consent is obtained. Verbal consent is required for transfusion and must be documented in the patient's records. The conversation should be tailored to the specific patient and must include the following:

- Type and specification of blood component
- Indication for transfusion
- Risks and benefits of transfusion
- Alternatives treatments to transfusion
- Informing the patient that following transfusion they can no longer donate blood

Ideally this conversation must occur in a timely manner prior to transfusion, so the patient is given time to reflect on the decision they make and undertake any further research they feel is necessary.[6]

5.3 Refusal of blood

Following discussion about the risks and benefits of transfusion, some people may decline, this may be for a variety of reasons including religious beliefs. It is important that the patient understands the possible outcomes of not having a blood transfusion and, where, possible is offered alternative treatment. Refusal must be documented in the patient records and brought to the attention of all healthcare professionals involved in their care. Certain patient groups, such as Jehovah's Witnesses, may have an Advance Decision document covering their choices, which can be filed in the patient records for reference. Patients should be asked to clarify which blood components and products, if any, they would be willing to accept.

Following the 2020 Covid 19 pandemic and the subsequent vaccination programme, some patients have concerns around donor blood from vaccinated donors. Vaccination status of donors is not information that is collected, and therefore preferences cannot be accommodated. This may cause patients to decline transfusion. In such circumstances where concerns are unable to be address, and patients decline, alternatives and PBM measures should be employed to support the patients choice.

If a patient requiring surgery, with a likelihood of blood loss, declines transfusion, the multi-disciplinary team should discuss with the risks with the patient and develop an optimisation plan. This is also a good opportunity to clarify with the patient which blood components and transfusion related procedures (e.g. cell salvage) would be acceptable.[6] If the patient is a member of the Jehovah's Witness community, there is a specialist hospital liaison committee that can support patients and can be useful for such discussions. The contact details of local liaison teams are usually held in the Trust transfusion policy.

The Association of Anaesthetists' guidelines for the care of Jehovah's Witnesses and patients who refuse blood are outlined here. These guidelines can be useful for the care of any patient who refuses blood.[7]

NEONATE AND PAEDIATRICS

Aged 0-15
Persons with parental responsibility can make decisions for a child if it is in the child's best interest. If the decision is not considered to be in the child's best interests (for example if they refuse a transfusion and clinicians believe not transfusing would endanger the child's health) a process of mediation could be considered. If mediation is unsuccessful, or it is an emergency situation, the decision can be over-ruled via application to the High Court for permission to administer life saving treatment. In an emergency a child can be transfused while the application is taking place.

Aged under 16 considered "Gillick competent"
Patients deemed "Gillick competent" can agree to treatment that the person with parental responsibility has declined or refuse, if the case may be. However, if the transfusion is thought to be in their best interests the person with parental responsibility can override their refusal.

Aged 16 and 17
Young adults have the same right to refuse treatment as an adult, except in the case where they are making advance decisions. A court order can also be made in this age category to enforce treatment, which cannot be done for adults with decision making capacity.

5.4 Sampling

Ensuring positive patient identification is crucial at every stage of the transfusion process. Depending on the clinical setting, patients should wear either an ID wristband or an equivalent, clearly displaying the required mandatory identifiers, as indicated in the blue box.

Positive Patient Identifiers
First name
Last name
Date of birth
Unique patient identification number

PATIENT SAFETY

Undetected patient identification errors or 'wrong blood in tube' events could lead to incompatible transfusions, which are potentially fatal and considered an NHS never-event.[6]

When taking a sample from a patient…

- Patients must verbally confirm their first name, last name, and date of birth if they are able to do so.
- Sampling, completing the tube label, and filling out the request form must be carried out as uninterrupted tasks, with only one patient at a time.
- The sample tube and the request form must contain the four minimum identifiers, be completed at the patient's bedside, and be legible if handwritten.
- The sample tube must be signed by the person collecting the sample, and the request form must include the name and contact number of the requester.

THE UNKNOWN PATIENT

The British Society for Haematology (BSH) Guidelines 2012 state that for patients whose identity cannot be ascertained, the minimum identifiers are gender and a unique number.

The Patient Safety Alert (2018) Safer temporary identification criteria for unknown or unidentified patients recommends generating temporary names, numbers and D.O.Bs to improve accuracy and avoid similarities in common unknown identifiers such as “unknown male”. The alert provides access to random name and number generator spreadsheets. For more information, see the full alert provided on the NHS England website.

The British Society for Haematology published guidelines for the administration of blood components. You can access these guidelines by following the link below:

Guidelines for Administration of Blood Components

The British Committee for Standards in Haematology published guidelines for laboratory staff regarding pre transfusion compatibility procedures. You can access these guidelines by following the link below:

Pre-Transfusion Compatibility Procedures in Blood Transfusion Laboratories

5.5 Request

A request form for blood should be sent to the Hospital Transfusion Laboratory (HTL) and must include:

Positive Patient Identifiers
First name
Last name
Date of birth
Unique patient identification number

- Positive patient identifiers
- Diagnosis, any significant co-morbidities and reason for transfusion
- If the patient is currently pregnant or has been so in the last 3 months
- Transfusion history in the last 3 months
- Component required, volume/number of units and any specific requirements
- Time/date and location of transfusion
- Name and contact number of requester

Organisations' policies may differ and should be tailored to meet the needs of the laboratory and clinical systems in place. Timely requesting and good communication with the HTL are essential for a smooth transfusion process.

THINK PBM

Various national guidelines help support the appropriate use of blood components with extended specification. Most components with additional specifications will come from a relatively small pool of donors. Prioritising these in accordance with clinical needs promotes continuity within the blood supply chain. For more information on special requirements, see **Section 4**.

5.6 Authorise

Authorisation is the process by which the need for the request, consent and any specific requirements are confirmed to the HTL in order for them to make components available. This can be referred to as "ordering". There are no legal barriers to any healthcare professional authorising blood component transfusions, provided it is within their scope of practice, they are appropriately trained and have declared competency.

Section 130 of the Medicines Act, amended by Section 25 of the Blood Safety and Quality Regulations (BSQR) 2005 (SI2005 No 50), means that blood components are excluded from the legal definition of medicinal products and therefore must be “authorised” and not “prescribed”.[9]

A hospital policy must state which staff groups, once trained, are able to authorise blood components, how they will be supported, and any additional or subsequent training required. It is also acknowledged that for this role to be successful in clinical practice, a high level of medical consultant support is required. It is essential that all key stakeholders are consulted and that the service provided is in the best interests of the patient.

The Independent and Supplementary Prescribing for Nurses and Midwives and Supplementary Prescribing for Allied Health Professionals (V300) course does not cover authorisation of blood components. However, non-medical authorisation courses support healthcare professionals in gaining the knowledge necessary to support competence in authorisation of blood components. One such course is the NHSBT Non-Medical Authorisation of Blood Components course (NMA), offered nationally to allied healthcare professionals. More information can be found on the Hospitals and Science clinical courses web page.

Authorisation information must contain the minimum positive patient identifiers for bedside checks along with:

- Component to be transfused
- Date of transfusion
- Volume/ number of units and rate of infusion
- Specific requirements
- Written or electronic signature of authoriser present

Authorisation should be documented in the patient records.

Positive Patient Identifiers
First name
Last name
Date of birth
Unique patient identification number

Additional Information:
United Kingdom & Ireland Blood Transfusion Network Education Working Group (2022) Clinical Decision-Making and Authorising Blood Component Transfusion – A Framework to Support Non-Medical Healthcare Professionals.

5.7 Collect

Table 1. Cold Chain requirements for storage, collection and transport from The Guidelines for Administration of Blood Components (2018) British Society of Haematology.[10]

	Temp stored at	Time out of storage	Considerations
Red Cells	2-6°C	30 minutes to return to refrigeration *	If likely to be more than 30 minutes to transfusion, consider using a validated transport box
Platelets	20-24°C with agitation	No more than 8 hours away from controlled temperature and agitation at any one time (up to a maximum total interruption time of 24 hours	Must not be chilled. Ensure not transported alongside chilled products.
Fresh Frozen Plasma (FFP)-Thawed	2-6°C	Return to storage within 30 mins if not required	Use within 24 hours of thawing unless required for major haemorrhage, in which case can be stored at 2-6°C for 5 days.
Cryoprecipitate-thawed	Ambient temp	Maximum 4 hours	Must be discarded if not used within 4 hours

*Note BSH 2018 guidelines addendum allows 60 minute excursion up to 3 times in the life of the unit. For more information see full guidelines.

For more information about the individual components or emergency collection see section 3.3.2.

Components should only be collected if the patient is ready to receive the transfusion. Readiness should be considered as:

- Consent obtained and documented
- Rationale for transfusion documented
- Authorisation including any specific requirements documented and correct
- Patient is ready and baseline observations are complete and within expected values for the patient (see section 5.10)
- Venous access in-situ and patent
- Patient identification in place
- Required equipment available.

Collection must only take place by an individual who has completed all the relevant training. NBTC recommends that this be completed every 2 years minimum, however, trusts may choose a more regular interval as part of local policy (see training section 1.3).

On collection the staff member should have the minimum identifiers of the patient as well as details of the component required and compare these to the details on the compatibility label. If multiple units are collected at the same time, they should be transported in a validated transport box.

Any discrepancies should be immediately reported to the HTL, and the component should remain in the laboratory until the issue is resolved. Details of the person collecting the unit, time, date, component type and donation number of unit collected should be retained by the laboratory.[11]

On receipt in a clinical area an appropriately trained member of staff should check and sign the documentation to ensure that the correct component for the patient has been collected.

If emergency units are collected it is imperative that a mechanism is in place for the HTL to be informed.[11] For more information about emergency situations see section 7.

For further information see:

BSH Guidelines Administration of Blood Components (2018)

PATIENT SAFETY

Multiple errors have been identified when several components have been transported at the same time. Unless there is a clinical need, it is best practice to request one unit at a time.

5.8 Check & Administer

Blood components should be administered by registered professionals who are trained and competent to do so (see section 1.3).

NHSBT launched “Blood Assist”, a web or phone-based app to support good transfusion practice, which includes a bedside checklist. Visit the Blood Assist website here for more information.

The identity check between patient, authorisation documentation and blood component are the final opportunity to confirm the right blood, right patient, right time, and right place. Positive Patient Identification should be carried out for each unit transfused at the bedside.

Whether hospital policy dictates a single independent or a double independent check, or the use of electronic systems, the DoH (2017) Central Alerting System – Safe Transfusion Practice recommends the use of a robust bedside check list with a confirmatory step where the individual performing the checks signs to affirm they have been completed.[12] SHOT evidence and BSH (2018) guidelines stipulate that the checks should include the following:

Written Authorisation

- Check identifiers on authorisation form against patient ID band.
- Check authorisation has all essential information outlined in AUTHORISATION section.
- Check the authorisation is signed.

Visual Inspection:

- Check component for damage or discoloration.

Check component:

- Check the component type, blood group, donation number, specific requirements and expiry date against the traceability tag.

Check ID band:

- Where possible ask the patient to state their first name, last name and DOB. Check this matches the ID band. If the patient is unable to provide verbal confirmation, consider carrying out a 2-person check.
- If correct, check the ID band against the patient details on the traceability label.

Complete Documentation

PATIENT SAFETY

If in doubt at any stage of the checking process, do not proceed with the transfusion. Liaise with the transfusion laboratory and rectify any discrepancies before restarting the checking process. For educational support, **watch this short video produced by NHSBT and SHOT**.

5.9 Technical Considerations

Table 2. Technical Considerations[10]

Access	• IV cannula, central or PICC line as per manufacturer's specification. • Intraosseous access where necessary. * Size depends upon the size and integrity of the vein. Smaller gauge access may lead to slower infusion rates. * Check access is unobstructed prior to collecting component for transfusion.
Infusion	• CE marked infusion equipment and in date. • Specific blood administration giving set with a integral mesh filter. • Electronic or gravity-controlled infusion equipment, but rate and volume should be observed. * Giving sets should be changed every 12 hours or as per manufacturers instruction. * Red blood cells and plasma can be given via the same giving set, but it must be changed for platelets or another infusion. * Drugs or IV fluids should not be added to blood bags or lines, and generally administration of them should be avoided while transfusing a blood component.
Time	• Red cell transfusions should be completed within 4 hours of removal from controlled temperature environment. • An adult therapeutic dose of platelets is usually transfused over 30-60 minutes. • FFP is usually transfused at a rate of 10-20mL/kg/hour. • A five unit pool of cryoprecipitate is transfused over 30-60 mins. * Rapid infusion may be required in major haemorrhage. It is recommended that transfusion takes place within core hours, unless clinically required.

OTHER BLOOD PRODUCTS

Human albumin solution (HAS)
- Administer using a 15-micron filter vented giving set (most standard intravenous fluid administration sets).

Intravenous immunoglobulin (IVIg) Immunoglobulin
- Administer using a 15-micron filter vented giving set (some manufacturers supply a giving set with product).

For infusion rates review the manufacturer's Summary of Product Characteristic (SmPC).

Rapid Infusers

Rapid Infusers may be used where large volumes must be transfused quickly. They should be used with appropriately sized access and with infusion sets that manufacturers deem compatible with rapid infusion devices.

Blood Warmers

Hypothermia impairs haemostasis and reduces oxygen delivery from red blood cells to tissues.

Blood warmers should be considered for use:

- In patients with clinically significant cold agglutinins (after discussion with the Haematology team and the transfusion laboratory).
- In the management of major haemorrhage where blood will be rapidly transfused.
- When managing and maintaining a patient's core temperature is essential.

The decision to use blood warmers should be on an individual basis.[9]

For guidance on use in paediatrics and neonates, see BSH guidelines (2016).

NEONATES/PAEDIATRICS

Extra caution should be exercised when obtaining Positive Patient Identification for paediatric patients, especially at birth to avoid confusing samples with maternal samples, or in the prescence of multiple births. The second sample rule for first time patients will also ensure accurate grouping.

Prescription of blood components for paediatric transfusion should be in mililitres, unless there are local risk-assessed protocols for prescribing in units for older children, and the maximum volume should not be greater than prescribed for adults.

Recipients aged under 1 year should be transfused with components with neonatal/infant specification, unless unavailable in an emergency.

Paediatric/neonatal blood administration sets (with a smaller prime volume) are appropriate for small volume transfusions.

Neonatal blood administration systems are available, which allow blood components to be delivered via a syringe driver.

The above systems should be CE-marked transfusion sets and include a filter.

A new syringe and administration set should be used when administering different components, but also when the component is from a different donation to ensure traceability in the event of an adverse reaction.[12]

For more detailed guidance see the guidelines on transfusion for fetuses, neonates and older children.

5.10 Monitoring

Careful monitoring of the patient is essential during transfusion to ensure that any adverse reactions are noted as early as possible and managed.

Minimum observations of the patient should be as follows:

BASELINE OBSERVATIONS
within the the 60 minutes preceding transfusion should include:
- Temperature
- Respiratory rate
- Pulse and blood pressure (BP)

ADDITIONAL OBSERVATIONS
within the first 15 minutes of transfusion commencing:
- Temperature
- Respiratory rate
- Pulse and blood pressure (BP)

POST TRANSFUSION OBSERVATIONS
within 60 minutes of the transfusion completing:
- Temperature
- Respiratory rate
- Pulse and blood pressure (BP)

These observations should be completed for each unit transfused.

* The above is the minimum required. Hospital transfusion teams may choose to incorporate further observations as part of local policy, or the patient's condition may indicate more regular observations.

Ideally, the patient should be visible at all times. They should be informed of symptoms of adverse reaction and encouraged to report them.

If the patient has been deemed to be at risk of TACO (see section 6.5.2 for more information on risk factors), additional observations such as urine output, fluid balance and oxygen saturations should also be monitored.[9]

For more information, see BSH Guidelines on Administration of Blood components (2018).

5.11 Traceability

The Blood Safety and Quality Regulations (BSQR) 2005 (SI2005 No 50) require Blood Establishments and Hospital Blood Banks to retain data, allowing full traceability of each unit in their care from donor to recipient or destruction. The necessary information includes blood supplier identification, issued blood component identification, transfused recipient identification, date of transfusion, or disposal of unit along with confirmation of disposal. These records must be retained for 30 years.[10] The traceability information should be completed by the person administering the component once the transfusion is started, returning this information to the laboratory as soon as possible to allow its correct fate to be recorded. Local policy and processes must be in place to underpin this, whether electronic or manual, and compliance to regulations should be audited frequently.[9]

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Patient Safety and Reporting

6.1 Introduction

Transfusion medicine from donation to administration involves complex processes with the potential for risks to patient safety. Over 2 million component units were issued in 2022, the risk of serious harm from a blood component transfusion calculated at around 1 in every 15,450 units transfused and risk of death around 1 in 63,537 units, demonstrating that transfusion practice in the UK is generally safe[1]. However death and major morbidity can still occur, putting in place measures to reduce risk is a key objective of Hospital Transfusion Teams (HTTs). Thorough haemovigilance allows us to identify potential hazards, learn from events, and demonstrate effectiveness of interventions. Haemovigilance in the UK is overseen legally by the Medicines and Healthcare products Regulatory Agency (MHRA) with hospitals reporting via the Serious Adverse Blood Reactions and Events (SABRE) online tool, and professionally via SHOT (Serious Hazards of Transfusion). For more information on the roles of MHRA and SHOT see section 1.1.

This section will guide you through the potential risks and common errors as well how to respond to them. This includes the importance of reporting, the various categories, emergency preparedness and transfusion reactions.

6.2 Human Factors and Patient Safety

The Department of Health report, "An Organisation with a Memory" (2000), highlighted the need to address not only a reduction of errors and failures in the NHS, but how as an organisation we manage such situations. Emphasising the impact on patients, relatives and staff involved, and the financial burden failures create, the report focused on shifting from a person-centred approach to error, to a system-based “holistic” approach to failure.

Advocating safety is best achieved in an informed culture comprised of:

- **Open reporting culture**
- **A just culture that does not focus on blame**
- **A flexible approach to skills and knowledge**
- **A learning culture- implementing reform**

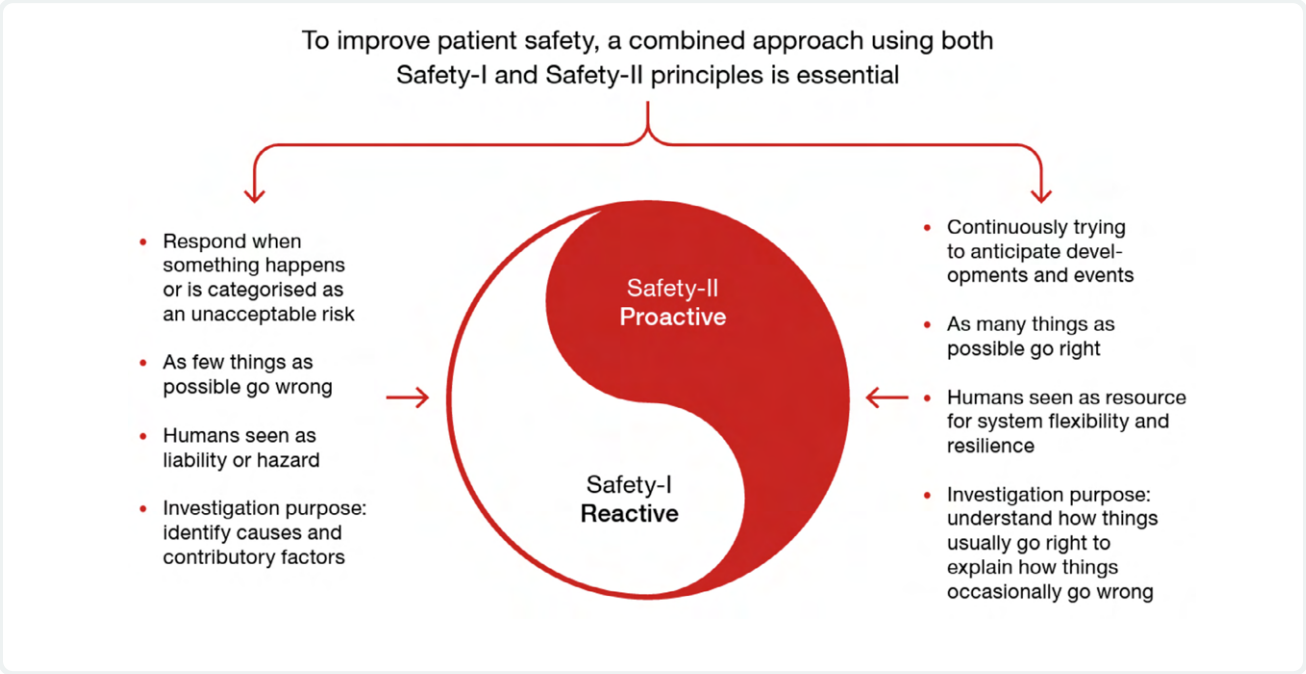
These ideas formed the “The Seven Steps to Patient Safety: A guide for NHS staff” (2004) and still underpin the approach to patient safety we see today.[2] Recommendations regarding holistic training for all key staff were once again echoed in the 2019 SHOT report.[3]

In 2013, The NHS concordat recognised Human Factors in Health Care as:

“Enhancing clinical performance through an understanding of the effects of teamwork, tasks, equipment, workspace, culture and organisation on human behaviour and abilities and application of that knowledge in clinical settings”

The concordat committed its support to helping the NHS do the right thing first time, every-time.[4] SHOT began dedicating an annual report chapter to Human Factors in the Management of Transfusion related errors in 2014. Errors contribute to the majority of reports submitted to SHOT year on year. Redesigning systems by applying Human Factors (HF) principles will help. Listing relevant organisations taking on the challenge of utilising HF, the 2014 annual report called all to join in.[5] In 2016 SHOT introduced a Human Factors Investigation Tool (HFIT), along with a self-directed learning package to promote the application of HF principles to transfusion errors. Although the 2019 report recognises concerns that healthcare settings still harbour a blame culture, a survey conducted following the 2018 annual report contradicted this.[3]

Patient safety incident reporting and learning systems are also evolving, in order to support the development of an informed or safety culture. Reporting is shifting from a traditional safety-I approach, whereby systemic improvements are made through focusing on what went wrong, to a safety-II approach. Safety II looks to implement improvement and learning by pro-actively looking at safe and effective episodes of care, as outlined below.[6]



Follow the link to access the SHOT Human Factors supporting resources.

6.3 Reporting

To improve patient safety learning from all incidents, events, reactions, and near misses, it is vital they are appropriately reported. This involves external reporting to relevant bodies, as well as via internal reporting systems. This ensures that they are documented, and that corrective and preventative actions are implemented in order to avoid recurrence.

It is a professionally mandated requirement that certain transfusion errors, reactions, and incidents (including issues related to cell salvage and fractionated blood products) are reported to SHOT. It is a legal requirement, as set out in the Blood Safety and Quality Regulations (BSQR) 2005[7] to report serious adverse reactions and events to MHRA. This is completed via the Serious Adverse Blood Reactions and Events (SABRE) system, which also submits a report to SHOT. The centralised haemovigilance scheme ensures national themes of error, improvement and good practice can be identified.

The process of reporting is described below[1]

Who reports?

Nominated person/s from Trusts/Health Boards
(This is usually either the Transfusion Practitioner (TP) or Transfusion Laboratory Manager (TLM))

What to report?

Serious Adverse Events or Serious Adverse Reactions (SAE/SAR) relating to transfusion, categorised according to the SHOT definitions criteria, which are reviewed and updated annually. Information is also collected relating to investigations of these incidents and the corrective and preventative actions.

How to report?

Initial reports are submitted via the MHRA online portal (SABRE)

What happens to these reports?

Reports are transferred to SHOT automatically via the SABRE/SHOT interface, and reporters are asked to complete additional detailed questions.

What happens next?

On a monthly basis, completed reports are downloaded, collated, triaged and reviewed by the Haemovigilance Data Manager, Clinical Incidents Specialist and Laboratory Incidents specialist at SHOT.

Who evaluates these reports?

SHOT Working Expert Group (WEG) members then review the cases, assess imputability and may either accept/withdraw/transfer cases or request further information as appropriate.

What happens next?

SHOT confirms all the SAR to MHRA, which is the competent authority for BSQR

Urgent actions are recommended to improve patient safety in transfusion, as needed, after consultation with the wider SHOT Steering Group/ WEG group

All learning points, key SHOT messages with illustrative cases are included in the Annual SHOT Report released in July each year and available freely online. Key recommendations are made to improve transfusion safety and enable sustained change.

All incidents should also be reported internally via local risk management systems using the Patient Safety Incident Response Framework (PSIRF), which was implemented in September 2022 in all NHS Trusts in England by NHS England (NHSE), with an expectation for transition to PSIRF by Autumn 2023. PSIRF also replaces Root Cause Analysis with Patient Safety Incident Investigation (PSII) and promotes a range of system-based approaches for learning from incidents such as Systems Engineering Initiative for Patient Safety (SEIPS) framework. Trusts must also have Patient Safety Incident Response Plans (PSIRPs) agreed with commissioners.

For further information on PSIRF see NHS England » Patient Safety Incident Response Framework

As well as reporting incidents to SHOT/SABRE they should also be recorded with NHS England. The system was formally known as the NHS Serious Incident Framework, as part of the Strategic Executive Information System (StEIS). This has now been replaced by the Learn from Patient Safety Events service (LFPSE) and will allow organisations to record patient safety events and access data on recorded events. A "Never Event" in transfusion practice relates to an "Unintentional transfusion of ABO-incompatible blood components", this should be identified both within the SHOT report and LFPSE.[9]

6.4 Serious Adverse Events

The MHRA defines Serious Adverse Events (SAE) for transfusion as:

"Any untoward occurrence associated with the collection, testing, processing, storage and distribution of blood or blood components that might lead to death or life threatening, disabling or incapacitating conditions for patients or which results in, or prolongs, hospitalisation or morbidity"[10]

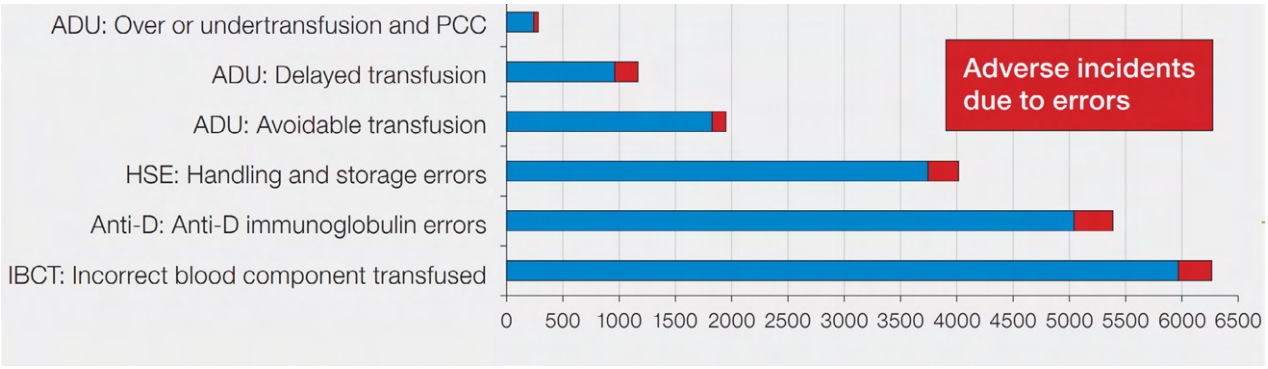


Fig 1. Cumulative Data for Adverse Transfusion Events 1996 - 2022 from the SHOT Annual report 2022[1]

6.4.1 Wrong Component Transfused (WCT)

Wrong component transfused can be split into two categories:

Specific Requirements Not Met (SRNM)	Incorrect Blood Component Transfused (IBCT)
• Irradiated component need • HLA matching • Antigen negative red blood cells when antibodies identified • Extended phenotyping for clinical conditions • Neonatal specification	• Incorrect blood group • Unit intended for another recipient and incompatible • Unit intended for another recipient and compatible • Unit given other than that which was authorised

In the 2022 report there were 296 IBCT incidents an increase from 266 in 2011, of which 87 were WCT slight decrease from 2011 and 209 SRNM, an increase from 173 in 2011. These accounted for 8.5% of all reports. There were two patient deaths in 2022 due to IBCT-WCT errors, both were the result of ABOi red cell transfusions with the primary error in both occurring at the collection step. Major morbidity equated to five cases, one of which was patient with sickle cell disease to the HDU following an ABO incompatible red cell transfusion. The other four cases resulted in sensitisation to the K antigen in patients of childbearing potential due to component selection errors in the Laboratory. In addition to national reporting, such incidents should be internally reported and investigated using a human factors approach. Reports both internal and national should receive feedback and input the Hospital Transfusion Committee.[1,5,11,12] See section 6.2.

PATIENT SAFETY

PREVENTION IS KEY! The implementation and establishment of clear policies, processes and Standard Operating Procedures are essential. Guidance for steps to reduce the risk of IBCT incorrect blood component transfused can be found in **section 5** for clinical practice and **section 3** for supporting information for laboratory processes.

6.4.2 Handling and Storage Errors

As highlighted in Section 5.5, each component type has specific storage, handling and transfusion time requirements; any deviation from these parameters may reduce the quality and safety of the component. 2022 SHOT report data shows a significant proportion of these occurred in the clinical area with the most prevalent causes being technical administration errors and cold chain errors.[1] This forms a consistent pattern over the years, yet with rigorous application of the steps outlined in section 5 and close monitoring, such errors should be avoidable.[3,11]

For further reporting definitions and criteria for Handling and Storage Errors (HSEs), for all adverse event reporting see: Reporting (shotuk.org)

6.4.3 Right Blood, Right Patient

Transfusing an incorrect blood component is a reportable adverse event, because of the potential harm to a patient.

Failure to follow positive patient identification at any point in the process can lead to these errors. Bedside checklists are a final point of confirmation and if used correctly, will minimise incorrect blood component transfusions and help identify where failures of positive patient identification have occurred.[9]

Positive Patient Identifiers
First name
Last name
Date of birth
Unique patient identification number

6.4.4 Near Miss

This category is for any event that, if undetected, could have led to incorrect determination of blood group or transfusion of an incorrect component. Near misses formed the largest proportion of events reported to SHOT in 2022, an increase of 211 cases more than in 2021. The largest number of near misses falls into the Wrong Blood in Tube (WBIT) category, with 734 WBITs incidents reported in 2021 and 890 in 2022.

Incidents of WBITs have steadily increased since 2010, posing an ongoing challenge for HTCs. Reporting near miss events helps promote a proactive approach to safety and allows healthcare staff to recognize and mitigate potential hazards before they cause harm.[1,11]

For further details on WBITs and recommendations for reducing incidence, see the Healthcare Safety Investigation Branch (HSIB) report.

For information on near miss reporting, see chapter 12 of the SHOT annual report.

Delays

A delay in transfusion is defined as significant delay of a transfusion where a blood component was clinically indicated but was not undertaken, or a blood component was not available in an appropriate time frame. Reports of delays in transfusion have been steadily increasing since 2010. While this may be in part due to improved reporting, the most recent SHOT report recognises a multitude of factors influencing the delay of a transfusion including, wrong assumptions, sample errors, IT issues and staffing shortages. Between 2010 and 2020, transfusion delays contributed to 54 potentially preventable deaths. This led to a Central Alerting System (CAS) report issued from SHOT in 2022 outlining the identified safety issues and required actions to prevent such delays. Follow the link to access the full report: CAS-ViewAlert.

6.4.5 Avoidable / Delayed / Under / Over Transfusion (ADU)

Under/Over Transfusion

This relates to an authorised transfusion dose that is inappropriate to achieve the patients' target haemoglobin level. Issues relating to volume and potential TACO are recorded separately. In most cases, this applies to achieving a suitable Hb level, issues relating to volume and potential TACO are recorded separately[10] (see section 6.5.2). A clear understanding of the baseline haemoglobin and target threshold are vital to ensure appropriate transfusion dosing, along with vigilant monitoring throughout the administration to ensure the full dose is delivered in and safe timely manner (see section 5.10).

Avoidable

This category relates to errors in the decision-making process for authorisation, rather than an issue with the component itself. Poor communication once again is a significant factor here, as well as lack of knowledge, and poor decision making. This includes the use of emergency O D negative blood where group specific or crossmatched components were available, and the use of blood where haematinic insufficiencies have failed to be addressed.[10]

SHOT Bites No. 8 addresses key points for the appropriate activation of a Major Haemorrhage Protocol and the use of emergency O D negative units.

THINK PBM

Inappropriate activation of major haemorrhage policies, and failures to deactivate in a timely manner contributed to a large number of avoidable transfusion events. Only 4% of the population have blood type group O D negative, it is a precious resource that requires careful management to ensure it is available for those who really need it. Follow the guidance offered in the NHSBT O D negative tool kit.

6.5 Serious Adverse Reactions

A Serious Adverse Reaction (SAR) is defined as:

"an unintended response in a donor or in a patient that is associated with….. transfusion of blood or blood components that is fatal, life-threatening, disabling or incapacitating, or which results in or prolongs hospitalisation or morbidity" (SHOT 2018)

In 2022 there were 26 deaths associated with SAR to transfusion, with TACO remaining the leading cause of deaths, with an increase from 131 deaths in 2021 to 160 in 2022.

Amongst these cases, it was noted a significant contributing factor was the clinical decision to optimise the haemoglobin in chronically anaemic patients to normal levels as opposed to a patient specific threshold. Chronic anaemia is a key part of the TACO risk assessment.

PATIENT SAFETY

Many transfusion reactions are the result of human error, by not completing all of the suggested pre transfusion checks. In order to start the transfusion, the following must be completed:

- Positive Patient Identification confirmed
- Checks between product, patient and prescription complete
- TACO checklist complete
- Integrity of blood unit
- Informed consent obtained and documented
- Observations complete and within limits normal for patient

The graph below demonstrates the number of cases resulting in major morbidity for each SAR category in 2022.

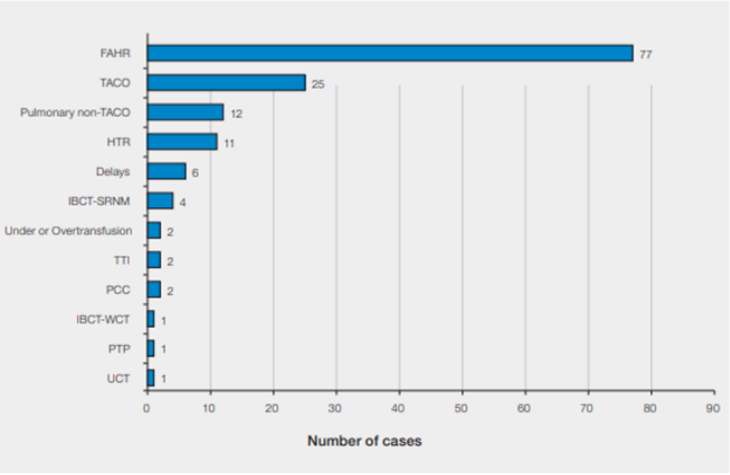


Fig 2. Number of cases resulting in major morbidity for each SAR category in 2022 from the SHOT Annual report 2022[1]

Prevention and management of transfusion reactions can be broken down into the following sequence, which will be explored in more detail below.

Reduce risk → Recognise → Assess → Manage → Report

6.5.1 Reduction of risk

It is imperative that all checks are performed prior to a transfusion, to ensure that:

1. the patient is the correct patient
2. the need for transfusion outweighs the potential risks
3. transfusion is planned for an appropriate time and place

Positive Patient Identifiers
First name
Last name
Date of birth
Unique patient identification number

During the processing and manufacture of blood components, several steps are taken to reduce the risk of various transfusion reactions. See section 2.3.

6.5.2 Transfusion Associated Circulatory Overload

Transfusion Associated Circulatory Overload (TACO) is defined as acute or worsening respiratory compromise and/or acute or worsening pulmonary oedema during or up to 12 hours after transfusion, with additional features including cardiovascular system changes not explained by the patient's underlying medical condition; evidence of fluid overload and a relevant biomarker. TACO occurs for a variety of reasons and is one of the biggest causes of mortality and morbidity in transfusion. There are three key recommendations for reducing the risk of TACO.

- A formal pre-transfusion risk assessment for all patients receiving a transfusion. SHOT have developed a checklist template for trusts to use.
- Carry out a structured investigation for each TACO incident to ensure all measures are taken to protect patients from TACO.
- Utilise weight adjusted dosing to guide volume requirements in non-bleeding adult patients.

TACO Checklist	Patient Risk Assessment	YES	NO
	Does the patient have any of the following: diagnosis of 'heart failure', congestive cardiac failure (CCF), severe aortic stenosis, or moderate to severe left ventricular dysfunction?		
	Is the patient on a regular diuretic?		
	Does the patient have severe anaemia?		
	Is the patient known to have pulmonary oedema?		
	Does the patient have respiratory symptoms of undiagnosed cause?		
	Is the fluid balance clinically significantly positive?		
	Is the patient receiving intravenous fluids (or received them in the previous 24 hours)?		
	Is there any peripheral oedema?		
	Does the patient have hypoalbuminaemia?		
	Does the patient have significant renal impairment?		

If Risks Identified	YES	NO
Review the need for transfusion (do the benefits outweigh the risks)?		
Can the transfusion be safely deferred until the issue is investigated, treated or resolved?		

If Proceeding with Transfusion: Assign Actions	TICK
Body weight dosing for red cells	
Transfuse a single unit (red cells) and review symptoms	
Measure fluid balance	
Prophylactic diuretic prescribed	
Monitor vital signs closely, including oxygen saturation	

Name (PRINT):	
Role:	
Date:	Time (24hr):
Signature:	

Due to the differences in adult and neonatal physiology, babies may have a different risk for TACO. Calculate the dose by weight and observe the notes above.

TACO=transfusion-associated circulatory overload

Fig 3. TACO pre-transfusion checklist from SHOT 2021[13]

6.5.3 Recognition and initial management of a transfusion reaction

Most reactions occur within the first 15 minutes of the transfusion starting; however, it is possible for reactions to be delayed for hours or even days following transfusion.

In order to ensure rapid recognition of a reaction, it is essential that the patient is monitored during and following the transfusion (see section 5.10 on minimum monitoring that should occur). Pre-transfusion observations are required to provide a reference point for significant deviation during transfusion. If transfusion occurs as a day-case procedure the patient should be informed of the symptoms of a delayed reaction and given a point of contact, available 24 hours a day.[14]

Staff competent to administer blood components have a responsibility to be able to recognise a transfusion reaction and act appropriately.

SYMPTOMS THAT MAY SUGGEST AN ACUTE TRANSFUSION REACTION

- Fever
- Chills
- Rigor
- Tachycardia
- Hyper/Hypo tension
- Collapse
- Flushing
- Urticaria
- Respiratory distress
- Pain
- Malaise
- Nausea/vomiting

6.5.4 Management of Transfusion Reactions

If any of the above symptoms occur or if there is any concern over the patient's condition:

- STOP the transfusion immediately
- Assess the patient
- Check patient ID/blood compatibility label
- Seek senior medical assistance

The BSH provides guidelines for the management of transfusion reactions, summarised in the flow chart below. This guidance can also be accessed via the Blood Assist app.

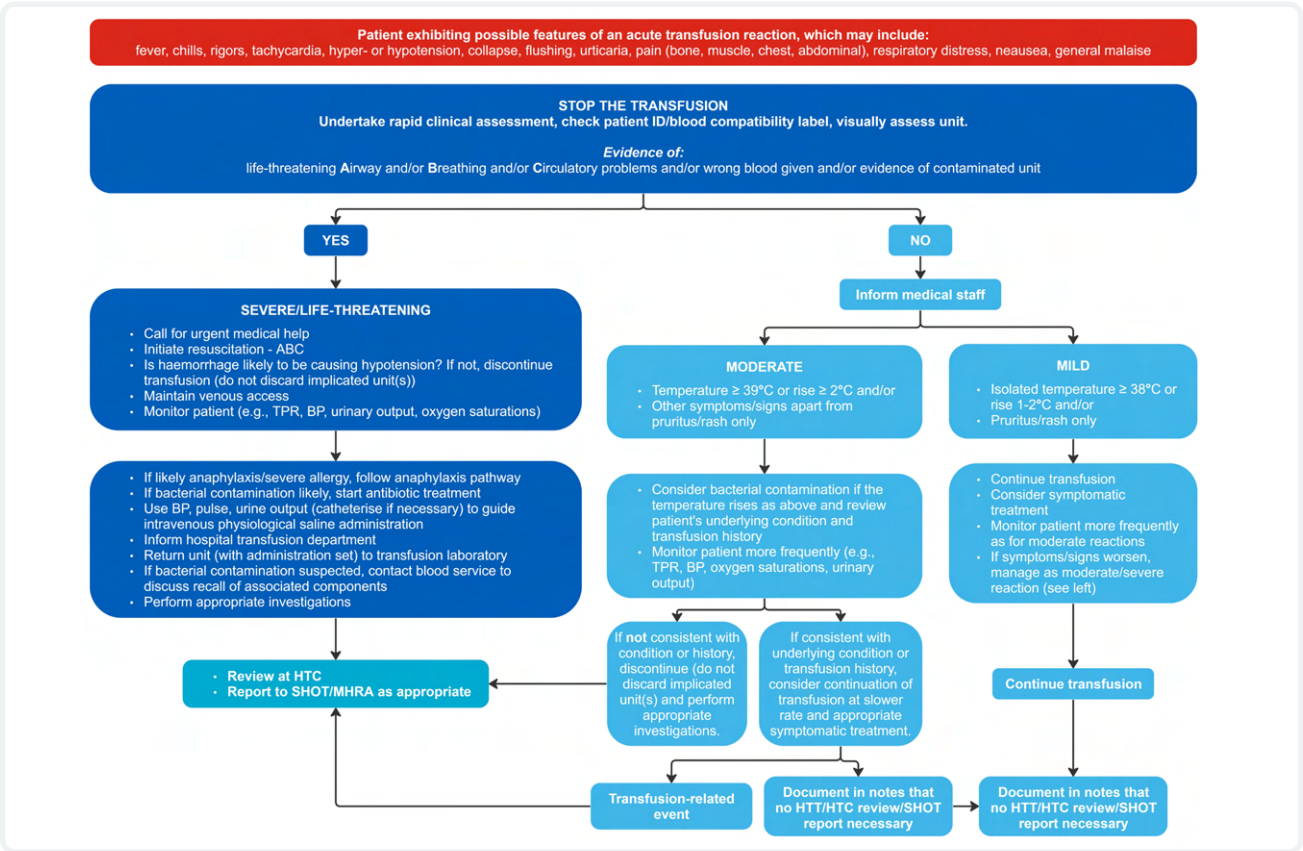
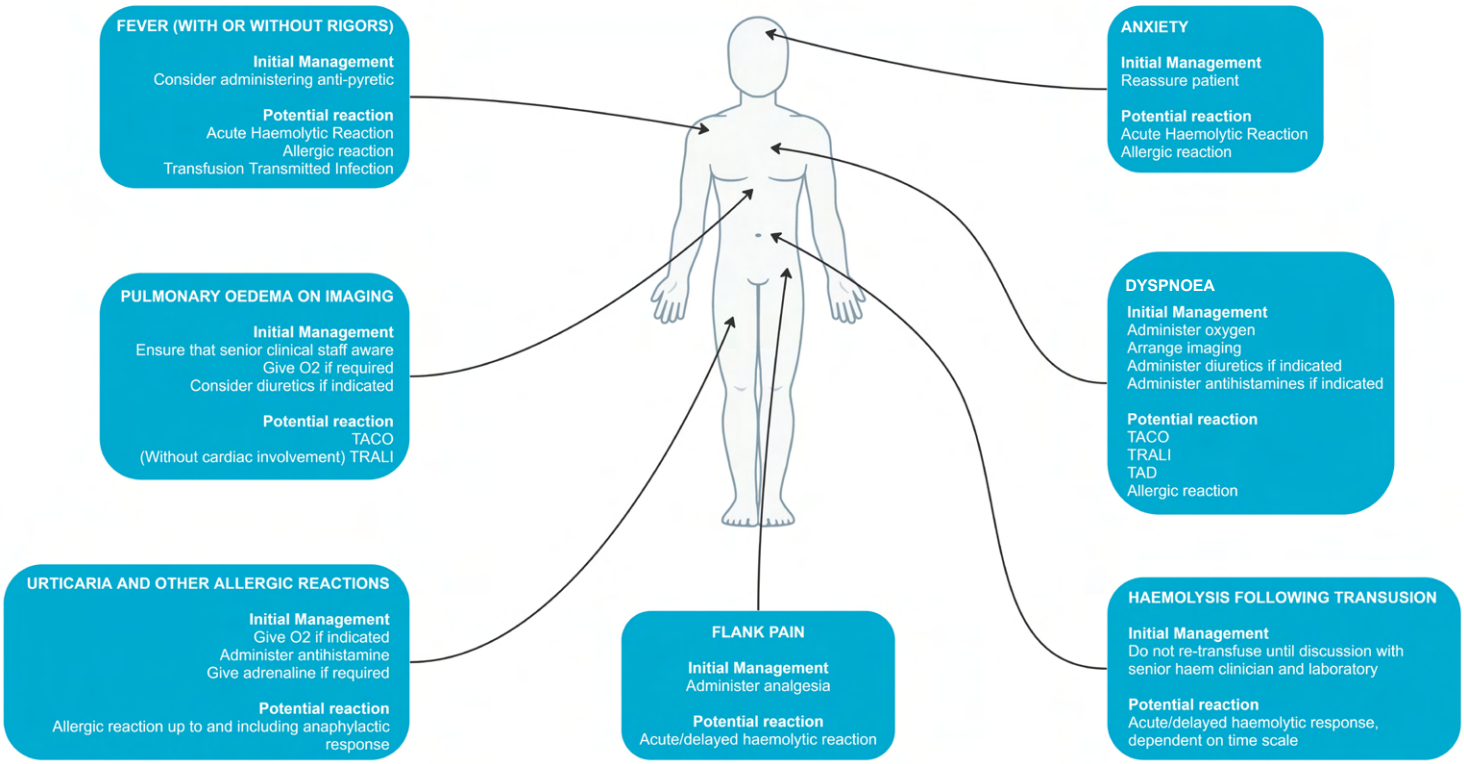


Fig 4. Guideline on the investigation and management of acute transfusion reactions Richard Soutar, Wendy McSporran, Tracey Tomlinson, Catherine Booth, Sharran Grey. First published: 26 April 2023[14]

In the event of severe or moderate reactions, advice and guidance from the Hospital Transfusion Laboratory (HTL) and haematologists should be sought, as it is likely that additional blood tests will be required. It is essential that the unit is returned to the HTL and quarantined. The unit may need to be returned to NHSBT for further testing. The patient may require additional monitoring and may need to be transferred to an area able to provide a higher level of care.[14]

SIGNS AND SYMPTOMS

The diagram below outlines some of the initial management that may be required depending on the symptom exhibited.



PATIENT SAFETY

All moderate and severe reactions should be reported. For guidance on reporting see **section 6.3**.

6.5.5 Types of transfusion reaction

It may not be possible to define the specific reaction initially. It is important to focus on the management of the symptoms of the reactions first. Defining the reaction may not be possible until after further testing of the unit and patient.

Most staff who administer blood do not need to understand the different types of reactions; however, a Transfusion Practitioner will need a greater level of knowledge and understanding as they may be responsible for supporting appropriate actions for the affected patient, as well as escalating the incident internally and externally to organisations such as NHSBT and SHOT.

The categories of Severe Adverse Reaction for reporting purposes are as follows:

Reaction type	SHOT code
Febrile, allergic and hypotensive reactions formerly known as Acute Transfusion Reactions – ATR	FAHR
Haemolytic Transfusion Reaction- Acute (symptoms within 24 hours of transfusion) Haemolytic Transfusion Reaction-Delayed (symptoms 24 or more following transfusion)	HTR- Acute HTR- Delayed
Post Transfusion Purpura	PTP
Uncommon or new complications of transfusion – does not fall into other categories	UCT
Transfusion Associated Graft versus Host Disease	Ta- GvHD
Transfusion Associated Circulatory Overload	TACO
Transfusion Associated Dyspnoea	TAD
Transfusion Related Acute Lung Injury	TRALI
Transfusion Transmitted Infection	TTI
All Anti D Errors not including allergic reaction (should be reported via yellow card)	Anti-D
Events and reactions associated with cell salvage	Cell Salvage

PAEDIATRICS/NEONATES

Transfusion Reactions

Acute side effects from transfusion may be greater for children than adults, a single unit of blood transfused to a child has greater potential to cause harm as it is likely to represent a greater proportion of their total blood volume. Neonates in particular have increased risks due to their potential need to be intensively transfused, immature immune and metabolic systems, and rapid development.[15]

Studies suggest there is greater prevalence of reactions in paediatric and neonatal transfusion, particularly in platelet transfusions with allergic, febrile, or mixed allergic and febrile reactions being the most common among children.[16]

There are specific recommendations (BSH 2016) for pre-compatibility testing in neonates and infants less than four months old, in component requirements for children under one year of age, and for neonatal exchange and intrauterine transfusion.For more information, **view the full guidelines here**.[17]

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Major Haemorrhage, Emergency Preparedness and Resilience

Availability of blood components and providing appropriate components in a timely manner is essential to ensure patient safety and reduction of risk, whether for a major haemorrhage within a hospital or provision of components at local or national level.

Maintaining a healthy blood supply relies on carefully planned donation strategies, an understanding of hospital needs via systems such as Blood Stocks Management Scheme (BSMS), appropriate blood use and utilisation of Patient Blood Management (PBM) strategies. See section 9 for more information on BSMS.

This section will cover the recommendations for major haemorrhage management. It will look at the considerations hospitals should take to ensure emergency preparedness in the event of mass casualty and interruptions to blood supply.

7.1 Major Haemorrhage

In 2010, The National Patient Safety Agency (NPSA) issued a Rapid Response Alert (RRA) to hospitals following 11 reports of death and 83 incidents of harm since 2006, due to delays in the provision of blood in an acute emergency. The alert focused on communication, specific trigger phrases to action the major haemorrhage protocol (MHP) (e.g. Code Red) and a dedicated co-ordinator to communicate between the clinical area and the hospital transfusion laboratory (HTL). The alert emphasised that urgent provision of blood should not require the authorisation of a haematologist, but they, along with the HTL, should be alerted at the earliest opportunity.[1] It is equally important that HTL staff are informed to stand down in a timely manner, to allow them to re-prioritise work accordingly. Any unused components and all traceability tags must be returned to the HTL as soon as possible.[2]

There are variable definitions of major haemorrhage based on volumes of blood loss, or volume of blood transfused over a period. These are retrospective definitions, arguably arbitrary, and difficult to apply in the acute situation. The current trend is towards the use of a more anticipatory or dynamic definition for major haemorrhage (MH), based on the clinical status of the patients.[1] This example applies to adults: -

"Bleeding which leads to a heart rate more than 110 beats/min and/or systolic blood pressure less than 90 mmHg."[1]

Staff must be trained to recognise blood loss, ideally before significant incremental haemodynamic changes, and have access to local major haemorrhage policies, with clearly defined and agreed triggers that meet the requirements of specific specialities such as paediatrics and obstetrics.

Treatment of MH with blood components should be carefully guided by close monitoring of blood test results, point of care testing (POCT) where available and HTL input.[1] The BSH recommend blood samples should be taken every 30–60min depending on the severity of the haemorrhage, to guide and ensure the appropriate use of blood components.[1]

Here is a general summary of the clinical recommendations for management of MH, including component use. It is important to understand that management will vary depending on the cause of blood loss. For further information and specific recommendations for specialities, **see the full guidelines here**.

PATIENT SAFETY

These key safety alerts apply to all types of MH including obstetrics, paediatrics, and neonates:

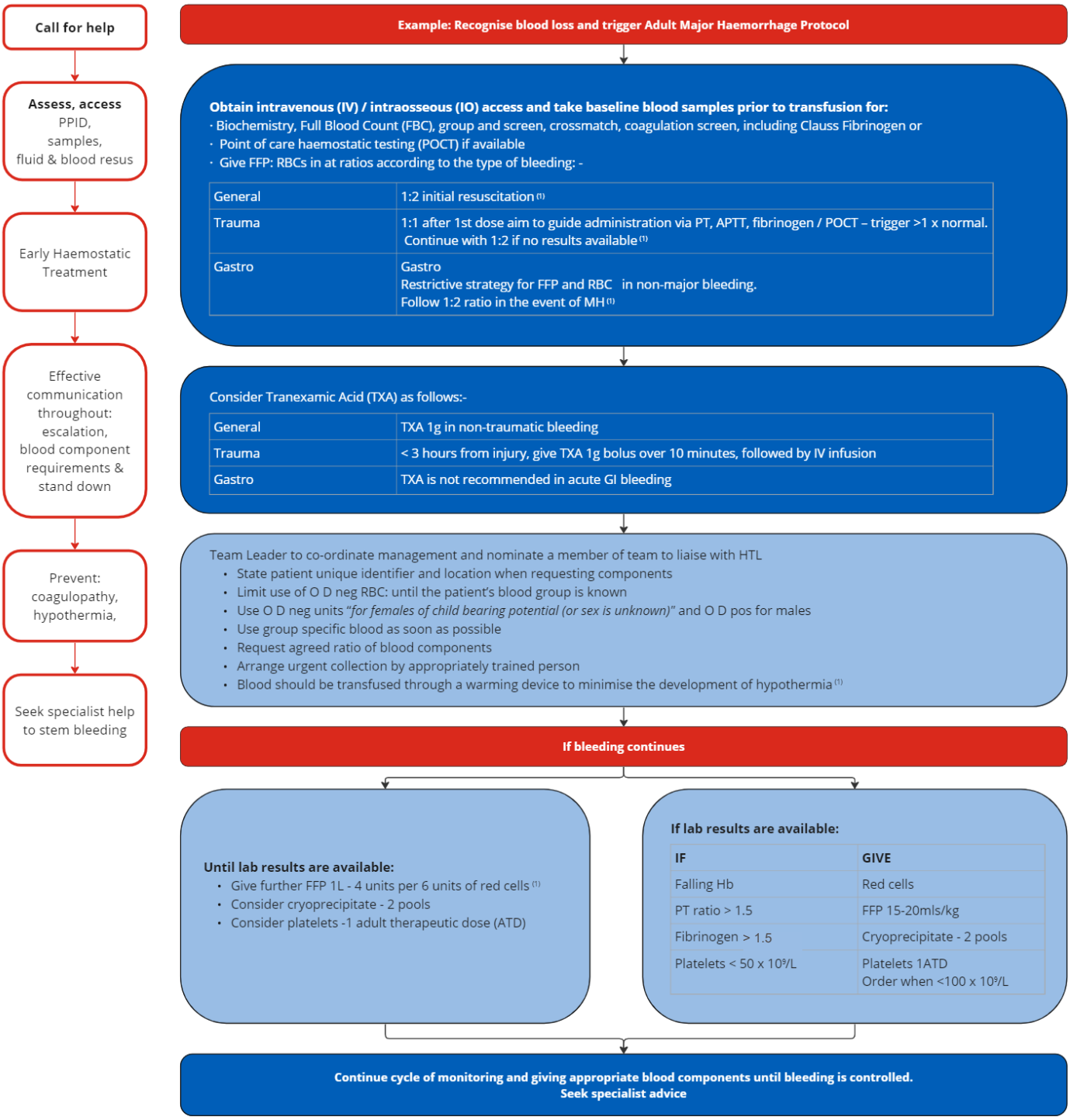
"While national guidelines for appropriate use of O D Neg still refer specifically to female <50 years, wider consideration must be taken for all people of childbearing potential, and age ranges specified in hospital policy may reflect your local patient demographic."

Reverse anticoagulants at the earliest opportunity. PCC and intravenous Vitamin K should be used if immediate warfarin reversal is required. Seek haematologist advice for Direct Oral Anticoagulant (DOAC) reversal (follow local hospital Trust guidance).[1]

Give Tranexamic acid as early as possible (within three hours from injury), this is now supported by ambulance services in the UK.[1] Check if first dose has already been administered in the pre-hospital care setting.

Calcium levels should be monitored and supplemented as appropriate.[1]

Once bleeding is controlled, there is no indication to restore Hb to physiological levels.[1]


Call for help
Assess, access PPID, samples, fluid & blood resus
Early Haemostatic Treatment
Effective communication throughout: escalation, blood component requirements & stand down
Prevent: coagulopathy, hypothermia,
Seek specialist help to stem bleeding
Example: Recognise blood loss and trigger Adult Major Haemorrhage Protocol
Obtain intravenous (IV) / intraosseous (IO) access and take baseline blood samples prior to transfusion for:
· Biochemistry, Full Blood Count (FBC), group and screen, crossmatch, coagulation screen, including Clauss Fibrinogen or
· Point of care haemostatic testing (POCT) if available
· Give FFP: RBCs in at ratios according to the type of bleeding: -
General
1:2 initial resuscitation (1)
Trauma
1:1 after 1st dose aim to guide administration via PT, APTT, fibrinogen / POCT – trigger >1 x normal. Continue with 1:2 if no results available (1)
Gastro
Gastro
Restrictive strategy for FFP and RBC in non-major bleeding.
Follow 1:2 ratio in the event of MH (1)
Consider Tranexamic Acid (TXA) as follows:-
General
TXA 1g in non-traumatic bleeding
Trauma
< 3 hours from injury, give TXA 1g bolus over 10 minutes, followed by IV infusion
Gastro
TXA is not recommended in acute GI bleeding
Team Leader to co-ordinate management and nominate a member of team to liaise with HTL
• State patient unique identifier and location when requesting components
• Limit use of O D neg RBC: until the patient's blood group is known
• Use O D neg units "for females of child bearing potential (or sex is unknown)" and O D pos for males
• Use group specific blood as soon as possible
• Request agreed ratio of blood components
• Arrange urgent collection by appropriately trained person
• Blood should be transfused through a warming device to minimise the development of hypothermia (1)
If bleeding continues
Until lab results are available:
• Give further FFP 1L - 4 units per 6 units of red cells (1)
• Consider cryoprecipitate - 2 pools
• Consider platelets -1 adult therapeutic dose (ATD)
If lab results are available:
IF
GIVE
Falling Hb
Red cells
PT ratio > 1.5
FFP 15-20mls/kg
Fibrinogen > 1.5
Cryoprecipitate - 2 pools
Platelets < 50 x 10⁹/L
Platelets 1ATD
Order when <100 x 10⁹/L
Continue cycle of monitoring and giving appropriate blood components until bleeding is controlled.
Seek specialist advice

THINK PBM

While rapid access to emergency red cells (O D negative or O D Positive, where appropriate) is routine for emergencies, steps to ensure transition to group specific components are also important. Ensure a crossmatch sample is taken and correctly labelled prior to administration of the first unit of any unmatched component, and follow robust processes within in the HTL to rapidly supply group specific units in an emergency.

Tranexamic Acid (TXA) is recommended for use in traumatic injury with major haemorrhage or where the patient is at risk of major blood loss (except where contraindicated). It should also be considered for use in non-traumatic major haemorrhage.[1] However, the HALT-IT trial found TXA to have no effect on reducing mortality risks in GI bleeding.[5]

Intraoperative Cell salvage (ICS) provides the ability to supply washed salvaged red cells rapidly and can be of great benefit in certain emergency situations, reducing exposure of patients to donor blood, and preserving O D negative supplies. A 24-hour service is recommended for cardiac, obstetric, trauma and vascular centres.[1]

In 2017 an addendum to the BSH (2015) guidelines was issued, suggesting the use of ABO incompatible platelets (negative for high titre agglutinins) for the management of major haemorrhage was appropriate. D negative platelets should be made available for women <50 years of age, where group is unknown.[6] For further information on PBM initiatives see **section 8**.

Major Obstetric Haemmorrhage (MOH)

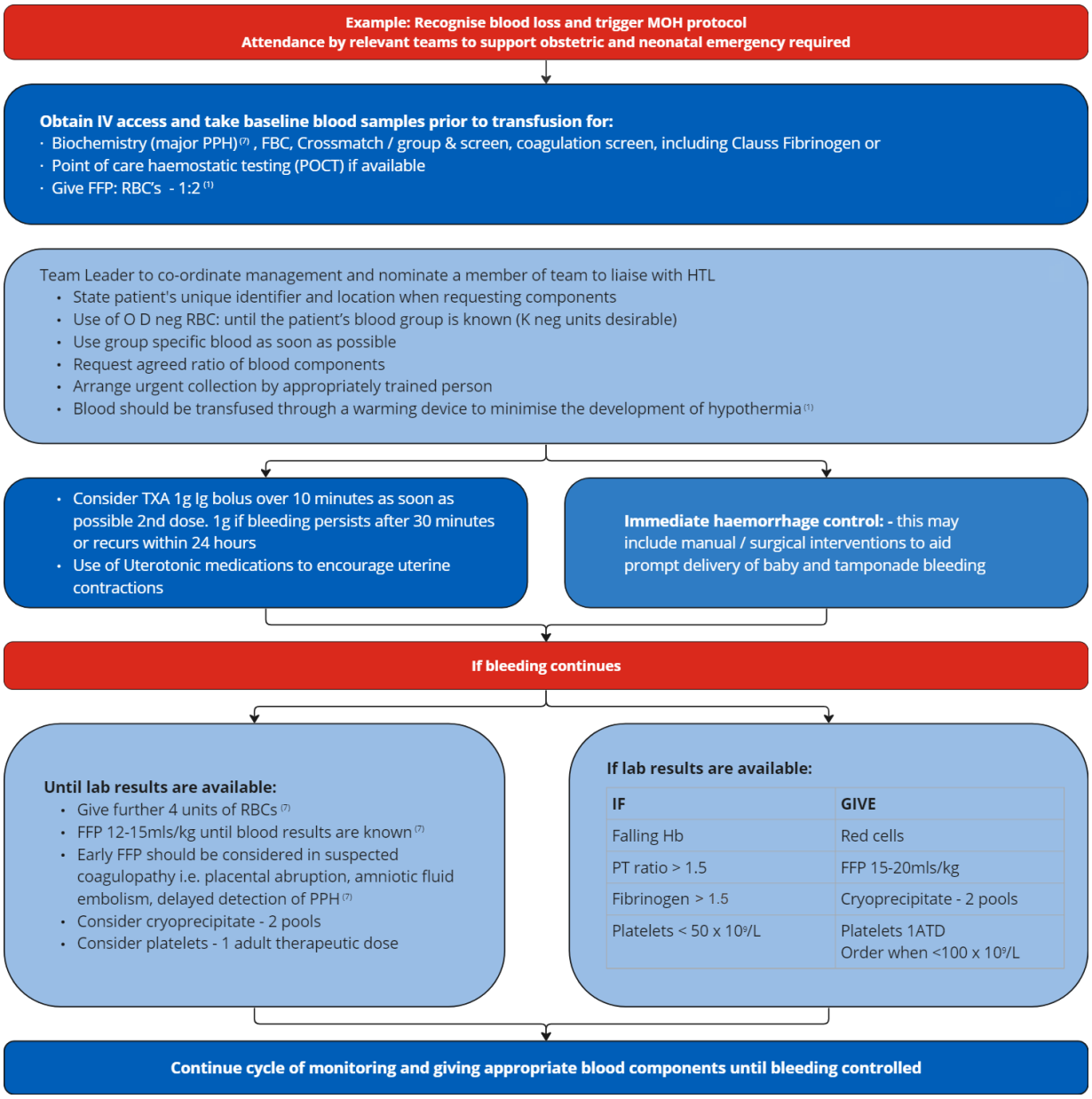
At full term the blood flow to the uterus is approximately 700mL per minute and bleeding can be catastrophic. Obstetric haemorrhage encompasses ante-partum haemorrhage (APH) and postpartum haemorrhage (PPH).[14]

APH is defined as bleeding from or into the genital tract, occurring from 24+ weeks of pregnancy and prior to birth of the baby. 3-5% of pregnancies are complicated by APH and are the leading cause of perinatal and maternal mortality worldwide.[15] The leading risk factors for APH are placental praevia, placental abruption and local bleeding (for example vulva, vagina, or cervix).[15] There are several risk factors for APH including pre-eclampsia, previous pregnancies with placental abruption, previous caesarean sections, premature rupture of membranes, assisted conception, multiparty and trauma or previous surgery resulting in deficient endometrium, as well as advanced maternal age, smoking and drug abuse.[15] This is not an exhaustive list of risk factors but highlights the importance of effective antenatal care and optimisation of a patient's own blood supply throughout the pregnancy, to guide them through a less potentially complicated delivery.

PPH is the most common cause of MOH[7] and can usually be defined as an estimated blood loss >1000mL during a caesarean section or >500ml after a vaginal birth[1] due to atony, retained products or placental accreta. PPH remains a leading cause of early maternal death, and a major cause of morbidity due to hysterectomy, anaemia, and associated risks of blood transfusion. Management of haemorrhage should focus on obstetric intervention including uterotonic drugs, surgical procedures as well as following the same key principles of major haemorrhage management in the event of severe or catastrophic bleeding.[1] This includes early recognition, risk management, good communication, collaboration, appropriate treatments, and blood component support. Transfusion should be guided by ongoing clinical assessment and laboratory test results, with meticulous attention to fibrinogen levels,[1, 7] due to the increase in levels during pregnancy (range of 4-6g/l at delivery versus 2-4g/l non-pregnant).

For more information see **section 8.3.7**.

The PRactical Obstetric Multi-Professional Training (PROMPT) course is an evidence-based training package that teaches healthcare professionals how to respond to obstetric emergencies including APH and PPH. It is also acknowledged by the Royal College of Gynaecologists (RCOG) and Royal College of Midwives (RCM) and is widely embedded into hospital maternity departments training programmes. To find out more about the course please click the link **PROMPT Maternity Foundation**.



* RCOG recommend maintaining the platelet count above 50 x10^9/l in the acutely bleeding patient, using a trigger of 75 x10^9/l to provide a margin of safety with ongoing bleeding.

THINK PBM

Maternal anaemia increases the risk of primary PPH. Timely recognition and treatment of maternal anaemia not only reduces the risk of blood loss, but of the adverse outcomes from PPH and risks associated with transfusion in major haemorrhage. Consider risk factors for APH and PPH as well as medications that may contribute to bleeding when optimising in the antenatal (AN) period or establishing possible cause(s) in the delivery / post-partum period.

Tranexamic acid should also be considered for use in obstetric haemorrhage, the WOMAN trial showed reduction in bleeding deaths and need for surgery in women with PPH.[1] A second dose is recommended where bleeding persists after 30 minutes or recurs within 24 hours. Use of Intraoperative Cell salvage (ICS) in obstetrics is endorsed by NICE and salvaged blood should be transfused through a leucodepletion filter.[17] RCOG recommends Cell Salvage for patients where the anticipated blood loss is great enough to induce anaemia or expected to exceed 20% of estimated blood volume.[16] A minimum dose of 1500iu anti-D immunoglobulin should be given following the reinfusion of salvaged red cells in D negative women who have delivered O D Pos (or unknown group) baby.[16]

Follow this link to **the patient information leaflet on PPH from the Royal College of Obstetricians and Gynaecologists**. For further information on PBM initiatives see **section 8**.

PAEDIATRICS

Major haemorrhage due to trauma is uncommon in children, therefore such situations usually occur in a surgical setting. Children's blood volume varies through age ranges from 90mls/kg in infancy, down to 70/80 mls/kg in later childhood. It is often widely accepted to use an average of 80mls/kg.[8]

Major haemorrhage in children may be defined as:

1. Loss of one blood volume in 24 hours (approximately >80ml/kg in those <40kg) or
2. Loss of 50% blood volume in three hours (approximately 40ml/kg in those < 40kg) or
3. Loss of >3ml/kg/min

Just as with adults haemodynamic instability as an indicator for MH is often more practical, however, it is important to recognise that children may compensate much longer than adults. Therefore, instability may present much later and the clinical implications of recognising blood loss at this point have the potential to be greater.

BSH Guidelines for the transfusion of fetuses, neonates, and older children (2016) broadly advocate the same principles for adult management of MH for the care of children, focusing on the need for training and education, early recognition along with clear communication and multi-disciplinary co-operation.

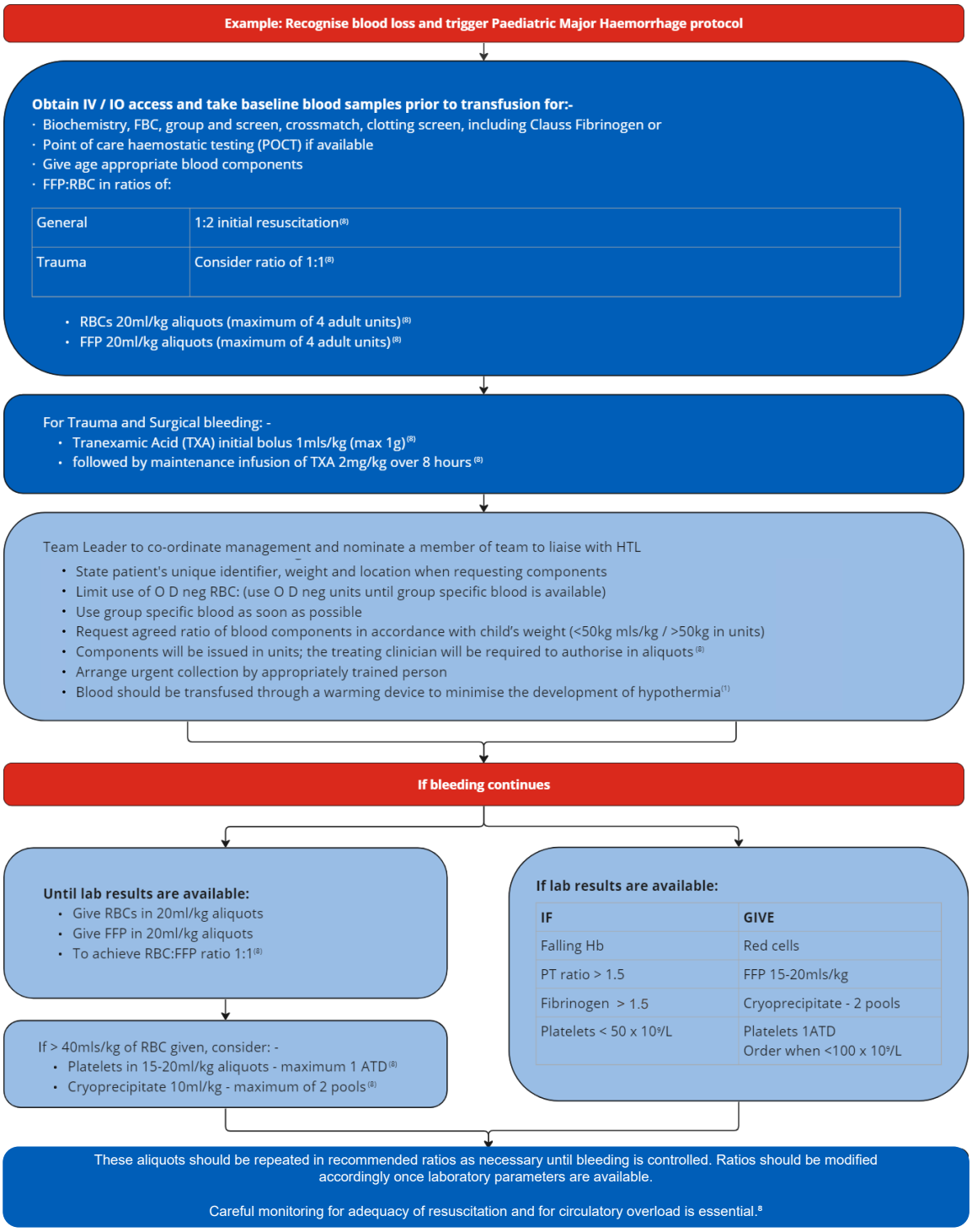
There are some specific considerations to consider, however, with this varied cohort of patients:

- transfuse age-appropriate components where possible
- do not delay - if unavailable use the most appropriate component until age-appropriate components are available
- samples are taken prior to administration of first unit, if group unknown, allowing a switch from emergency O D negative to group specific at the earliest opportunity
- components ideally should be transfused on a volume basis in mls/kg for children <50kg in weight
- component use should be guided by ongoing clinical assessment and laboratory results, including haemostatic testing at the earliest opportunity, until bleeding is controlled with careful monitoring of circulatory overload

Therapeutic aims:

- Hb =80 g/L
- fibrinogen >1.5 g/L
- PT ratio <1.5
- platelet count > 75 x 10^9/L[8]

For more information, see the full BSH guidance Transfusion for Fetuses, Neonates and Older Children (b-s-h.org.uk)



THINK PBM

Pre-operative anaemia should be investigated, diagnosed, and treated.

A perioperative Hb transfusion threshold of 70g/l should be used in stable patients without major co-morbidity or bleeding[8]

Tranexamic acid should be considered in all children undergoing surgery where there is risk of significant bleeding (<40ml/kg is anticipated); little published evidence in neonates undergoing non-cardiac surgery[8]

ICS should be considered in all children at risk of significant bleeding undergoing surgery and where transfusion may be required, providing there are appropriately trained staff[8]

For major haemorrhage in neonates, apply the same principles of the management of major bleeding in children as there is little evidence for this age group[8]

Audit and review of major haemorrhage events

Reports of delays in provision of blood components continue to rise, resulting in a Central Alerting System (CAS) report in 2022 from Serious Hazards of Transfusion (SHOT). The alert stipulated actions to ensure key national guidance and recommendations were adhered to and that mechanisms are in place to ensure rapid release of blood components and prothrombin complex concentrate (PCC). The NPSA RRA and CAS recommendations and actions should be incorporated into local policy, tailored to specific systems, layout, and requirements of each Trust.

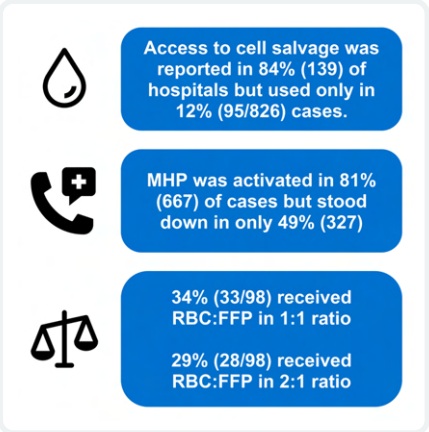
Follow this link to see the full CAS alert.

Failing to recognise bleeding and poor communication are contributing factors to delays and support the need for regular training and MH drills or simulations, not only to reinforce protocol but to embed clear communication processes between teams.[3]

Issues that occur in a MH that fall into a specific SHOT reporting category (follow this link for these reporting categories) must be reported to the relevant body or bodies, as required. Some Trusts prefer all MHs to be reported internally to monitor frequency, severity and to implement any further patient safety improvements.

Monitoring and audit of MH are agreed at local level, and your policy should outline the process, frequency, and criteria. For more information about reporting see section 6.

In 2018, 165 hospitals participated in the National Comparative Audit (NCA) for Management of Major Haemorrhage. All hospitals had protocols in place and 99% of Trusts had a 24/7 HTL service, to support the activation of a MHP.



The audit made several recommendations for Trusts to support best practice in major haemorrhage management. Such as:

- Clinical teams are trained to recognise blood loss that requires activation of the major haemorrhage and how and when to stand down the major haemorrhage call.
- Routine audit and regular training and drills are carried out for major haemorrhage events.
- Clotting screens including fibrinogen levels are taken to guide component use and management of bleeding.
- Pre-thawed FFP can be considered for use by Major Trauma Centres (MTCs) and very high use hospitals to help reduce wastage.[4]

Follow this link for the report, including further findings and recommendations.

7.2 Emergency preparedness, resilience and response, Major incidents and shortages

It is a statutory requirement that all NHS organisations, and departments within them, must be prepared for emergency situations and have an emergency preparedness policy in place; this includes blood transfusion teams.[9] Most Trusts will have an overarching Emergency preparedness, resilience and response (EPRR) representative and a senior working group to ensure plans are put into place. As a member of the blood transfusion team, you must be familiar with the Trust's wider EPRR policy and ensure that the transfusion and bloodstocks preparedness plans are regularly reviewed and up to date.

The National Blood Transfusion Committee (NBTC) has developed guidance relating to EPRR and transfusion that can be used as a guide for hospital transfusion teams. It was initially developed following the London bombings in 2005 and related primarily to mass casualty events. It was updated in 2019 and 2020 to broaden its scope to other incidents that may cause disruption, for example IT outages or adverse weather.[10] There are two broad categories where transfusion would be significantly affected: blood shortages and major incidents, with potential overlap between them.

7.2.1 Shortage planning

It is critical that transfusion support remains available for patients who need it most in an emergency, and NHS planning requires contingency plans to ensure the effective use of blood components when stocks fall to very low levels.

Blood supply shortages in England are uncommon, however, in October 2022, NHS Blood and Transplant issued its first ever amber alert when blood supplies reached a critically low level. This was due to several compounding challenges, including sickness, recruitment and retention of donor staff and extreme weather conditions, all of which cause difficulties in collecting sufficient blood from donors.

With support from the NBTC an integrated plan for the management of red cell shortages[11] was first issued in July 2004, with a platelet shortage plan[12] following in September 2006 and most recently a plasma shortage plan. These have been reviewed and updated several times.

The plans are designed to ensure that:

- Red cells / platelets are available for all essential transfusions for all patients equally across the country
- Overall red cells / platelet usage is reduced to ensure the most urgent cases receive the available units.[8,9]

Both the red cell shortage and platelet shortage plans are structured to provide a framework of actions for NHSBT and hospitals on four phases – green, blue (pre-amber), amber and red, dependent on NHSBT stock levels. They include generic actions for hospitals during each phase, with key indications for transfusion and PBM recommendations to assist with prioritising patients to achieve a reduction in use. It is recommended each hospital has their own specific Emergency Blood Management Arrangement (EBMA) as part of an overall emergency planning policy.

The group responsible for managing these arrangements (the Emergency Blood Management Group (EBM group) should have direct links to a senior EPRR representative. A serious shortage, which may result in postponing surgeries, should be considered a critical incident within the Trust.[11,12]

A range of resources and recommendations can be found on the following NBTC website to support clinical teams Recommendations | National Blood Transfusion Committee.

7.2.2 Mass Casualty Events

NHS England issued clinical guidelines for major incidents and mass casualty events in December 2018 following a period of multiple major incidents in the UK. The incidents presented a range of challenging clinical scenarios, such as blast injury, that was not seen in day-to-day practice. This document allowed the sharing of best practice from such experiences and includes useful references throughout to the management of traumatic major haemorrhage.[13]

The NBTC EPRR document referenced above highlights some of the actions that should be taken by transfusion staff in the event of a major incident. One of the main recommendations is pro-actively using transfusion staff "on the ground". For example, following the Manchester bombings, HTL staff attended the emergency department and assisted in the triaging and allocation of emergency blood components. It is essential that hospital transfusion staff can provide expert transfusion support during incidences and guidance should be utilised to develop plans to support this.[9] As a member of the transfusion team, you should ensure that you are familiar with your Trust's major incident plans and any action cards relevant to blood transfusion.

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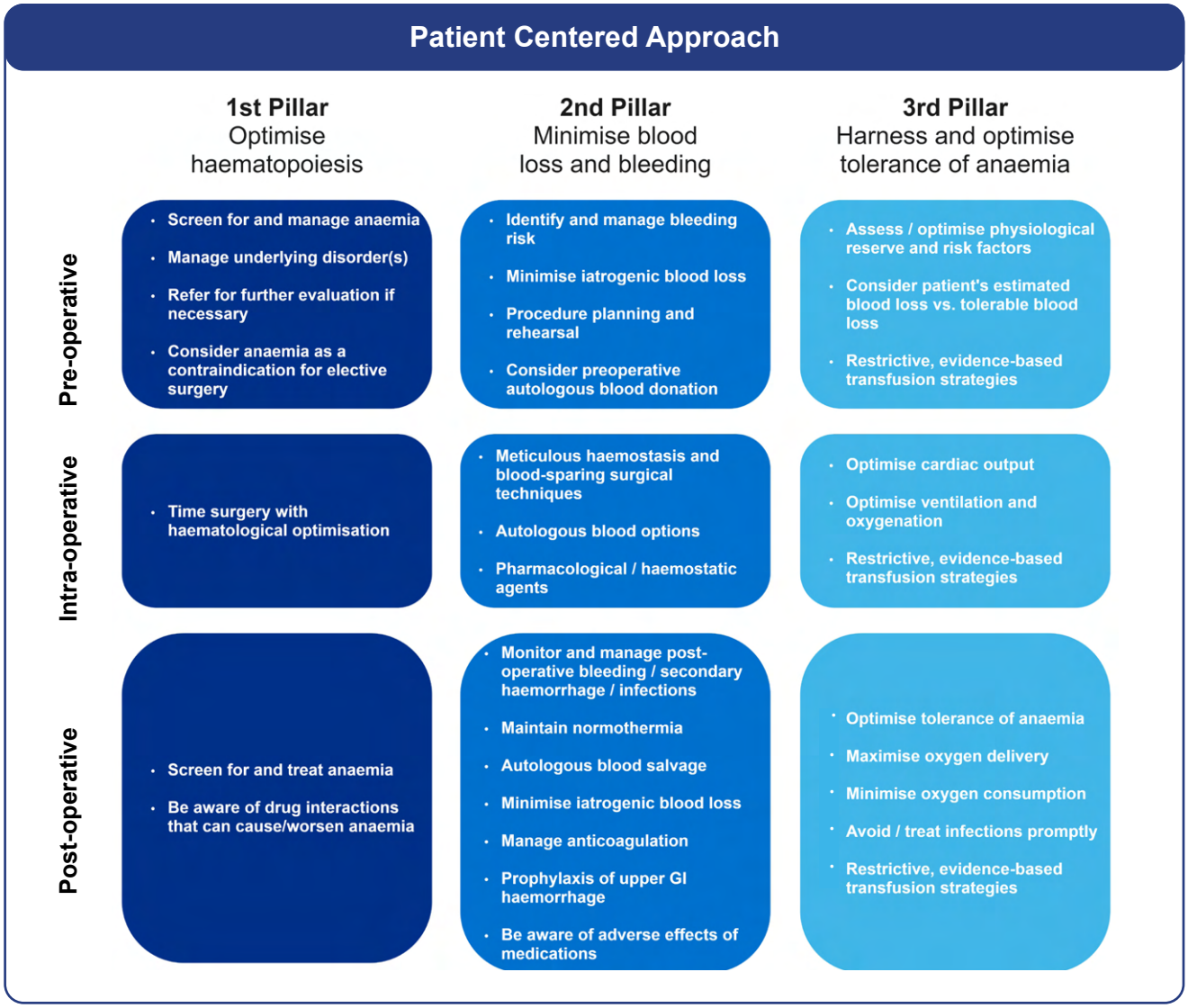
Patient Blood Management and Appropriate Blood Use

8.1 What is Patient Blood Management?

Patient Blood Management (PBM) is a multidisciplinary approach involving the application of evidence based medical and surgical concepts, designed to maintain haemoglobin concentrations, haemostasis and reduce blood loss thus optimising the care of patients and improving patient outcomes.[1,2] PBM is an international initiative for best practice in transfusion medicine with WHO encouraging all member states to implement such initiatives and programmes.[3] PBM is pioneered in England through a joint initiative between NHSBT and the National Blood Transfusion Committee (NBTC), with support from NHS England (NHSE). It began in 1998 with "Better Blood Transfusion", which was superseded in 2012 by Patient Blood Management. Scotland, Wales and Northern Ireland support their own PBM initiatives via their national blood services, with all countries working collaboratively.

The clinical approaches of Patient Blood Management are underpinned by three pillars.



While the three pillars focus on the surgical setting, many of the concepts apply to management of medical patients who may need transfusion. The concepts within the three pillars help put the patient at the heart of clinical decision-making. Historically, transfusion was considered the primary clinical approach and was, for a time, the only available option. However, the 'three pillars approach' ensures patients are optimised utiliisng the best treatment and choice, whilst helping to avoid inappropriate and unnecessary use of blood components.

With the introduction of the 2012 Patient Blood Management Strategy, The NBTC sets out its recommendations for hospitals to support PBM implementation in hospital practice.

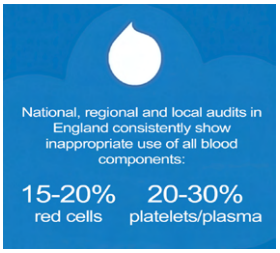
Everyone involved in the transfusion of blood components should be involved in PBM. It requires leadership and support at every level, including health care professionals and hospital trust management, as well as regional and national organisational support, if we are to realise its true potential.

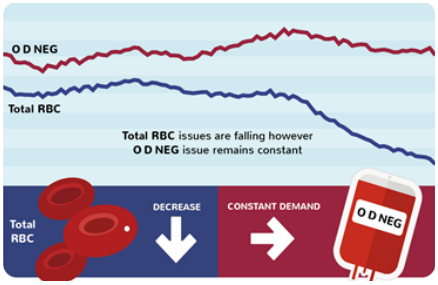
8.2 Why is Patient Blood Management important?

With an aging population, ever-changing societal and environmental factors and new medical advances, PBM has an increasingly important role in healthcare. The growing challenge to meet demand for blood components, including specific requirements and phenotypes, bring with it the challenge of maintaining a robust blood supply. PBM can help provide the balance between supply and demand through appropriate use.

Patient Benefit

Employing alternatives to transfusion reduces a patient's exposure to the risks associated with blood components and avoids inappropriate use. PBM strategies have other benefits, including empowering patient decision-making, reducing the length of hospital stay and improved recovery.





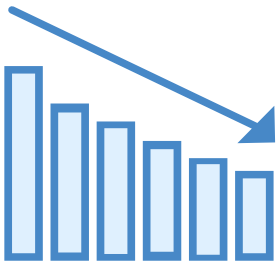
Sustainability

Transfusing blood only when absolutely necessary helps ensure components are available for those who need them most, and where alternatives are not appropriate. Around 7% of the UK population are O D negative, but this blood group accounts for 13% of hospital demand.[7]

Cost

The National Institute for Health and Care Excellence (NICE, 2015) cost analysis for blood transfusion suggests the cost of implementing PBM initiatives will be offset by the savings from reduced component use and length of stay, but also by better utilisation of resources such as staff time and resources. The analysis modelling demonstrated the use of TXA to yield the greatest cost efficiency.[8]

Reduction in blood component use demonstrates the impact of PBM and, whilst the 2018 PBM survey evidenced continuing momentum, it also highlighted the work still to be done. In 2019, the Transfusion 2024 symposium took place and set out a 5-year clinical and laboratory strategy for blood transfusion in England, reflecting the wider aims of the NHS Long Term Plan. Transfusion 2024 focuses on promoting a skilled and trained work force, better use of data and technology and the application of integrated models of working, while upholding the principles of the NHS Patient Safety Strategy.[9] Specific recommendations have been set out regarding PBM as follows:



Patient Benefit

Develop a transfusion practice self-assessment tool for hospitals to allow benchmarking and take initial steps toward external accreditation. (Responsibility of hospital trusts, NBTC, and NHSE).

Resources to support clinical practice

Strengthen the support within hospitals and NHSBT for transfusion practice and develop a competency framework for transfusion practitioners. (Responsibility of NHSBT, NBTC and NHSE).

Inclusion of transfusion in national quality and safety initiatives

Inclusion of relevant and feasible transfusion data in national databases of diseases/outcomes.

Follow this link to view the full Transfusion 2024 report

For further reading, please see:

- NHSE's Long Term Plan
- The Patient Safety Strategy July 2019
- The full PBM 2018 survey

8.3 Initiatives

8.3.1 Consent

Consent is a fundamental legal and ethical principle. All patients have the right to be involved in decisions about their treatment, and healthcare professionals (HCPs) have a responsibility, where possible, to obtain informed consent.

Discussing the risks and benefits, and exploring the alternatives to transfusion, is an essential component of valid consent and good PBM practice. Before any transfusion, HCPs must be satisfied that they have the patient's consent or other valid authority before providing treatment or care. Consent and its practical application are covered in more detail in section 5.2.

PAEDIATRICS/NEONATES

- The British Association of Perinatal Medicine recommends formal written consent for neonatal exchange transfusion. SaBTO recommendations stand for all other paediatric transfusions.[11]
- Children of any age can consent to transfusion if they are deemed to meet Gillick competence criteria. However, it is good practice to discuss treatment with both the parent/carer and the child. Parent/child information leaflets should be provided.[11] These are **available from NHSBT Hospitals and Science website**.

More information on consent for children is available from the **GMC**.

8.3.2 Patient Information

Good quality information helps patients to be prepared and fully aware of the next step in their treatment. Involving patients in their care improves their overall experience. When patients are anxious or worried about their condition, treatment, or procedure, it is often difficult to retain information and NICE Quality standard 138, Statement 4, and NICE guideline NG24, recommend both written and verbal information are provided. Having written information they can go back and re-read is vital.[11,12,13] NHSBT has produced **a series of patient information leaflets to support the care of patients who may need a transfusion**.

8.3.3 Anaemia Management

Anaemia affects around a third of the global population, with World Health Organisation (WHO) suggesting the highest prevalence worldwide is found in pre-school aged children and pregnant women.[14,15] Uncorrected anaemia is associated with increased risk of morbidity and mortality, poor pregnancy outcomes as well as poor physical and cognitive development, and a lack of work productivity of up to 20% in adults.[14] The causes of anaemia are broad and complex, from nutrient deficiency, genetic disorders, auto-immune disease, blood loss, infection, inflammation, and chronic disease. Identifying and treating the underlying cause is the essential first step in anaemia management to effectively optimise the haemoglobin levels.[15]

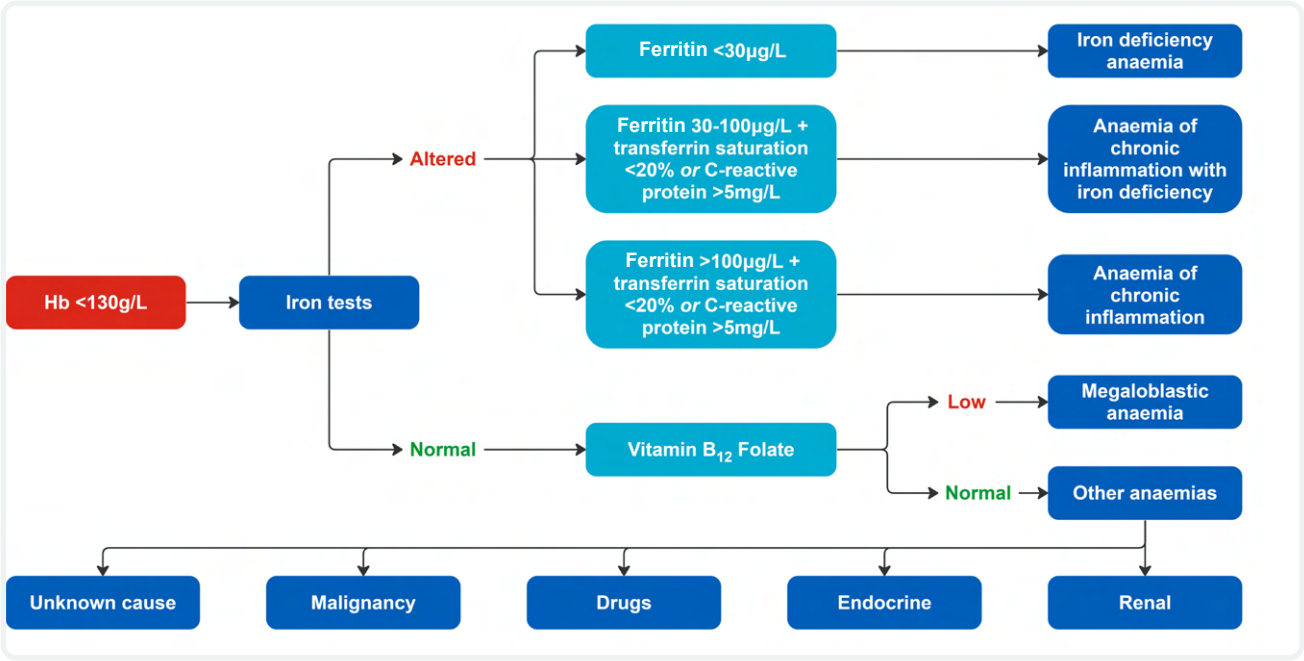


Fig 5. Algorithm for classification of peri-operative anaemia.[1]

With the burden of anaemia becoming more apparent across clinical settings, there are many guidelines to help optimise patients with anaemia. These aim to alleviate the symptoms of anaemia and reduce the potential need for transfusion and its associated risks.

Dietary advice can be effective in preventing and resolving early stages of nutrient deficiency (B12, folate and iron deficiency) but efficacy can be limited by the underlying cause. See the following links for NHSBT's patient information leaflets, such as Iron in your Diet and Anaemia.

Pre-operative Anaemia

Patients with anaemia are five times more at risk of requiring transfusion perioperatively. Pre-operative anaemia is associated with increased risk of mortality, acute kidney injury, and infection. It is suggested the prevalence of anaemia in the pre-operative patient group could be up to 75%,[16,17] posing a significant risk to patients. The application of PBM principles can mitigate these risks and enhance patient care.

The NHSBT PBM team has developed a toolkit for clinicians to support the management of pre-operative anaemia and an online pre-operative anaemia management resource toolkit, providing education resources, guidelines, audits, and resources to support setting up services.

- PBM toolkit
- Pre-operative anaemia toolkit

Iron Deficiency Anaemia

Iron deficiency is the most common cause of anaemia, accounting for over half of all cases of anaemia worldwide. It is the most widespread nutritional disorder, with significant prevalence in the developed world.[14] In the UK, it is estimated to affect 3% of men and 8% of women and is a recognised risk factor for adverse outcomes in pregnancy, chronic kidney disease, gastrointestinal disorders, heart failure and many other chronic diseases.[18,19]

Guidance for the management of iron deficiency anaemia can be found below:

- NICE guidelines for identifying and managing iron deficiency
- RCN guidelines for management of iron deficiency anaemia in adults
- NHSBT PBM toolkit for the management of iron deficiency anaemia

PAEDIATRICS

NICE Blood Transfusion guidelines NG24 apply to all patients over the age of 1 year old. They recommend offering oral iron pre and post surgery to patients with iron deficiency anaemia, and to consider intravenous (IV) iron:

- where oral iron is not tolerated or is unlikely to be absorbed,
- where functional iron deficiency is diagnosed, or
- where the time frame to surgery would not support oral iron therapy.[12]

It is important to note that IV iron is not licenced for use in children; some preparations specify they can be used over the age of 14 years of age, but this is dependant on the manufacturer.[23] The use of IV iron in children is a clinical decision made on a risk/benefit basis, often referred to as "off license prescribing". Local policy should support this decision making process.

B12 & Folate Deficiency

The prevalence of B12 and folate deficiency in the UK is around 6% in people under 60 years of age, and around 20% of people over the age of 60.[20] In addition to the autoimmune disorder pernicious anaemia, B12 and folate deficiency can be caused by poor diet or poor absorption due to gastric disorders, alcoholism, or medications.

Follow this link for **guidance on the recognition and management of B12 and folate deficiency.**

Maternal Anaemia

The British Society of Haematology (BSH) and the Royal College of Obstetricians and Gynaecologists (RCOG) identify obstetric anaemia as a haemoglobin of:

- less than 110 g/L during the first trimester
- less than 105 g/L during the second and third trimester
- less than 100 g/L postpartum

The World Health Organization (WHO) suggests around 38% of pregnant women worldwide suffer with anaemia.[15] There are several causes of anaemia in pregnancy, including haemodilution from plasma expansion, blood loss, B12 & folate deficiency but the most prevalent cause is iron deficiency.[15] The 2018/2019 National Comparative Audit (NCA) of The Management of Maternal Anaemia and Iron Deficiency found 12 and 28-week screening was carried out 97-98% of the time, but of 262 women identified as anaemic, only 55 were commenced on oral iron and 17 were given IV iron.[21] Left untreated, anaemia in pregnancy increases the risk of post-partum haemorrhage and is linked to poor outcomes such as low birth weight and pre-term birth.[22]

For further information and guidance, see **the full audit and the British Society for Haematology (BSH) guidelines for management of iron deficiency in pregnancy**.

Anaemia related to specific disorders

Anaemia is a significant cause of morbidity in many disorders and diseases. Here is a selection of guidelines for further understanding on how diagnosis and management need to be adapted to the underlying cause:

- **NICE Blood and immune system conditions overview**
- **European Society of Cardiologists guidelines for the treatment and management of acute and chronic heart failure**
- **British Society of Gastroenterology guidelines**
- **Chronic kidney disease: assessment and management**
- **Centre for Perioperative Care (CPOC) anaemia in the perioperative pathway**

For further information on the pharmacological therapies options for treating anaemia, see **section 8.3.8**.

elfh
elearning for healthcare

For further learning and education on anaemia, there are a number of e-learning modules hosted via elearning for healthcare. Follow the link here to access the courses listed below:

- Introduction to Anaemia
- Anaemia Management in Primary care
- Anaemia Management in Secondary care
- Anaemia in Chronic Disease
- Management of Maternal Anaemia

8.3.4 Surgical Techniques

Pre-operative planning can reduce the requirement for blood during surgery. Ideally, the patient will be assessed in advance of surgery, and any concerns or adverse test results associated with haemostasis or anaemia, investigated and optimised (see section 8.3.3 and section 8.3.8 for more information). Seek haematology input for more complex cases.

A variety of surgical and anaesthetic techniques are available to minimise blood loss during surgery depending on the type of surgery and anaesthetic used. Examples include:

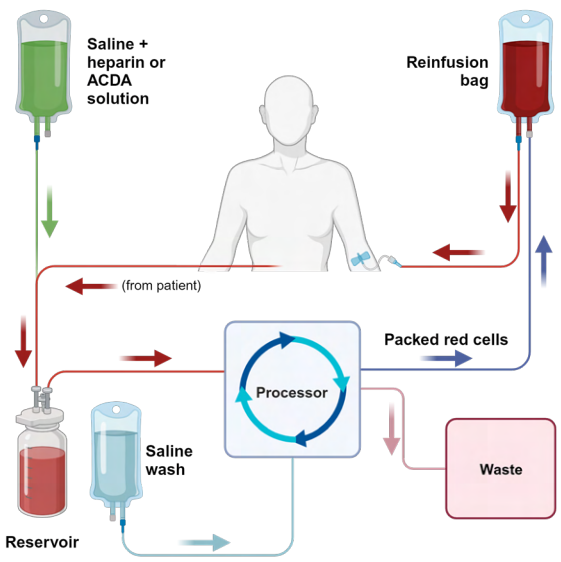
- Patient positioning
- Diathermy
- Use of vasoconstrictors and tourniquets
- Therapeutic hypotension
- Cell salvage
- Drugs which can assist coagulation (for example tranexamic acid and topical haemostatic agents)[24]

8.3.5 Cell Salvage

"Access to 24-hour cell salvage support should be available in cardiac, obstetric, trauma and vascular centres"[25]

Cell salvage is a process whereby a patient's own blood, is collected, washed, and processed using cell salvage equipment. The processed blood is then returned to the patient as packed red blood cells. Cell salvage is utilised in various surgical and obstetric procedures. It is primarily used intra-operatively, but there is limited evidence suggesting its potential use in post-operative situations. However, this post-operative use is not widespread in the UK. NICE recommends further research to determine the efficacy and cost-effectiveness of post-operative cell salvage.

The diagram below demonstrates in simple terms how the procedure functions:



Many hospitals now have cell salvage available for specific cases. Unfortunately, the challenge is usually availability of trained staff, equipment and cost of consumables. Its use can reduce the requirement for allogeneic red blood cell transfusion, removing the risk to patients and resulting in reduced demand on the blood supply chain.

Follow this link for more information about cell salvage via the UK Cell Salvage Action Group.

There is also an e-learning module available via Blood Transfusion Training.

NEONATES/PAEDIATRICS

- NICE Guideline NG24 (patients >1 year old) recommend Intra-operative cell salvage is used where high blood loss is expected.[11]
- BSH (2016) recommends cell salvage in paediatric and neonatal patients undergoing cardiac surgery with cardiopulmonary bypass.[10]
- The Association of Anaesthetists' guidelines (2018) recommend collection of blood for potential cell salvage ('collect only' mode) should be considered for surgical procedures where blood loss may exceed 500 ml or > 10% of calculated total blood volume in children weighing > 10 kg.[28]
- All the guidelines stress the importance of availability of appropriately trained staff.

8.3.6 Post-operative Care

To reduce the need for unnecessary transfusion following surgery, the following should be considered:

- Use of restrictive transfusion thresholds (see section 8.4)
- Minimising unnecessary blood sampling
- Use of cell salvage
- Use of iron and other treatments to increase RBC production

8.3.7 Point of Care Testing

Point of care testing (POCT) refers to any testing performed outside the hospital laboratory, near or at the point of patient care delivery, where the result influences the plan of care. Quality and efficient care depends directly on timely accurate laboratory results to promptly implement effective management plans, administer immediate treatments in life-threatening conditions and meet waiting time targets. POCT can be a valuable tool to achieving this but must have appropriate quality control and governance to ensure results are reliable.[29] With respect to making the decision to transfuse, there are many POCT systems that can aid a prompt and appropriate decision for the use of blood and blood products.

Table 3. Common assays and equipment. Adapted from Mooney et al. (2019)

Test	Indication	Location	Commonly used equipment
Full blood count (FBC) including differential	Trauma and haematology Some variability when compared to laboratory results	A&E, outpatient clinics, primary care, theatre	Pentra 60
Haemoglobin (Hb)	Exclusion of anaemia *Should only be used where an acceptable correlation has been demonstrated with an established method	Operating theatres, clinics, GP, Obstetrics	HemoCue
Activated Partial Thromboplastin Time (APTT)	Factor deficiency, haemostatic assessment Evidence supporting accuracy against laboratory measure-ments is variable	Acute and intensive care settings	CoaguChek Pro II
Viscoelastic assays	Trauma and Obstetrics Thromboelastography is not a substitute for conventional laboratory testing, such as International normalised ratio (INR), but it offers additional information and may guide blood transfusion at the POC	Operating theatres, Emergency Department	Rotational thromboelastometry (ROTEM®). Thromboelastography (TEG®)
Prothrombin (PT)/INR	Trauma, stroke-thrombolysis, warfarinised patients Used for monitoring of vitamin K antagonist oral anticoagulant therapy.	Emergency Department, Coronary Care Units, anticoagulant clinics, operating theatres, intensive care unit (ICU)	CoaguChek XS series

Use of POCT in major haemorrhage allows for patient specific, physiologically guided use of components, without the time delay of laboratory process. It is particularly important in supporting PBM pillar 2 – Management of intraoperative bleeding.[30] See **the guidelines on setting up and delivering POCT** for further guidance.

8.3.8 Pharmacological interventions

There are a variety of pharmacological agents available to support haemostasis management in order to ensure we promote the optimisation of a patient's own blood, and guide appropriate blood and products use.

Drugs reducing clot formation and reversal agents

If a patient is undergoing a haemostatic challenge (e.g. surgery), it is vital that their medications are reviewed and any antiplatelet or anticoagulant medications are stopped in good time, in order to reduce the risk of bleeding.

Reversal agents can be used to reverse anticoagulation in patients who are bleeding or who need to have urgent surgery. They carry additional risks such as thrombosis and are derived from blood donations. They should not be used prior to elective surgery.

Drug	More information	Reversal
Warfarin	Vitamin K antagonist. Anti-coagulant, used primarily for stroke prevention in patients with atrial fibrillation. Requires regular monitoring to INR to ensure most appropriate dose. If stopping for surgery, will require careful management and potentially bridging with shorter acting agents (as it takes 5-7 days to wear off and this is unpredictable).	Vitamin K can be used to reverse the effects of warfarin but this can take 12-24 hours. Prothrombin Concentrate Complex (PCC; containing factors II, VII, IX, X), works immediately and should be used in acute bleeding alongside Vitamin K. Fresh Frozen Plasma should not be used unless PCCs are not available.[30]
Direct Oral Anticoagulants (DOACs; e.g. Apixaban, Dabigatran, Edoxaban, Rivaroxaban)	DOACs either inhibit thrombin or factor Xa. These do not require regular monitoring, however, patients should be made aware of signs and symptoms of abnormal bleeding and renal function must be monitored[31]	DOAC's have a short half-life and there may not always be a need for reversal, dependent on dose timing and renal function.
Anti-Platelets (e.g. Aspirin, Clopidogrel, Ticagrelor)	Anti-platelets decrease platelet aggregation and inhibit clot formation. Two treatment types may be prescribed simultaneously to increase efficacy, and no regular monitoring is required. Treatment will need to be stopped in a timely manner depending on condition, drug(s) and dose prior to procedures with high risk of bleeding. Due to the life span of platelets, usually 5-7 days off treatment is required.	No reversal agents for anti-platelet drugs. In acute bleeding, options available include Tranexamic Acid or platelet transfusion. The PATCH trial[32] demonstrated that patients experiencing intra-cranial haemorrhage, who had been taking an anti-platelet drug, had an increased mortality if they received a platelet transfusion, resulting in calls for more caution in the use of platelet transfusion in this cohort.

For more information on reversal agents for each specific DOAC see link here.

Drugs that improve clotting or reduce blood loss

When a patient is bleeding or is likely to bleed, there are several drugs that can be administered which can assist in clot formation, therefore, reducing the likelihood of the bleed becoming catastrophic.

Drug	More information
Tranexamic Acid (TXA)	TXA is an antifibrinolytic drug. It inhibits the breakdown of clots and reduces inflammation. It is recommended by NICE NG24 and NICE QS 138 that TXA be administered to adults who are having surgery where moderate blood loss can be expected.[15] Several large-scale studies have shown their efficacy in traumatic bleeding (CRASH-2),[34] traumatic brain injury (CRASH-3)[36] and obstetric haemorrhage (WOMAN).[36] BSH Major Haemorrhage guidelines recommended its use in major haemorrhage,[37] however, subsequent results from the HALT-IT trial, indicate that it has no benefit in GI bleeding, therefore it should not be used in these cases.[38] There is a specific TXA toolkit developed by the PBM team, which details the indications for use in detail.
Fibrinogen Concentrates	Fibrinogen concentrates are primarily licensed for patients with congenital fibrinogen defects, however, they can be used in bleeding patients to correct low fibrinogen levels as an alternative to cryoprecipitate. This is off license indication in most circumstances. Some hospitals will include fibrinogen concentrate in their major haemorrhage protocols for this reason, however, there is a lack of independent clinical trials confirming its safety and efficacy.[39]

NEONATES/PAEDIATRICS

NICE Blood Transfusion Guidelines NG24 (patients > 1 year old) suggest cell salvage should not be routinely used without tranexamic acid administration and for children undergoing surgery, where moderate blood loss is expected, TXA should be considered.[12]

BSH (2016) recommends consideration of antifibrinolytic therapy in neonates and children undergoing cardiac surgery at high risk of significant bleeding, and support its use in paediatric trauma.[11]

BSH (2016) also recommends appropriate pre-operative vitamin K replacement, the management of routine anticoagulant therapy by stopping or reversing the therapy, or bridging with low molecular weight heparin as per children's British National Formulary (BNF) guidance.

For clinically significant bleeding following cardiopulmonary bypass and a platelet count <100 × 10^9 /l, PT or APTT >1·5 times midpoint of normal range, fibrinogen <1·5 g/l specific component replacement may be warranted, but due to insufficient evidence,[11] fibrinogen concentrate is not currently licensed in children.

Drugs to support erythropoiesis

There are several therapeutic options available to help support and encourage the body's own red blood cell production. These can be used in anaemia management or to support reducing the risk of requiring blood.

Drug	More information	Considerations
Folate	In the form of folic acid, it is advised as a course of 5mg daily for 4 months for the treatment of megaloblastic anaemia. Longer term therapy may be required if no reversible cause of deficiency is identified. Should not be prescribed for use in undiagnosed megaloblastic anaemia without B12 replacement concomitantly.	Malabsorption - higher doses may be required, Cytotoxic drugs - folate is usually supplemented in the form of calcium folinate.[39]
B12	As most causes of B12 deficiency are due to malabsorption, traditionally replacement has been IM.[39] However, there is evidence this is not necessary. Available as cynacobalamin (po) or hydroxocobalamin (IM), although there are restrictions on the prescription of cyanocobalamin.[40]	Dosing requirements vary depending on the underlying cause, and whether therapy is treatment or prophylaxis.[41] See BSH B12 and Folate Deficiency Guidelines
Oral Iron	Elemental iron must be bound in order to be used therapeutically. For oral treatment iron is bound to salts. There are 3 forms: ferrous fumarate, sulphate, gluconate. Each has varying levels of elemental iron. It is the elemental iron value that is important when prescribing oral iron. Once daily or alternate day of elemental iron dosing is considered to improve absorption.[42]	Consideration should be given to use in those with gastrointestinal and inflammatory conditions where absorption is likely to be impaired. Consideration should also be taken when treating patients who have experienced intolerance. Avoiding administration alongside other medications, or with tea or coffee, and taking with a source of vitamin C, may help improve absorption.[43]
IV Iron	IV iron is indicated when intolerance, or ineffectiveness of oral iron is present or rapid replacement is required. There are different preparations available but the non-dextran formulations, e.g. Ferric derisomaltose (Ferinject) and iron isomaltoside (Monofer) can be given more quickly and with fewer side effects than older preparations. IV iron dosing should be calculated according to current Hb, desired Hb and weight. Refer to local guidelines to determine whether actual booking weight or ideal body weight at booking should be used to determine the correct dose. Consult product specific information for maximum administration volumes.	Contraindications include the first trimester of pregnancy, decompensated liver disease and active infection. Please see RCOG (2015) and BSH (2019) for more information. All IV irons carry a rare but potential risk of anaphylaxis, and therefore must be administered in the presence of staff trained to manage anaphylaxis and with access to resuscitation equipment.[44]
Erythropoietin Stimulating Agents	Erythropoietin Stimulating Agents (ESAs) substitute or supplement native erythropoietin to increase red blood cell production. The main indications for use are in anaemia of chronic kidney disease and myelodysplasia. There are potential applications for use in improving haemoglobin in patients who decline or are unable to have transfusion. ESAs also have an indication for use in chemotherapy related anaemia, although this is used with caution as it can cause proliferation of certain cancers. Dosing is dependent on the product, but is calculated based on weight and indication.[45] NICE NG24 does not recommend the use of ESA to reduce blood transfusion needs in surgery, unless a patient declines blood transfusion or the appropriate blood type is unavailable due to the presence of antibodies.[13]	Close monitoring of blood pressure and Hb is required. Over correction of Hb and use with hypertension has been associated with increased risk of thrombotic events.[46] For contraindications, refer to the British National Formulary (BNF).

For information about fractionated products, see section 9.

Coagulation factors are used in patients who have inherited bleeding disorders, for example haemophilia A, and are usually only stocked in hospitals with a haemophilia unit. See section 8 for more information on factors.

8.4 Appropriate use

Following the assessment of a patient, where blood transfusion is clinically indicated, it is essential that the component or product type, its specification and the volume to be transfused is appropriate.

Restrictive transfusion and NBTC indication codes

Several studies have shown that restrictive transfusion thresholds are appropriate for most patients (see section 5.1). This is reflected in the NICE guidelines NG24, which cover indications for transfusion.

The National Blood Transfusion Committee (NBTC) appraised evidence in relation to transfusion thresholds in 2016 and produced an audit tool to be used to review the use of red cells, fresh frozen plasma, platelets, cryoprecipitate and PCC.

The literature was reviewed in 2020, and the audit tool was subsequently updated.

NHSBT has produced a range of resources to support restrictive transfusion, which can be reviewed and downloaded.

The NBTC audit tool provides codes for various clinical situations where transfusion may be indicated.These can be used on authorisation documentation and in discussion with the HTL about the indication for the transfusion. It is, however, important to note that clinical assessment plays an essential part in the decision to transfuse or not.[46]

The indications can be found on the Blood Components App or webpage.

NEONATES/PAEDIATRICS

The recommendation for use of red cells in infants and children suggests the use of a Hb threshold of 70 g/l pre-transfusion in stable non-cyanotic patients. If the child is unstable or has symptomatic anaemia, a higher threshold may be considered.[11]

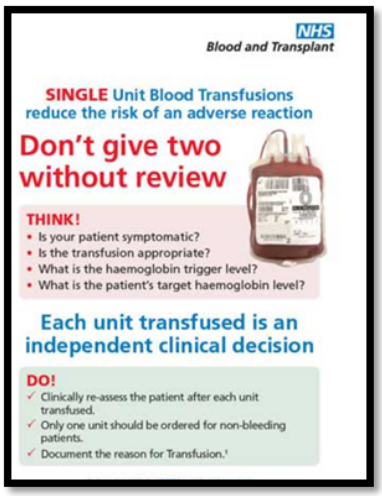
BSH (2016) provides clinical indications for the use of platelets for children and neonates, and indications for the use of red blood cells in neonates.

Maximum Surgical Blood Ordering Schedule (MSBOS)

An MSBOS is a locally agreed guideline, which details the number of units of red cells that should be crossmatched in advance of a variety of procedures. The basis behind having such a schedule is to rationalise the crossmatch to transfusion ratio and, therefore, reduce wastage while still ensuring that there are still appropriate components available if required.[48]

A successful MSBOS should be:

- Evidence-based (crossmatch to transfusion ratio considered) and audited regularly to ensure it is kept in-line with changing practice
- Widely consulted – developing/updating a MSBOS requires wide consultation between the Hospital transfusion team, surgeons and anaesthetists, as well as the co-operation of all junior medical staff
- Regularly reviewed and updated
- Readily accessible to all relevant health care professionals (HCPs)



Single unit transfusion

In 2014 the NBTC PBM recommendations included the following: "Transfuse one dose of blood component at a time, e.g. one unit of red cells or platelets in non-bleeding patients and reassess the patient clinically and with a further blood count to determine if further transfusion is needed".[8]

Following the 2014 recommendations, NICE QS 138 statement 3 (2016), stated that clinical and laboratory reassessment should occur after each unit transfused,[15] to mitigate the risk of developing acute complications, e.g. transfusion associated circulatory overload (TACO) and that the patient is not unnecessarily exposed to other risks of transfusion.

In 2018 the NHSBT PBM team worked on several projects nationally, which developed resources and strategies to implement these recommendations. Further information can be found here.

For further clinical support on the key PBM initiatives, see the PBM toolkit.

O D Negative red blood cells management

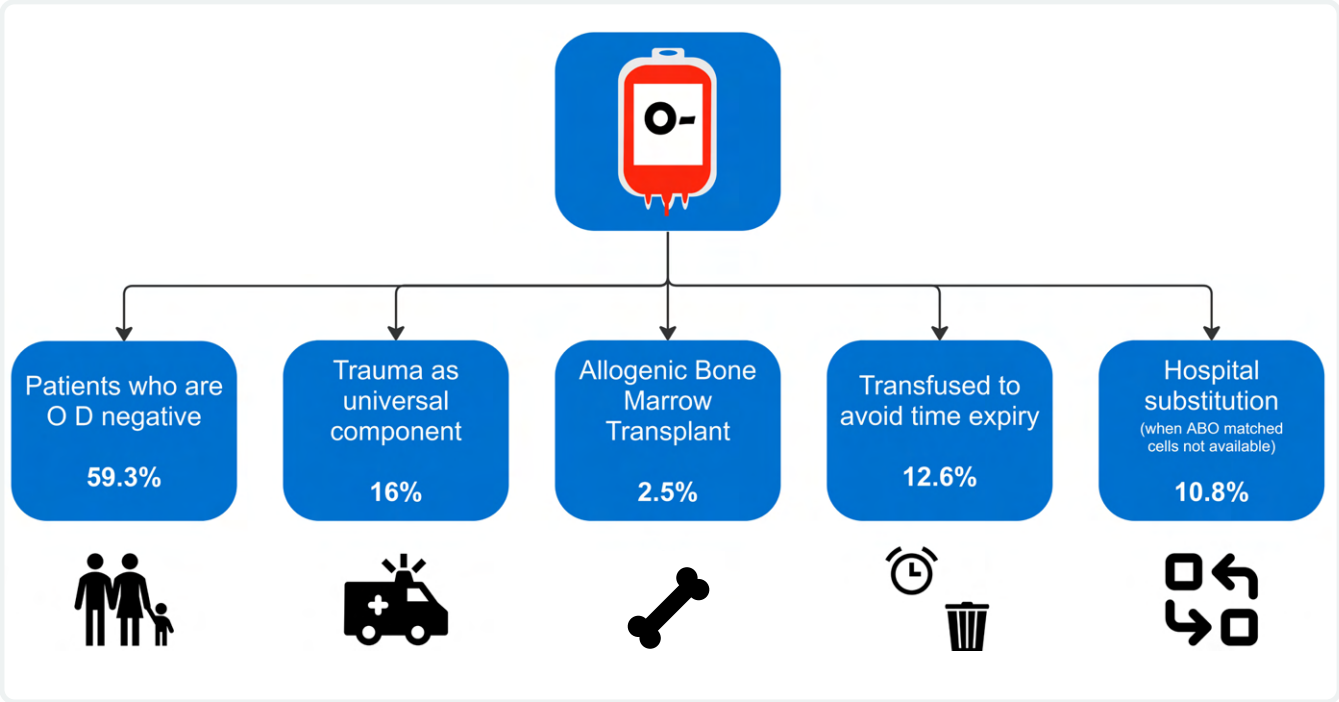
O D negative is often referred to as the "universal" group in red cells and can be suitable to be used in emergency situations where the patient's blood group is unknown. There are, however, limitations to this, particularly if the patient has unexpected antibodies. This widespread perception that O D negative is universal has contributed to the growing pressure on O D negative blood supplies in England, due to both increased ordering and substitutions for rarer blood groups.

There will always be an imbalance in supply and demand as, O D negative patients will usually require O D negative blood, but other patients also need it too, for example, patients undergoing ABO incompatible stem cell transplantation. Assuming the prevalence of this blood group in patients is approximately the same as in the donor population, there will always be a higher proportion of patients needing it than donors donating it.

Total red cell use has fallen in recent years, however, the demand on O D negative red cells has increased slightly. It is therefore essential that O D negative red cells are used appropriately, in order to reduce the pressure on the supply chain and ensure that this precious resource goes to the appropriate patients.

The NBTC produced guidance in 2018 detailing what constitutes appropriate use of O D negative blood. This is generally limited to major haemorrhage, where the patient is of childbearing potential.

In 2018, the National Comparative Audit for Blood Transfusion Survey of Group O D negative red cell use, found that those red cells are often used inappropriately as the chart below illustrates, with up to 23% wasted, transfused to avoid time expiry, or transfused to an emergency patient who did not require D negative blood.[47]



The NCA made several recommendations. One key recommendation is the provision of O D positive red blood cells for males and females not of childbearing potential. The NHSBT PBM team have developed an extensive toolkit to guide hospitals in the management of their O D negative stocks.

See section 3.3, section 4 and section 5.1 for more information on appropriate component selection and phenotyped components.

A D negative platelet management

It is acceptable to use ABO incompatible platelets, negative for high titre agglutinins, in the management of patients with major haemorrhage.[36] A D negative platelets are often stocked for emergency use. Using A D negative platelets as a "universal" component contributes to >17% of total platelet demand from a potential donor population of only 7%.

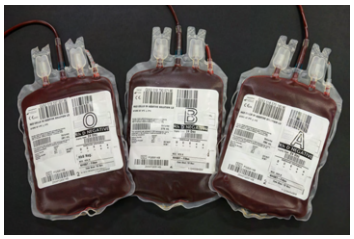
It is, therefore, essential that in order to maintain supply, A D negative platelets must be used appropriately. Until March 2017, the BSH Major Haemorrhage guidance recommended that group A should be used in an emergency, with D negative available for children and those of childbearing potential, however, this was amended to state the following:

'"It is acceptable to use ABO-incompatible platelets negative for high titre agglutinins in the management of patients with major haemorrhage"[37]

In practice this means that national guidance no longer requires A D negative platelets to be used for emergencies. There are several steps that hospitals can take to protect the supply of A D negative platelets:

- Develop practices to support the use of ABO and D matched platelets, i.e. ascertaining a patient's blood group as soon as possible in a major haemorrhage in a patient of unknown group.
- Review ordering and only order A D negative platelets for those patients that really need them.
- Review stock platelet groups and whether there is a requirement to have stock in-situ, quantity and groups should be based on specialities in the hospital and distance from a stock holding unit.

8.5 Blood Stocks Management



The origins of the Blood Stocks Management Scheme (BSMS) date back to a 1984 health circular mandating hospitals, to keep accurate records of blood stock issues and wastage; this was then supported through the publication of Better Blood Transfusion 2. The Scheme as we know it today is the result of a collaboration between NHSBT and hospitals to better understand and improve blood stock management.

VANESA (Vital Appropriate Knowledge Enhances Stock Analysis) is a data management system that collects blood service and hospital data. The BSMS utilises this data to produce a variety of reports for hospitals such as, budget reports, trend analysis reports, and a monthly highlight report covering issues, wastage and O D negative red cell issues and wastage as a percentage. The reports can drive forward change in practice around how components are used, supporting appropriate use and reduce avoidable wastage throughout the supply chain. This allows the supply process to be efficient, effective and protects blood components as a valuable resource. The scheme also offers direct support to hospitals and provides education and resources to support laboratory staff, transfusion practitioners and hospital transfusion committees, working closely with the PBM team. The BSMS team also support blood services via their planning and forecasting department, through the use of VANESA data and interpretation to understand hospital demand. In order to understand the data in relation to practice and patient need, BSMS and NHSBT rely on open communication and information from hospital transfusion teams around changes to demand, service developments or circumstances that can impact component demand. You can share this information via your regional Patient Blood Management Practitioner or Customer Service Manager.[48]

For further information and to access resources, publications, or to join the scheme, **visit the BSMS website**.

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Anti-D and Fractionated Products

Fractionated plasma products or plasma derivatives are a range of therapeutic preparations, manufactured from pooled plasma. They are manufactured through a process of separation, purification, and concentration to form therapeutic doses. This can be done for desired groups of proteins or by specific protein.

The processes undertaken to manufacture these therapeutic doses are deemed pharmaceutical methods, defining these treatments as medicines which are managed under The Human Medicines Regulations 2012 and must be prescribed by a licensed practitioner.

9.1 Anti-D

This is a blood product given to D negative individuals to prevent sensitisation when exposed to D positive antigens, by neutralising any D positive red blood cells (RBC). Sensitising events include pregnancy, transfusion and transplantation (covered in section 3.1.4).

For pregnancy, routine anti-D prophylaxis is offered to D negative individuals to prevent sensitisation from potential D positive babies, to reduce the risk of Haemolytic disease of the Fetus and Newborn (HDFN) (section 3.1.4). Optional fetal RhD screening may indicate that prophylaxis is not required (section 3.2.9).

More information can be found in the guidelines on the use of Anti-D Immunoglobin for the Prevention of Haemolytic Disease of the Fetus and Newborn.

9.1.1 Administration

Anti-D should be given within 72 hours of a sensitising event, though some protection may be offered if given up to 10 days post event.[1] The table below indicates the minimum anti-D dose recommended in the BSH guidelines.[1] Please note that not all preparations will be available, so higher doses may be given.

Gestation (weeks)	Minimum Anti-D Dose (IU) [1]	Further information
<12	250	**Following situations:** • Ectopic/molar pregnancy • Therapeutic termination • Repeated PV bleeding and abdominal pain • Surgical evacuation
12 – 20	250	• Any sensitizing event • Patients suitable for cffDNA will be tested at 16 weeks if available
20+	500	• Any sensitizing event • FMH estimation testing – Kleihauer (KL) • Quantitation, repeat testing and further anti-D may be needed if KL positive
28*	1500	• RAADP* • 28-week sample should be taken before anti-D given
Delivery	500	• Cord sample taken • Confirmed RhD+ baby anti-D issued • FMH estimation – KL • Additional testing as stated for 20+ weeks above • Where intraoperative cell salvage is performed in Rh D negative women, without previous sensitization and where cord blood is confirmed Rh D positive, a 1500IU dose should be administered after reinfusion of any salvaged cells. A maternal sample should be rechecked no more than 45 minutes later, for estimation of fetomaternal haemorrhage and any further required dosing

*Routine Antenatal Anti-D Prophylaxis (RAADP) can be given as one dose of 1500IU at 28-30 weeks, or two doses of 500IU at 28 and 34 weeks. This is a national scheme and is in addition to other anti-D doses, as this dose is designed to cover the entire pregnancy.[1]

Serious Hazards of Transfusion (SHOT) also produced an aide memoire for the administration of anti-D in pregnancy.

Preparations available:

- 500IU (D-Gam 50 micrograms/ml solution BPL)
  - Intramuscular use - recommended deltoid*
- 1500IU (Rhophylac 300 micrograms/2ml CSL Behring)
  - For intravenous or intramuscular use (by slow injection)
  - BMI ≥30 IV should be considered

** Please note overweight/obese patients may require IV anti-D*

Post administration, anti-D will be detected in a patient's antibody screen for several weeks. The timescale depends on the dose used.

9.1.2 Side effects/reactions

- **Uncommon** – chills, fever, headache, malaise, skin reactions
- **Rare or very rare** – arthralgia, dyspnoea, hypersensitivity, nausea, tachycardia, vomiting

Frequency not known – Intravascular haemolysis. A period of monitoring for 20 minutes should be carried out post administration including vital signs. Administration of any anti-D product should be carried out where emergency equipment is present, and staff are trained and competent to deal with adverse events.

(Information adapted from: https://bnf.nice.org.uk/drug/anti-d-rh0-immunoglobulin.html)

Product specific side effects can be found at the following link:

- 500IU
- 1500IU

9.2 Human Albumin Solution

Human albumin solution (HAS) is a solution that contains albumin, a protein found in human blood plasma. Albumin is the most abundant protein in plasma and plays various essential roles in the body, including maintaining colloidal osmotic pressure, transporting hormones and other substances, and regulating blood volume. HAS may be indicated for use in treatment such as burns and hyproproteinaemia but should not be used to "correct" the low serum albumin level associated with acute or chronic illness.

9.2.1 Administration

Preparations of HAS available are:

- 20% solution in 100 mL – clinical use is in treatment of hypoproteinaemic oedema with nephrotic syndrome and for patients with ascites in chronic liver disease.
- 4.5%/ 5% solution in 100, 250 and 500 mls – clinical use is for acute volume replacement.

HAS should be administered via an intravenous fluid administration set with a 15µm filter; a blood transfusion administration set is NOT required.[2]

9.2.2 Side effects/reactions

Rare or very rare – fever, flushing, nausea, shock, urticaria
Administration should occur where active monitoring, including vital signs, can be carried out and staff are trained to respond to adverse events and can access emergency equipment.
(Information adapted from from https://bnf.nice.org.uk/drug/albumin-solution.html)

Follow this link for product-specific side effects.

9.3 Clotting Factor Concentrates

Clotting factor concentrates are used to prevent (prophylaxis) or to treat bleeding episodes. They should be given under guidance of haematologists and/or, if available, coagulation consultants.
There are two types of clotting factor concentrates:

- **Plasma factor concentrate - made from human plasma by fractionation, examples below:**
  - Factor VIII – used in Haemophilia A (now largely replaced with recombinant products) and Von Willebrand's disease
  - Factor IX – used in Haemophillia B (now largely replaced with recombinant products)
  - Prothrombin Complex Concentrate (PCC) – used for replacement of multiple clotting factors when deficient or used for the emergency reversal of warfarin (section 8.4)
  - Factor XIII – used for congenital factor XIII deficiency
  - Fibrinogen – for congenital hypofibrinogenaemia or afibrinogenaemia
  - Intermediate and high purity factor VIII – used in Von Willebrand disease
  - Protein C concentrate – used for congenital protein C deficiency

- **Recombinant clotting factors - recombinant DNA technology, examples below:**
  - Factor VIII – used in Haemophilia A
  - Factor IX – used in Haemophilia B
  - Factor VIIa – used in Haemophilia A or B patients, or treating Glanzmann thrombasthenia[3]

9.3.1 Administration

Please refer to manufacturer's instructions for specific products being issued.

9.3.2 Side effects/reactions

Please check individual products at the EMC website and the NICE Drugs A to Z index.

9.4 Prothrombin Complex Concentrates

This section refers to the use of Prothrombin Complex Concentrates (PCC) as a Warfarin rapid reversal product in the event of bleeding or need for urgent surgery; examples include Octaplex and Beriplex. They contain clotting factors II, VII, IX and X and coagulant proteins C and S, in order to replace production inhibited by Warfarin.

9.4.1 Administration

Therapeutic doses are calculated based on the patient's recent international normalised ratio (INR) result and actual or estimated body weight. In the event of life-threatening bleeding, the INR may be omitted to avoid delays to providing treatment. Preparations available will vary depending on the product used. Also note that there are maximum doses that should not be exceeded. PCC requires reconstituting before administration (see manufacturer's insert) and are administered intravenously. Infusion rates depend on product being used.

9.4.2 Side effects/reactions

Please check individual products at the EMC website and the NICE Drugs A to Z index.

9.5 Immunoglobulins

Immunoglobulins, also known as antibodies, are proteins produced by the immune system that help fight infections and disease and can be useful in treating certain health conditions.

Immunoglobulin G (IgG) is made by the B lymphocytes and is the most abundant antibody in the plasma; it can pass through membranes, including the placenta due to its small size. Immunoglobulin G can fight pathogens and inflammatory autoimmune responses by marking the pathogen for phagocyte cells to digest, activate the complement system to attract other immune cells to the site, and directly neutralise toxins and pathogens.

Immunoglobulins are given: -

- To replace missing antibodies in patients who do not produce them or have inadequate levels such as severe immunoglobulin deficiency
- Prophylactically, to protect against certain infectious organisms / pathogens such as: hepatitis A, measles, mumps, rubella, varicella, and other viruses that are currently prevalent in the general population
- As an immune modulator by reducing the inflammatory response in patients with certain autoimmune diseases, such as Myasthenia Gravis.

9.5.1 Manufacturing

Immunoglobulins are manufactured from large pools of historically non-UK pooled plasma, from usually male donors with high titres (high levels) of specific antibodies and immunoglobulin. Plasma for medicines is now being collected by NHSBT for fractionation. It will be used to make UK-sourced IVIg and potentially other blood products. The plasma is obtained from human donors who have undergone donor checks, and donor testing prior to its manufacturing stages to ensure it is negative to hepatitis B, hepatitis C and human immunodeficiency viruses (HIV) type 1 and type 2. The plasma undergoes a lengthy manufacturing process to ensure its safety including multiple filtrations, pasteurisation, and solvent detergent viral inactivation.

There are two types of immunoglobulin solutions available:

- Normal immunoglobulin
- Disease-specific immunoglobulin

Normal immunoglobulin:

- Contains immunoglobulin G (IgG) and specific antibodies to viruses that are common in the population. Intramuscular (IM) administration of normal immunoglobulin may be used to protect against pathogens such as hepatitis A, measles, rubella, polio

- High dose Intravenous immunoglobulin (IVIg) is used as replacement therapy in patients with severe immunoglobulin deficiency; this may be from birth or acquired, secondary to other factors such as: -
  - Chemotherapy, HIV
  - Autoimmune diseases such as Myasthenia Gravis as an immune modulator by reducing the inflammatory response

Disease-specific immunoglobulin:

Contains high levels of specific antibody to the target treatment such as tetanus, hepatitis B and rabies and varicella-zoster anti-D.

Anti-D immunoglobulin (covered in section 9.1)

Immunoglobulin therapy is a limited and expensive resource due to the reliance on donors, the increasing range of clinical indications for treatment and the lengthy manufacturing processes. This has resulted in the need for a Demand Management programme in the UK.

For further information on when immunoglobulins are used, consult the Department of Health and Social Care's National Demand Management Programme for Immunoglobulin and Clinical Guidelines for Immunoglobulin Use.

9.5.2 Administration

For Intramuscular (IM) route

They are administered by intramuscular injection when used as a protection against certain infective organisms. Refer to the relevant manufacturer's guidance on the site to administer IM immunoglobulin for optimal absorption.

For intravenous infusion

- Intravenous administration is used as a replacement or treatment therapy.
- Where Intravenous infusion is no longer a treatment option, sub cutaneous infusion may also be an alternative.
- Administer using a 15-micron filter vented giving set. (Some manufacturers supply a giving set with the product).
- The manufacturer's instructions should be followed for administration and recommended infusion rates.[4]

9.5.3 Side effects/reactions

Please check individual products at the EMC website and the NICE Drugs A to Z index.

9.6 octaplasLG

OctaplasLG® is a solvent detergent-treated fresh frozen plasma (FFP) product. Compatibility is the same as with standard FFP (section 3.3.3).

Therapeutic uses include:

- Coagulation factor deficiency correction or treatment if no clotting factor concentrates are available (factor V or X).[5]
- Therapeutic plasma exchange procedures – for example patient with thrombotic thrombocytopenic purpura (TTP).

9.6.1 Administration

Products are stored frozen and require thawing before allocation and issue to the patient. They are administered by intravenous infusion, using an infusion set with a filter.[5]

9.6.2 Side effects/reactions

Follow this link for the side effects and contraindications of octaplasLG.

9.7 Event reporting

As fractionated products are medicines, any side effects should be reported via the Yellow Card Scheme. Incidents involving anti-D should also be reported onto the SABRE (Serious Adverse Blood Reactions and Events) matrix in addition to the yellow card scheme, however, the MHRA (Medicine and Healthcare products Regulatory Agency) will automatically close their file and direct you to the SHOT (Serious Hazards of Transfusion) form (section 6.3).

Anti-D and Fractionated Products further reading:

https://www.nice.org.uk/guidance/ta156

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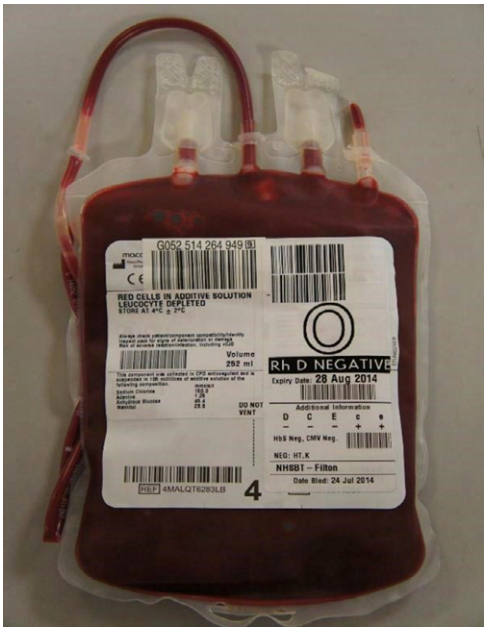
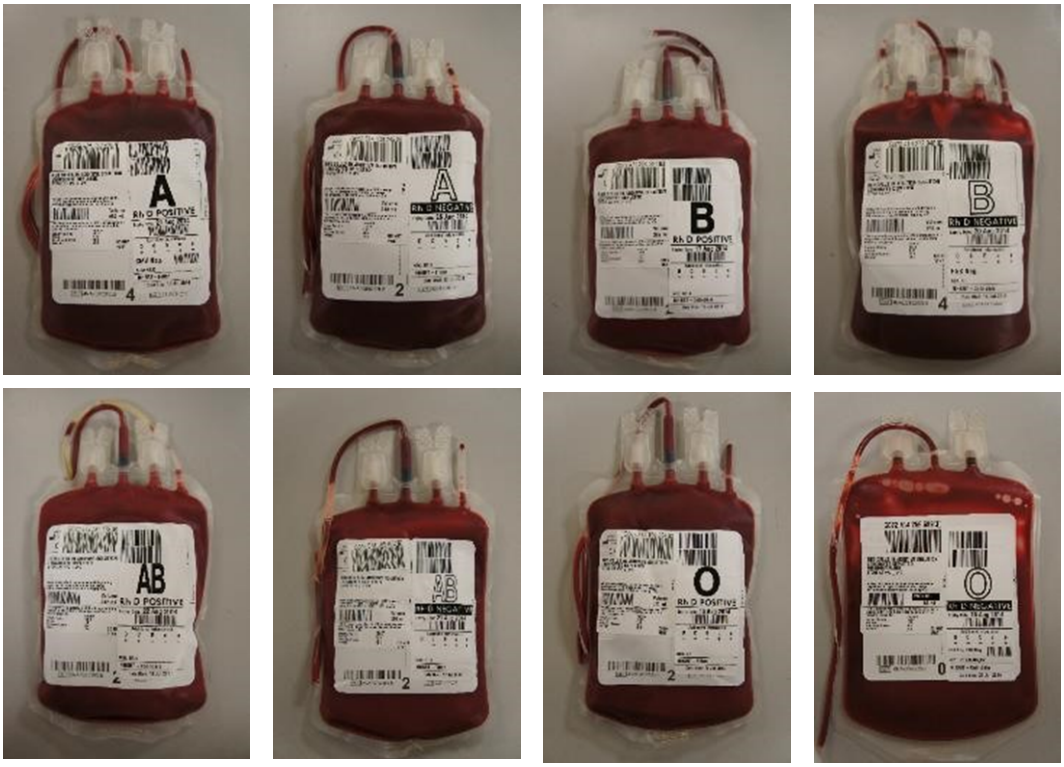
Appendices

I - Components

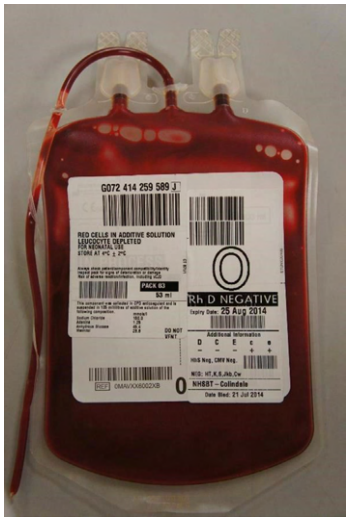
1: Standard Red Blood Cells



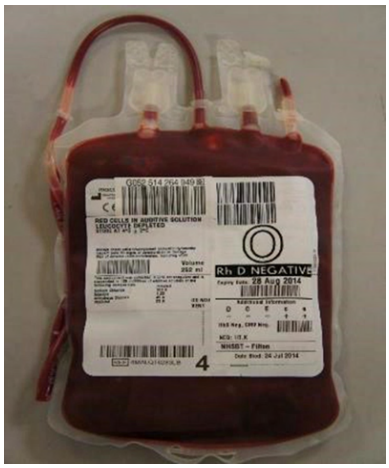
2. Standard Red Blood Cells – all groups



3. Neonatal Red Cell ‘Paedi-pack’

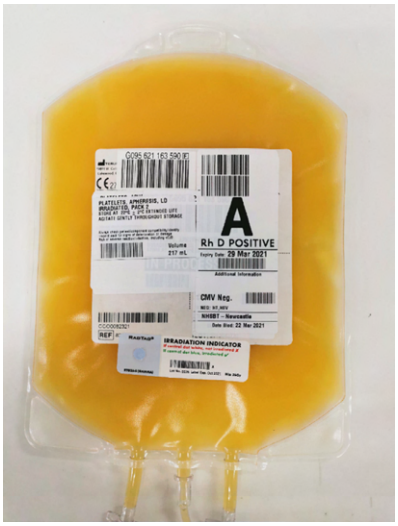


4. One Standard Red cell unit = 6 neonatal Red Cell Paedi-pack

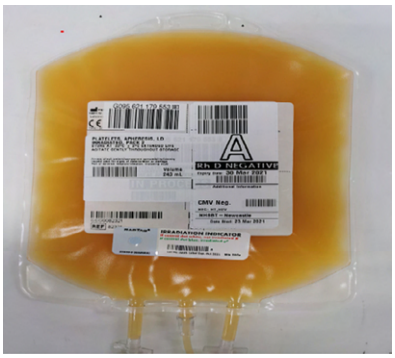


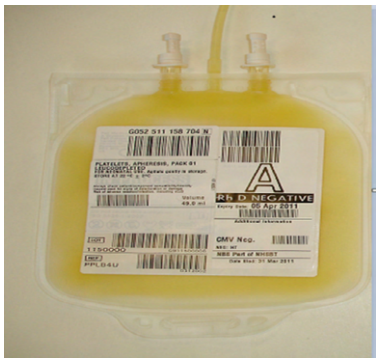
5. Large volume Neonatal Red Blood Cells

6. Standard Apheresis Platelets (irradiated)

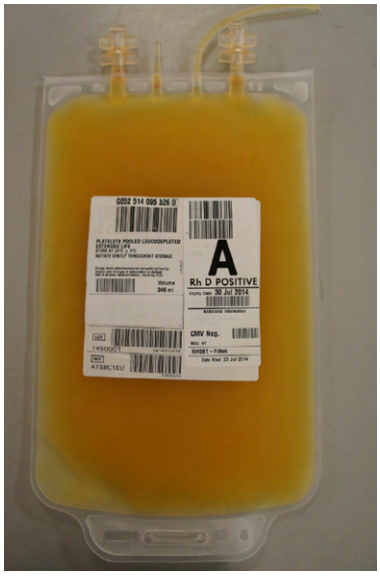


7. Standard & Neonatal & Apheresis Platelets

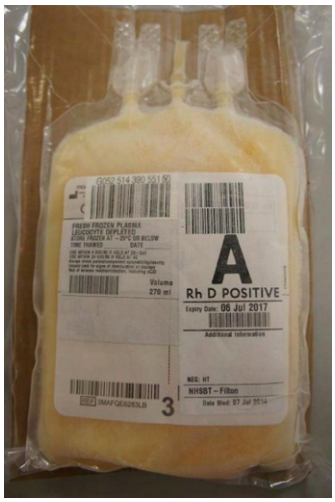




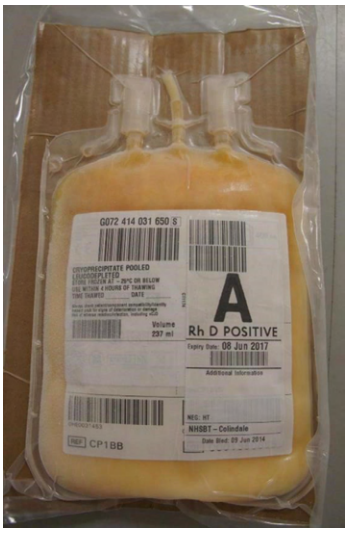
8. Standard Pooled Platelets



9. Fresh Frozen Plasma (FFP)

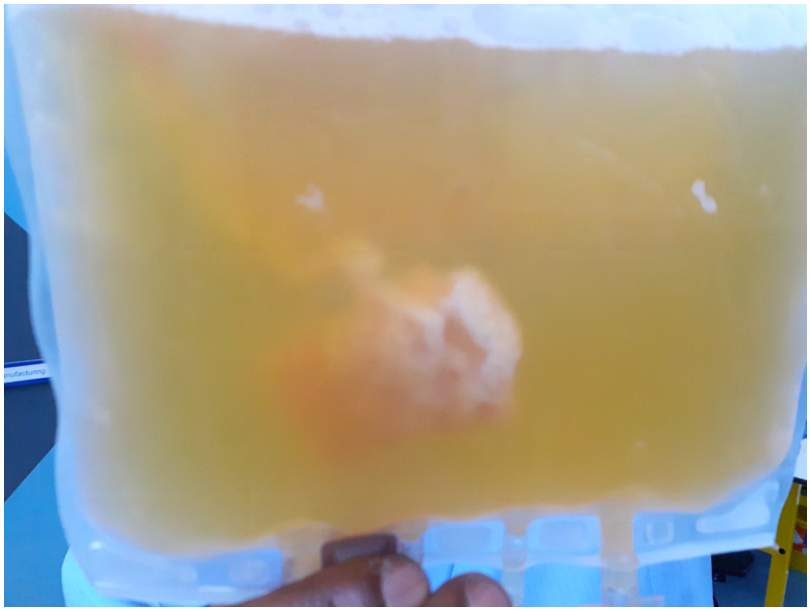


10. Pooled Cryoprecipitate



II - Contaminated/ Damaged components

1. Contaminated Component

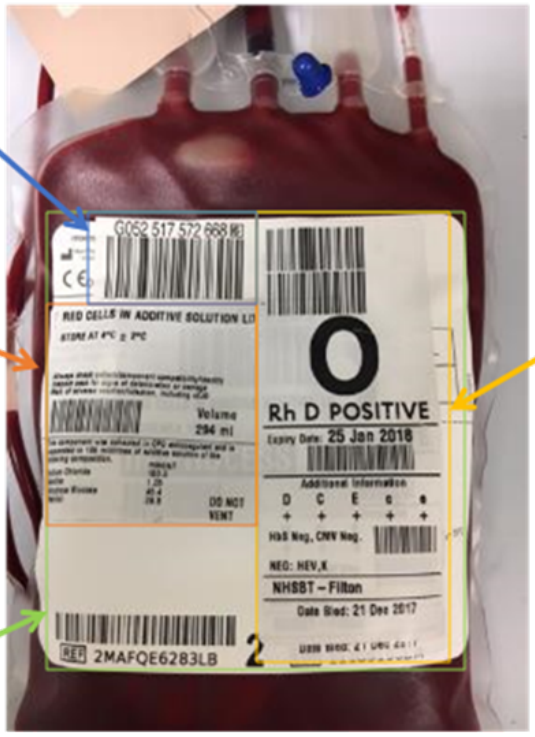


III - Understanding Blood labels

DIN Label - unique barcode with an eye readable version as well, used for audit trail purposes

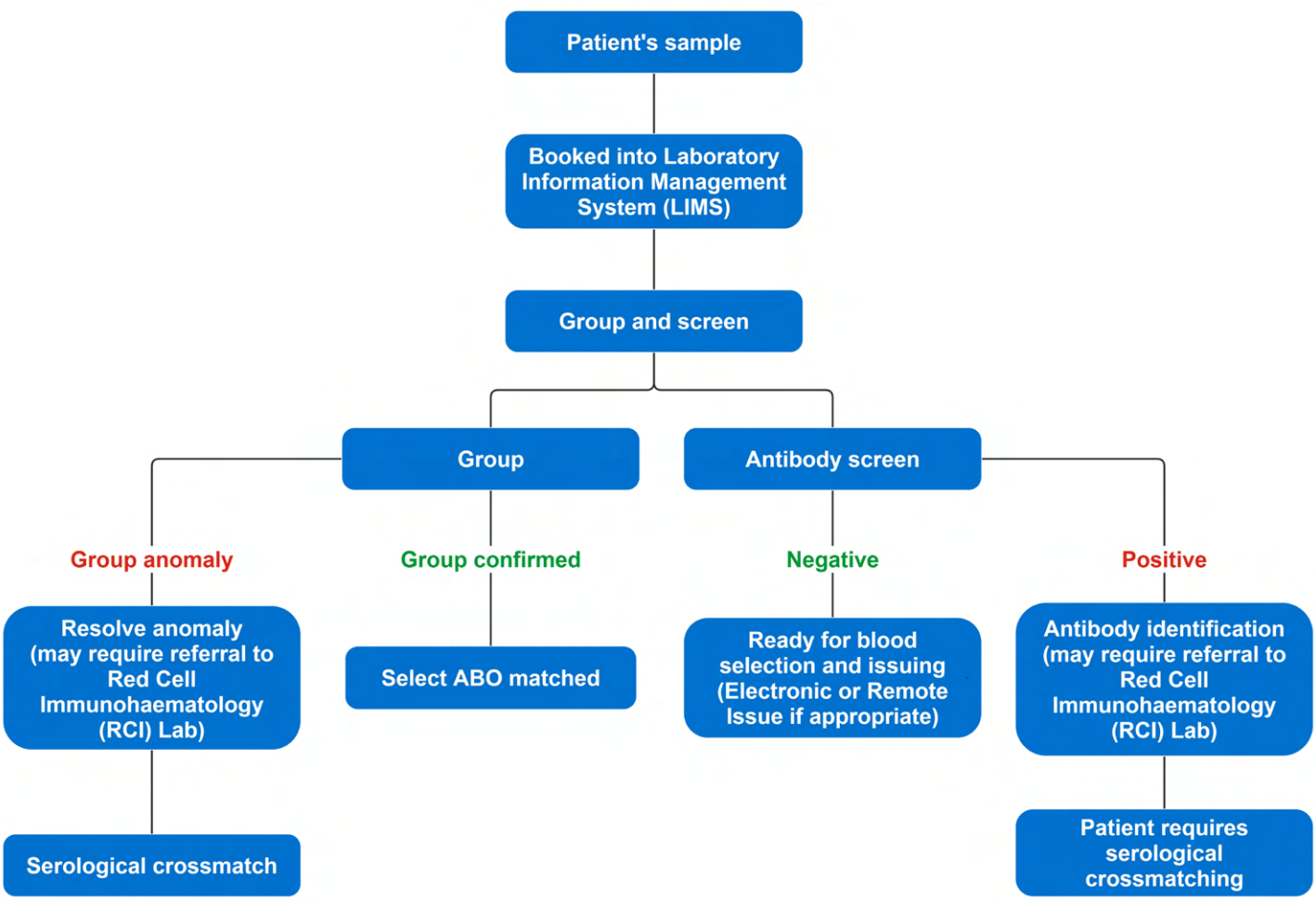
BIN label - gives information about the component type and additives used, storage requirements, general advice and the unit volume in barcode and eye readable format

Base Label - should display manufacturer's bar codes and reference numbers



Blood Group Label - short form barcode of DIN number required for validation, blood group barcode, expiry date barcode, donor phenotype and other characteristics CMV status for example, the NHSBT manufacturing centre processed at and the date unit was bled - all information in barcode for has to be in eye readable format as well

IV - Laboratory Process Flow Chart



V - Glossary of terms, acronyms, and abbreviations

This section provides details of commonly used acronyms and abbreviations in transfusion.

A Drop of Knowledge (ADOK)
A comprehensive document for transfusion practitioners, offering pertinent information on various aspects of transfusion. This document has since been superseded by Blood Essentials.

A Wealth Drop of Knowledge (AWOK)
A comprehensive document for transfusion practitioners, offering pertinent information on various aspects of transfusion. This document has since been superseded by Blood Essentials.

ABO Blood Group System
The most clinically significant blood group system.

Acid Citrate Dextrose Solution
A solution used as an anticoagulant, preserving blood for storage.

Acute
Referring to a condition or event that is sudden and severe.

Acute Coronary Syndrome
A group of conditions related to reduced blood flow to the heart.

Acute Haemolytic Transfusion Reaction
A rapid and severe immune response to transfused blood, leading to the destruction of red blood cells.

Administration
The process of managing or giving medical treatment, such as a blood transfusion.

Adrenaline
A hormone released by the adrenal glands.

Adult Therapeutic Dose (FFP)
The appropriate quantity of fresh frozen plasma administered to an adult based on clinical factors.

Adult Therapeutic Dose (Platelet)
The suitable volume of platelets given to an adult based on clinical indications.

Advanced Decision
A legal document specifying an individual's preferences regarding medical treatment in advance.

Agglutination
The clumping together of particles, such as red blood cells, due to interaction with specific antibodies.

Aggregation
The process of particles, like platelets, coming together or forming a mass.

Agitation/Agitator
The act or device used to stir or mix substances, often in the context of blood components.

Aliquot
A measured portion or sub-sample taken from a larger sample.

Allied Healthcare Professional
Healthcare professionals that provide a range of diagnostic, technical, therapeutic, and support services in connection with health care.

Allogenic
Relating to tissues, cells, or organs from a donor of the same species.

Alloimmunisation
The development of an immune response to foreign antigens from another individual, often through blood transfusion.

Ambient
Relating to or denoting the immediate surroundings or environment.

Anaemia
A condition characterised by a lower-than-normal number of red blood cells or reduced haemoglobin, resulting in a decreased ability to carry oxygen.

Anaemia of Chronic Inflammation
Anaemia associated with chronic inflammatory conditions.

Anaphylaxis
A severe and potentially life-threatening allergic reaction.

Antenatal
Pertaining to events or conditions before birth, especially during pregnancy.

Antenatal Screening
Health screening conducted during pregnancy.

Antiplatelet Medication
Medications that inhibit platelet aggregation, often used to prevent blood clots.

Antibody
A protein produced by the immune system in response to specific antigens, contributing to immune responses.

Antibody Identification
The process of determining the specific antibodies present in a patient's blood.

Antibody Identification Panel
A set of fully antigen-typed red cells used to identify clinically significant antibodies in a patient's plasma.

Antibody Screen
A short screening test to detect the presence of antibodies in a patient's plasma.

Antibody Specification
Detailed information about the specific antibodies present in a patient's blood.

Anticoagulation
The process of preventing blood clot formation, often using anticoagulant medications.

Anti-D Immunoglobulin
An immunoglobulin preparation used to prevent haemolytic disease of the newborn in Rh D positive babies carried by Rh D negative mothers.

Anti-fibrinolytics
Medications that block the breakdown of blood clots, preventing excessive bleeding.

Antigen
A substance that induces an immune response, often recognised by specific antibodies.

Antihistamine
A drug that inhibits the physiological effects of histamine, often used to treat allergies.

Anti-human Globulin
A substance used in laboratory testing, particularly in the indirect antiglobulin test.

Antipyretic
A substance or medication used to reduce or alleviate fever.

Apheresis
A procedure where blood is withdrawn, specific components are separated, and the remainder is returned to the donor.

Aplastic Anaemia
A rare and serious condition where the bone marrow fails to produce an adequate number of blood cells.

Appropriate Use (of blood) The appropriate and justified application of a blood transfusion.

Activated Partial Thromboplastin Time (APTT)
A laboratory test that measures the time it takes for blood to clot, evaluating the intrinsic pathway of coagulation.

Arthralgia
Pain or discomfort in one or more joints.

Ascites
The abnormal accumulation of fluid in the abdominal cavity.

Anti-Thymocyte Globulin
An immunosuppressive medication used to prevent or treat rejection in transplant patients.

Audit
A systematic evaluation of practices, processes, or records to ensure compliance with standards and regulations.

Authorise (blood component transfusion)
To provide formal approval or permission for blood component transfusion.

Autologous Blood
Blood donated by an individual for their own use, typically in elective surgeries or medical procedures.

Automated Testing / Automation
The use of automated processes or tools to perform sample testing.

B Cells
White blood cells that play a key role in the immune system by producing antibodies.

Bacteria
Microscopic organisms that can be beneficial or harmful, with some causing infections in humans.

Bacterial Contamination
The presence of bacteria in a substance or environment, potentially leading to infections.

Baseline Observations/Vital Signs/ Physiological Observations
Initial measurements of key physiological parameters, such as respiration rate, heart rate, blood pressure, and temperature, serving as a reference point for comparison.

Basophil
A type of white blood cell involved in the immune response, particularly against parasitic infections.

Bedside Checklist
A systematic list of items or procedures to be checked at the patient's bedside to ensure proper care.

Benchmarking
The process of comparing performance metrics or practices against established standards or best practices.

Bilirubin
A yellow pigment produced during the breakdown of red blood cells, often measured to assess liver function.

Bleeding Risk
The likelihood or probability of experiencing excessive bleeding, often assessed before medical procedures.

Blood Assist (App)
An application designed by NHS Blood and Transplant which provides an aide memoir for best practice in administration summarising key guidelines and recommendations from SHOT, the British Society for Haematology and the Advisory Committee on the Safety of Blood Tissues and Organs.

Blood Bank Fridges
Refrigeration units used in blood banks to store blood and blood products at specific temperatures.

Blood Components
A therapeutic constituent of blood (e.g., red blood cells, platelets, fresh□frozen plasma (FFP), cryoprecipitate, and granulocytes). Controlled under the Blood Safety and Quality Regulations 2005

Blood Components (App)
An application designed by NHS Blood and Transplant which summarises relevant UK guidelines to act as a guide for clinicians to facilitate appropriate use of blood and enable robust documentation of indications.

Blood Conservation
Practices or strategies aimed at minimising blood loss during medical procedures.

Blood Establishment
An organisation or facility responsible for collecting, testing, processing, and distributing blood and blood products.

Blood Film
A thin layer of blood spread on a microscope slide for examination, often used for cell morphology assessment.

Blood Groups
Classifications of blood based on specific antigens present on the surface of red blood cells.

Blood Pressure
The force exerted by circulating blood against the walls of blood vessels, often measured in millimetres of mercury (mmHg).

Blood Product
A medicine or product derived from whole blood or plasma (e.g., Human Albumin, Immunoglobulins, Prothrombin Complex Concentrates, Octaplas and Octaplex) and classified as a medicinal product. Controlled under The Human Medicines Regulations 2012.

The Blood Stocks Management Scheme (BSMS)
A scheme established in 2001 to understand and improve blood inventory management across the blood supply chain.

Blood Warmer
A medical device used to warm blood or blood products before administration to a patient.

Body Mass Index (BMI)
A numerical measure of a person's body weight in relation to their height, commonly used as an indicator of body fat and overall health.

Biomedical Scientist
A healthcare professional that conducts laboratory and scientific tests to support the diagnosis and treatment of disease.

BTEDG (formerly BMSEDG)
An education and continuing professional development group for healthcare professionals working in blood transfusion.

Bolus
A concentrated dose of medication or substance given rapidly, often intravenously.

Bone Marrow Transplant
A medical procedure involving the transplantation of bone marrow or stem cells to treat various conditions.

British National Formulary (BNF)
Provides prescribers, pharmacists, and other healthcare professionals with sound up-to-date information about the use of medicines.

Blood Safety Quality Regulations
Regulations governing the quality and safety standards associated with blood and blood products to ensure their safe use in medical settings.

Buffy Coat
The layer of blood containing white blood cells and platelets, separated from red blood cells during centrifugation.

Caesarean Section
Surgical procedures for delivering a baby, involving the incision of the abdominal and uterine walls.

Campath/Alemtusumab
A medication, also known as Campath, used for treating certain types of cancer and autoimmune diseases.

Cardiac Output
The volume of blood pumped by the heart per unit of time, typically measured in litres per minute.

CAR-T (Chimeric Antigen Receptor T-Cell Therapy)
A type of immunotherapy that involves modifying a patient's own T cells to target and destroy cancer cells.

CE Marked
Indicates that a product conforms to European Union standards for safety and other essential requirements.

Cell Salvage
The process of collecting and reinfusing a patient's own blood during a surgical procedure.

Central Alerting System
A web-based cascading system for issuing patient safety alerts, important public health messages and other safety critical information and guidance to the NHS and others, including independent providers of health and social care.

Centrifuge
A laboratory device used to separate components of a liquid by spinning it at high speeds.

Cell-Free Fetal DNA
Fragments of fetal DNA circulating freely in the maternal blood, often used in prenatal testing.

Change Control
The systematic process of managing changes to a system, process, or document to maintain its integrity and quality.

Chemotherapy
The use of drugs to treat cancer by killing or slowing the growth of cancer cells.

Childbearing Potential
The reproductive capability of an individual, particularly the ability to conceive and bear children.

Chronic
Persisting or recurring over a long period; often used to describe medical conditions.

Chronic Kidney Disease
A progressive condition in which kidney function declines over time.

Chronic Liver Disease
Long-term damage to the liver, often leading to impaired function.

Chronic Transfusion Programme
A programme focused on providing regular blood transfusions to manage chronic conditions, such as certain types of anaemia.

Citrate Phosphate Dextrose
A solution containing citrate, phosphate, and dextrose used in blood collection and preservation.

Clauss Fibrinogen
A method for measuring fibrinogen levels in the blood using the Clauss method.

Clinical Indication Codes
Codes to facilitate appropriate use of blood components and enable robust documentation of indications.

Clinically Significant
Pertaining to findings or conditions that have a meaningful impact on a patient's health or treatment
.

Clotting Factor Concentrates
Products containing concentrated forms of clotting factors, used in the treatment of bleeding disorders.

Coagulation
The process by which blood forms clots, preventing excessive bleeding.

Coeliac Disease
An autoimmune disorder characterised by an adverse reaction to gluten, damaging the small intestine.

Cold Agglutinin Disease
A condition in which antibodies cause red blood cells to clump together, leading to various symptoms.

Cold Antibodies
Antibodies that become active and agglutinate red blood cells at lower temperatures, often causing haemolysis in cold conditions.

Cold Chain
A system that ensures the proper transportation, storage, and handling of temperature-sensitive products, such as blood or vaccines, to maintain their integrity.

Compatibility
The suitability of different biological substances, such as blood types, for mixing or transfusion without adverse reactions.

Compatibility Label
A label indicating that blood components or substances are compatible for transfusion or use together.

Compatibility Tag
A tag or indicator attached to blood components or substances to signify their compatibility for specific medical purposes.

Competence
The ability of an individual or a system to perform tasks effectively, often assessed through skills, knowledge, and performance.

Competency Assessment
An evaluation process to ensure that an individual possesses the necessary skills and knowledge to perform specific tasks or roles.

Complement
A group of proteins in the blood that plays a role in the immune system's response to foreign substances.

Component Selection
The process of choosing specific blood components, such as red blood cells or plasma, for transfusion based on patient needs.

Congestive Cardiac Failure
A medical condition where the heart is unable to pump blood effectively, leading to congestion in the circulatory system.

Continuing Professional Development (CPD)
The ongoing process of acquiring and updating professional skills and knowledge throughout one's career.

Controlled Thawing
A regulated process of thawing frozen substances, such as plasma or cryoprecipitate, to ensure their integrity.

Cord Blood
Blood collected from the umbilical cord and placenta after childbirth, rich in stem cells and used for various medical treatments.

C-Reactive Protein
A marker of inflammation in the body often measured in blood tests.

Cryoprecipitate
A blood component rich in clotting factors, fibrinogen, and other proteins, obtained by thawing frozen plasma.

Cryopreserved
Preserved by freezing, often referring to biological substances like cells or tissues.

Cytokine
Proteins released by cells that act as signalling molecules, influencing the behaviour of other cells in the immune response.

Cytokine Release
The release of cytokines by cells, often in response to an immune stimulus or certain medical treatments.

Cytomegalovirus (CMV)
A type of herpes virus that can cause opportunistic infections, particularly in individuals with weakened immune systems.

Daratumumab
A monoclonal antibody used in the treatment of certain types of cancer, such as multiple myeloma.

DATIX
A software system used for the reporting and analysis of incidents and adverse events in healthcare.

Deglycerolising
The process of removing glycerol from frozen red blood cells or components.

Delayed Haemolytic Transfusion Reaction
A delayed immune reaction occurring after a blood transfusion, leading to the destruction of red blood cells.

Delayed Transfusion
The postponement of a blood transfusion for any reason, potentially causing harm.

Demand
The quantity of a particular blood component or product required to meet current needs.

Demand Planning
The process of forecasting and planning for the future demand for blood components.

Dendrite
A branching extension of a nerve cell, often involved in transmitting signals.

Department of Health and Social Care
A government department overseeing health and social care policies and services.

Diastolic Blood Pressure
The lower of the two values in a blood pressure reading, representing the pressure in the arteries when the heart is at rest.

Diathermy
A medical technique using electrical currents for therapeutic purposes, such as heating tissues.

Direct Antiglobulin Test
A laboratory test used to detect antibodies attached to the surface of red blood cells.

Direct Oral Anticoagulants (DOAC)
Medications that directly inhibit blood clotting factors, used as anticoagulants.

Diuretic
A medication that promotes the removal of excess fluid from the body through increased urine production.

Donation
The voluntary act of giving blood, organs, or tissues for medical use.

Donation Number
A unique identifier assigned to each blood donation, used for tracking and record-keeping.

Donor (blood)
An individual who voluntarily provides blood, organs, or tissues for medical purposes.

Donor Screening
The systematic assessment and evaluation of potential blood donors to ensure the safety and suitability of their blood for transfusion.

Duffy
A blood group system.

Dyspnoea
Shortness of breath or difficulty in breathing.

Ectopic Pregnancy
A pregnancy where the fertilised egg implants outside the uterus, typically in the fallopian tubes.

E-learning
Educational content or training delivered electronically, often through online platforms.

Electronic Issue
The electronic authorisation and allocation of blood components for transfusion.

Electronic Staff Record (ESR)
An electronic database containing employment and HR information for staff in the National Health Service (NHS).

Emergency Blood Management Arrangements
Protocols and plans established to manage the supply and transfusion of blood during emergency situations.

Emergency Blood Management Plan
A comprehensive strategy outlining procedures and actions for managing blood resources in emergency scenarios.

Emergency Issue of Blood
The immediate provision of blood components in critical situations, such as trauma or major bleeding.

Emergency Preparedness and Resilience
Measures and strategies put in place to prepare for and respond to emergency situations in healthcare.

Empirical
Based on observation, experience, or practical evidence rather than theoretical considerations.

Endocrine
Relating to glands that secrete hormones directly into the bloodstream to regulate bodily functions.

Engraftment
The successful integration and growth of transplanted cells, tissues, or organs in a recipient.

Enzyme Panel (Proteolytic Enzyme)
A set of enzymes or proteins, including proteolytic enzymes, analysed for specific purposes, often related to blood-related processes.

Eosinophils
A type of white blood cell involved in the immune response, particularly against parasites and allergens.

Erythroblasts
Immature red blood cells that still contain a nucleus, typically found in the bone marrow during erythropoiesis.

Erythropoietin
A hormone produced by the kidneys that stimulates the production of red blood cells in the bone marrow.

Erythropoietin Stimulating Agents
Medications that mimic the action of erythropoietin, used to stimulate the production of red blood cells.

Estimated Blood Loss
An approximation of the amount of blood lost during a medical procedure or due to bleeding.

Ethylenediaminetetraacetic Acid (EDTA)
A common anticoagulant used in blood collection tubes to prevent blood clotting.

Exchange Transfusion
The process of removing and replacing a patient's blood with donor blood, often used to treat certain medical conditions.

Expected Delivery Date
The anticipated date when a pregnant person is expected to give birth.

False Negative
A result that incorrectly indicates the absence of a condition or characteristic when it is actually present.

False Positive
A result that incorrectly indicates the presence of a condition or characteristic when it is not actually present.

Fate / Fating
The outcome or destiny of a particular blood component or product.

Ferritin
A protein that stores and releases iron in the body, often measured in blood tests to assess iron levels.

Fever
A higher-than-normal body temperature, often a sign of infection or inflammation.

Fibrinogen
A protein essential for blood clotting, converted into fibrin during the coagulation process.

Fibrinogen Concentrates
Purified forms of fibrinogen used in medical treatments, particularly for individuals with fibrinogen deficiency.

Flank
The side of the body between the ribs and the hip.

Fluid Balance
The equilibrium between fluid intake and output in the body, crucial for maintaining proper hydration.

Flushing
The process of rinsing or cleansing, often referring to the flushing of intravenous lines with saline.

Fetal Maternal Haemorrhage
The passage of fetal blood into the maternal circulation during pregnancy or childbirth.

Fetal Medicine Unit
A specialised medical unit that focuses on the assessment and management of fetal health.

Fetal Rh D Screening
The screening process to determine the Rh D status of the fetus during pregnancy.

Fetus
The unborn offspring in the uterus, typically referred to after the eighth week of gestation.

Folate
A B-vitamin (vitamin B9) important for DNA synthesis and cell growth.

Forward Group
The blood group (ABO and Rh) determined by testing the patient's red blood cells.

Fractionated Plasma
Plasma that has been separated into its individual components, often used for specific medical treatments.

Fractionated Products
Products derived from separating and isolating specific components from blood or plasma.

Fresh Frozen Plasma
A blood component containing plasma proteins, coagulation factors, and other substances, used for transfusion.

Frozen Blood Bank
A facility that stores blood components at ultra-low temperatures for extended periods.

Full Blood Count
A blood test that measures various components, including red blood cells, white blood cells, and platelets.

Genotyping
Determining the genetic makeup or specific genes of an individual.

Gillick Competent
A term indicating a minor's capacity to provide informed consent for medical treatment without parental involvement.

Giving Set
A system for administering fluids or medications intravenously.

GMP (Good Manufacturing Practice)
A system for ensuring that products are consistently produced and controlled according to quality standards.

Governance
The system of rules, practices, and processes by which an organisation is directed and controlled.

Graft versus Host Disease (GvHD)
A condition where transplanted donor cells attack the recipient's tissues.

Granulocytes
White blood cells with granular cytoplasm, including neutrophils, eosinophils, and basophils.

Group and Screen
A blood test to determine the ABO and Rh blood group and screen for antibodies.

Group Specific
Pertaining to blood components or products that are specific to a particular blood group.

Guidelines
Standardised recommendations or protocols for medical or clinical practice.

Haematological Malignancy
Cancer affecting the blood-forming tissues.

Haematinics
Substances that promote the formation of blood or increase haemoglobin levels.

Haematocrit
The proportion of blood that is cellular, measured as the percentage of red blood cells in a volume of blood.

Haematology
The branch of medicine dealing with the study and treatment of blood-related disorders.

Haemodilution
A dilution of the concentration of blood components, often intentionally induced during medical procedures.

Haemodynamic
Pertaining to the forces and flow of blood within the circulatory system.

Haemoglobin
The protein in red blood cells that carries oxygen from the lungs to the rest of the body.

Haemoglobin S (HbS)
The abnormal haemoglobin variant associated with sickle cell disease.

Haemoglobinopathies
A group of genetic disorders characterised by abnormalities in the structure or production of haemoglobin, including conditions like sickle cell disease and thalassemia.

Haemolysis
The breakdown or destruction of red blood cells, often leading to the release of haemoglobin into the bloodstream.

Haemolysis Screen
Laboratory testing to assess the presence of haemolysis, which may indicate various medical conditions.

Haemolytic Disease of the Foetus and Newborn
A condition where the mother's immune system attacks the red blood cells of the unborn or newborn child.

Haemophilia A
A hereditary bleeding disorder caused by a deficiency or dysfunction of clotting factor VIII.

Haemophilia B
A hereditary bleeding disorder caused by a deficiency or dysfunction of clotting factor IX.

Haemopoietic Stem Cell Transplant
The transplantation of stem cells to restore the production of blood cells in individuals with certain disorders.

Haemostasis
The process of blood clotting and cessation of bleeding to maintain vascular integrity.

Haemostatic Agents
Substances or medications that promote haemostasis and control bleeding.

Haemovigilance
Surveillance and monitoring of the safety and effectiveness of blood transfusion, including the reporting and investigation of adverse events.

Heart Failure
A condition where the heart is unable to pump blood effectively, leading to insufficient oxygen delivery to tissues.

Heparin
An anticoagulant medication often used to prevent blood clot formation.

Hepatitis B
A viral infection affecting the liver, caused by the hepatitis B virus.

Hepatitis C
A viral infection affecting the liver, caused by the hepatitis C virus.

Hepatitis E
A viral infection affecting the liver, caused by the hepatitis E virus.

Hepcidin
A hormone regulating iron metabolism, influencing iron absorption and distribution in the body.

High-titre
Refers to a high concentration or level of a specific substance, often antibodies.

High-titre Negative
Refers to the absence of high concentrations of specific antibodies.

Histocompatibility and Immunogenetics
The study of the compatibility of tissues and the genetic factors influencing immune responses.

Hodgkin's Lymphoma
A type of lymphoma characterised by the presence of Reed-Sternberg cells.

Hospital Transfusion Laboratory
A laboratory within a hospital focused on blood transfusion services, including blood typing and compatibility testing.

Hospital Transfusion Team
A team of healthcare professionals within a hospital responsible for managing blood transfusion services.

Human Factors Investigation Tool
A tool or method used to investigate and analyse human factors contributing to incidents or errors.

Human Albumin Solution
A sterile solution containing human albumin, used for various medical purposes.

Human Factors
The study of human behaviour, interaction, and performance within systems.

Human Immunodeficiency Virus (HIV)
The virus that causes acquired immunodeficiency syndrome (AIDS).

Human Leukocyte Antigen (HLA)
A group of genes responsible for the regulation of the immune system, important in organ transplantation.

Human Medicines Regulations
Regulatory standards and requirements governing the use and approval of medicines.

Human Platelet Antigen
Specific antigens present on the surface of platelets, important in platelet transfusion compatibility.

Human Rights Act
Legislation in the United Kingdom that protects and promotes fundamental rights and freedoms.

Human T-Lymphotropic Virus
A group of retroviruses, including HTLV-1 and HTLV-2, which can cause T-cell leukaemia and neurological disorders.

Howell-Jolly Bodies
Small, round remnants of the cell nucleus found in circulating red blood cells, typically removed by the spleen.

Hydroxocobalamin
A form of vitamin B12 used in the treatment of vitamin B12 deficiency and certain types of anaemia.

Hyperkalaemia
Elevated levels of potassium in the blood, which can have various causes and may lead to cardiac complications.

Hypertension
High blood pressure, a condition that can increase the risk of cardiovascular diseases.

Hypoalbuminemia
Low levels of albumin (a protein) in the blood, often associated with liver or kidney diseases.

Hypoproteinaemia Oedema
Swelling caused by low levels of proteins in the blood, leading to fluid retention.

Hypotension
Low blood pressure, which may result in dizziness, fainting, or other symptoms.

Hypothermia
Abnormally low body temperature, which can be life-threatening if not addressed.

Iatrogenic Anaemia
Anaemia that is inadvertently induced by medical treatments or interventions.

IgA (Immunoglobulin A)
A type of antibody that plays a crucial role in mucosal immunity, found in high concentrations in bodily fluids such as saliva and tears.

IgA Deficiency
A condition where there is a deficiency of immunoglobulin A, potentially leading to increased susceptibility to infections.

IgG (Immunoglobulin G)
The most abundant type of antibody in the blood, providing long-term immunity against infections.

IgM (Immunoglobulin M)
An antibody involved in the early immune response, often present during the acute phase of infection.

Immunocompromised
Having a weakened or impaired immune system, making an individual more susceptible to infections.

Immunogenic
Capable of triggering an immune response.

Immunoglobulin
A protein produced by plasma cells that functions as an antibody to recognise and neutralise pathogens.

Immune Thrombocytopenic Purpura (ITP)
A disorder characterised by a low platelet count due to the immune system mistakenly attacking and destroying platelets.

Indirect Antiglobulin Test
A laboratory test used to detect antibodies that may be coating red blood cells, leading to their destruction.

Infant
A child in the early stages of life, typically referring to the period from birth to one year.

Inflammation
The body's response to injury or infection, characterised by redness, swelling, heat, and pain.

Informed Consent
The process of obtaining consent, in which a health care provider educates a patient about the risks, benefits, and alternatives of a given procedure or intervention.

Infusion
The administration of fluids or medications into the bloodstream through a vein over a specific period.

Inherited
Traits or conditions passed down from parents to offspring through genetic material.

Institute of Biomedical Science
A professional body for biomedical scientists, supporting education, training, and professional development.

Installation Qualification
A validation process to ensure that equipment and systems are properly installed and meet specified requirements.

International Blood Group Reference Lab
A laboratory that serves as a reference for blood group systems and related research on an international level.

International Normalised Ratio (INR)
A standardised measure of blood clotting time used to monitor the effectiveness of warfarin.

International Society of Blood Transfusion
An international organisation focused on the advancement of transfusion medicine and science.

Intracranial Haemorrhage
Bleeding that occurs within the skull, potentially leading to increased pressure on the brain.

Intramuscular
Administered into or within a muscle, often referring to the route of drug administration.

Intraoperative Cell Salvage
The collection and reinfusion of a patient's own blood during surgery to reduce the need for external blood transfusions.

Intraosseous
Referring to the administration of fluids or medications directly into the bone marrow.

Intrauterine Transfusion
The transfusion of blood directly into the fetal circulation, typically performed to treat severe fetal anaemia.

Intravascular
Located or occurring within blood vessels.

Iron Deficiency
A condition characterised by insufficient levels of iron in the body, leading to anaemia and other symptoms.

Iron Therapy
Treatment involving the administration of iron to address iron deficiency or anaemia.

Irradiated (blood)
Subjected to ionising radiation, often used to prevent graft-versus-host disease in blood transfusions.

Irish Blood Transfusion Service
The blood service in Ireland, ensuring a safe and sufficient blood supply for healthcare needs.

ISO15189
An international standard for medical laboratories, specifying requirements for quality and competence.

Intravenous Immunoglobulin (IVIG)
A treatment containing concentrated antibodies, administered intravenously to boost the immune system.

Jehovah's Witness
A member of a religious group that abstains from blood transfusions based on religious beliefs.

Jehovah's Witness Hospital Liaison Committee
A committee that supports Jehovah's Witnesses in hospitals, particularly regarding medical decisions involving blood.

Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (JPAC)
A committee providing professional advice on blood transfusion and tissue transplantation services in the UK.

Kell blood group system
A blood group system.

Kidd blood group system
A blood group system.

Kleihauer-Betke Test
A test used to quantify the amount of fetal blood in the maternal circulation, typically after a maternal-fetal haemorrhage.

Laboratory Incident Specialist
A specialist involved in investigating and managing incidents or issues in a laboratory setting.

Laboratory Information Management System (LIMS)
Software used to manage laboratory data, samples, and associated information.

Landsteiner's Law
A principle stating that an individual will not produce antibodies against antigens present on their own red blood cells.

Lasting Power of Attorney
A legal document that allows an individual to appoint someone to make decisions on their behalf, especially in case of incapacity.

Left Ventricular Dysfunction
Impaired function of the left ventricle of the heart, leading to reduced cardiac output.

Leukocytes (White Cells)
White blood cells that play a crucial role in the immune system's defence against infections.

Lewis
A blood group system with specific antigens related to the Lewis blood group.

Liver Function Test
A set of blood tests used to assess the functioning of the liver.

Loin
The lower part of the back.

Low Molecular Weight Heparin
A type of anticoagulant medication with a lower molecular weight than standard heparin.

Leukodepletion
The process of removing white blood cells from blood components to reduce the risk of transfusion reactions.

Lutheran blood group system
A blood group system.

Lymphocytes
A type of white blood cell involved in the immune response, including T cells, B cells, and natural killer cells.

Macrocytic
Referring to abnormally large red blood cells, often associated with certain types of anaemia.

Major Haemorrhage
Severe and potentially life-threatening bleeding, requiring urgent medical intervention.

Malaise
A general feeling of discomfort or unease, often an early sign of illness.

Manual Testing
Laboratory testing conducted manually without the use of automated equipment.

Mass Casualty Event
An incident resulting in a large number of casualties that may overwhelm local resources.

Material Risk
A risk in which a reasonable person in the patient's position would be likely to attach significance to the risk, or a healthcare professional is or should reasonably be aware that the particular patient would be likely to attach significance to it.

Maternal Anaemia
Anaemia occurring during pregnancy, often related to iron deficiency.

Maternal (blood) Sample
A sample of blood taken from a pregnant woman for testing or analysis.

Maximum Surgical Blood Ordering Schedule (MSBOS)
A guideline specifying the maximum amount of blood that should be cross-matched for a surgical procedure.

Measles
A highly contagious viral infection characterised by fever, cough, and a distinctive rash.

Mean Corpuscular Haemoglobin (MCH)
The average amount of haemoglobin in a red blood cell.

Mean Corpuscular Haemoglobin Concentration (MCHC)
The average concentration of haemoglobin in a given volume of red blood cells.

Mean Corpuscular Volume (MCV)
The average volume of a red blood cell, often measured as part of a complete blood count.

Medicines and Healthcare products Regulatory Agency (MHRA)
A regulatory agency in the UK responsible for ensuring the safety and effectiveness of medicines and medical devices.

Megaloblastic Anaemia
Anaemia characterised by the presence of abnormally large red blood cells due to impaired DNA synthesis.

Microbiology
The study of microorganisms, including bacteria, viruses, fungi, and parasites.

Microcytic
Referring to abnormally small red blood cells, often associated with certain types of anaemia.

MNS blood group system
A blood group system.

Molar Pregnancy
A type of gestational trophoblastic disease characterised by the abnormal growth of trophoblastic tissue in the uterus.

Monocytes
White blood cells that play a role in the immune system's defence against infections.

Multidisciplinary
Involving or integrating expertise from multiple disciplines or fields of study.

Mumps
A contagious viral infection characterised by swelling of the salivary glands.

Myasthenia Gravis
An autoimmune disorder affecting the neuromuscular junction, leading to muscle weakness and fatigue.

Myelodysplasia/Myelodysplastic Syndrome
A group of disorders characterised by abnormal development and function of blood-forming cells in the bone marrow.

The National Blood Transfusion Committee
A committee involved in coordinating and advising on blood transfusion policies and practices at a national level.

National Comparative Audit of Blood Transfusion
A programme of clinical audits which looks at the use and administration of blood and blood components in NHS and independent hospitals in England.

Nausea
The sensation of discomfort or unease often accompanied by the urge to vomit.

Near Miss
An event or situation that could have resulted in harm but did not, often used in the context of patient safety.

Neonatal Alloimmune Thrombocytopenia (NAIT)
A condition where a pregnant woman produces antibodies that destroy platelets in the fetus, leading to thrombocytopenia.

Nephrotic Syndrome
A group of symptoms indicating kidney damage, including proteinuria, oedema, hypoalbuminemia, and hyperlipidaemia.

Neutrophils
A type of white blood cell that plays a key role in the immune response to bacterial infections.

Never Event
A serious and preventable medical error that should never occur in the healthcare setting.

NG24 (The National Institute for Health and Care Excellence (NICE) Guidelines 24)
The NICE guidelines on blood transfusion.

NHS Blood and Transplant (NHSBT)
An organisation responsible for managing blood donation, transplantation, and related services in the UK.

NHS England (NHSE)
The body responsible for overseeing the day-to-day operation of the NHS in England.

NHS Improvement (NHSI)
An organisation working to improve healthcare delivery and outcomes within the NHS.

NHS Serious Incident Framework
A framework outlining the process for managing serious incidents within the NHS.

NHSBT Customer Service Manager
A role or position responsible for managing customer service within NHS Blood and Transplant, often registered Biomedical Scientists with an interest in blood transfusion.

NHSBT Portfolio of Blood Components
A portfolio of blood components managed by NHS Blood and Transplant.

Northern Ireland Blood Transfusion Service
The blood service in Northern Ireland, ensuring a safe and sufficient blood supply for healthcare needs.

NICE
The National Institute for Health and Care Excellence, an organisation providing guidelines and advice on health and social care.

Non-medical Authorisation (NMA)
The practice of blood component transfusion authorisation by healthcare professionals other than medical doctors.

Nursing and Midwifery Council (NMC)
The regulatory body for nurses and midwives in the UK.

Neonate
A newborn baby, typically within the first 28 days of life.

Non-conformities
Instances where a product or process does not meet specified standards or requirements.

Normal Immunoglobulin
Immunoglobulin containing antibodies typically present in normal individuals.

Normocytic
Referring to red blood cells that are of normal size and morphology.

Normothermia
The normal body temperature of an individual.

NovoSeven
A brand name for recombinant activated factor VII (rFVIIa), a medication used to treat bleeding disorders.

National Patient Safety Agency (NPSA)
A former UK organisation responsible for improving patient safety and reducing the risk of harm.

Nucleated Red Cells
Red blood cells that retain their nucleus, which is not typical for mature red blood cells.

Obstetrics
The branch of medicine dealing with pregnancy, childbirth, and the postpartum period.

Octaplas
A brand name for a plasma product used for transfusion.

Octaplex
A brand name for a plasma product that contains clotting factors.

Operational Qualification
A phase of equipment validation ensuring that equipment functions according to specifications.

Osmotic Pressure
The pressure exerted by a solution to prevent the influx of water by osmosis.

Oxygen
A vital gas essential for the process of cellular respiration.

Oxygen Saturation
The percentage of haemoglobin binding sites occupied by oxygen at a given time.

P1PK
A blood group system.

Paediatrics
The branch of medicine dealing with the care of infants, children, and adolescents.

Pathogen
A microorganism capable of causing disease, such as bacteria, viruses, or fungi.

Patient Blood Management
A patient-centred, systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood, while promoting patient safety and empowerment.

Patient Blood Management England
A team within NHS Blood and Transplant responsible for the implementation and development of Patient Blood Management in England.

Patient Blood Management Practitioner
A professional trained in implementing patient blood management strategies.

NBTC (National Blood Transfusion Committee) Patient Blood Management Recommendations Strategy
A strategy developed by the National Blood Transfusion Committee for patient blood management.

Patient Information
Information provided to patients regarding their health condition, treatment, or other relevant details.

Patient Information Leaflet
A written document providing information about a specific medication, procedure, or medical condition for patients.

Patient Rep (Representative)
An individual representing the interests and perspectives of patients in healthcare settings.

Patient Safety
Measures and practices to prevent harm to patients during healthcare.

Patient Safety Alert
A notification highlighting a potential risk or issue related to patient safety.

Performance Qualification
A phase of equipment validation ensuring that equipment consistently performs as intended.

Peripheral Oedema
Swelling in the extremities, often due to fluid retention.

Pernicious Anaemia
A type of anaemia caused by vitamin B12 deficiency.

Phagocytes
Cells that engulf and digest particles, such as bacteria or cellular debris.

Pharmacological Agents
Substances, often medications, which have a pharmacological effect on the body.

Phenotyping
Determining an individual's blood group or specific genetic characteristics.

Physiological Reserve
The capacity of an organ or system to function effectively under stress or in the face of challenges.

PICC Line (Peripherally Inserted Central Catheter)
A long, thin tube inserted through a vein in the arm, leading to larger veins near the heart, often used for intravenous access.

Placenta
An organ that develops during pregnancy, providing oxygen and nutrients to the fetus and removing waste products.

Placenta Praevia
A condition where the placenta partially or completely covers the cervix, which can lead to complications during pregnancy and delivery.

Plasma
The liquid component of blood, composed of water, electrolytes, proteins, and other substances.

Plasma Derivatives
Products derived from plasma, often used for therapeutic purposes, such as clotting factor concentrates.

Platelet Additive Solution (PAS)
A solution added to platelets during storage to extend their shelf life.

Platelets (thrombocytes)
Small cell fragments in the blood that play a crucial role in blood clotting.

Point of Care Testing
Medical testing performed near the patient, providing rapid results for immediate clinical decisions.

Policy
A set of guidelines or rules established by an organisation to guide decision-making and actions.

Polymerase Chain Reaction (PCR)
A laboratory technique used to amplify and analyse DNA, often employed in diagnostic testing.

Pooled
Combining multiple blood or plasma donations to create a larger, homogeneous product.

Post-Natal
Relating to the period after childbirth.

Post-operative
Referring to the period after a surgical operation.

Post-partum Haemorrhage
Excessive bleeding following childbirth, which can be a serious medical emergency.

Pre-Transfusion Testing
Laboratory testing performed before a blood transfusion to ensure compatibility between the donor and recipient.

Pre-operative Anaemia
Anaemia present before a surgical procedure.

Pre-operative Optimisation
Measures taken before surgery to optimise a patient's health and reduce the risk of complications.

Primary Care
The first point of contact in the healthcare system, acting as the 'front door' of the NHS

Prophylaxis
Preventive measures or treatment to avoid the development of a disease or condition.

Protein C and Protein S
Proteins involved in the regulation of blood clotting.

Proteolytic Enzyme
An enzyme that breaks down proteins into smaller peptides or amino acids.

Prothrombin Complex Concentrate
A medication containing factors II, VII, IX, and X, used to treat bleeding disorders.

Pruritus
Itching or an unpleasant sensation on the skin that leads to scratching.

Potentially Sensitising Event
An event that may lead to the development of an immune response or sensitisation in the body.

Prothrombin Time
A laboratory test that measures the time it takes for blood to clot.

Pulmonary Oedema
Accumulation of fluid in the lungs, often a sign of heart failure.

Pulse (Heart Rate)
The number of heart beats per minute, typically measured at the wrist or neck.

Purine Analogue
A class of drugs that interfere with the synthesis of DNA and RNA.

Quality Standard 138
Likely a reference to a specific quality standard or guideline, possibly related to healthcare.

Quality Control
Processes and procedures to ensure that products or services meet predefined quality criteria.

Quality Assurance
Systematic activities to ensure that quality standards are met throughout a process or service.

Routine antenatal anti-D prophylaxis (RAADP)
A treatment option for all pregnant women who are Rh D negative and who are not known to be sensitised to the Rh D antigen.

Rabies
A viral disease that affects the nervous system of mammals, including humans.

Rapid Group
A quick identification of a blood group, often performed in urgent situations.

Rapid Infusion
The rapid administration of fluids or medications into the bloodstream.

Rare Donor Panel
A selection of blood donors with rare blood types or unique characteristics, often maintained for specific patient needs.

Red Cell Immunohaematology Reference Laboratory (RCI)
A reference testing service which provides vital support for blood transfusion, organ and stem cell transplantation.

Red Cell Distribution Width
A measure of the variation in size of red blood cells in a blood sample.

Reagent
A substance or compound used in a chemical reaction to detect, measure, or produce other substances.

Recipient
An individual who receives a transplant, blood transfusion, or any other medical intervention.

Recombinant
Produced by genetic recombination, often referring to biotechnologically engineered products.

Red Blood Cells (erythrocytes)
Blood cells responsible for carrying oxygen from the lungs to the rest of the body.

Platelet Refractoriness
A condition where a patient's platelets do not adequately respond to transfusions, often due to antibodies.

Remote Issue
The process of issuing blood from a central blood bank to a remote location.

Renal Impairment
Dysfunction or damage to the kidneys, affecting their ability to filter and excrete waste products.

Renal Function Test
Tests that assess the functioning of the kidneys.

Reservoir (Cell Salvage)
A container or system that collects and holds blood lost during surgery for later reinfusion.

Respiration Rate
The number of breaths taken per minute, indicating the rate of breathing.

Respiratory Distress
A medical condition characterised by difficulty in breathing, shortness of breath, or laboured breathing.

Restrictive Transfusion Thresholds
Guidelines or criteria that guide the amount of blood transfused to a patient based on specific medical indications.

Resuscitation
The act of reviving a person from unconsciousness or apparent death, often involving life support measures.

Reticulocytes
Immature red blood cells that are released into the bloodstream before maturing into erythrocytes.

Reversal Agent
A substance used to counteract the effects of a drug or toxin.

Reverse Group
A confirmation process in blood typing where the results are verified by testing against the reverse of the initial grouping.

Rh blood group system
A blood group system that classifies blood based on the presence or absence of the Rh antigens.

Rh Typed
The determination of an individual's Rh blood type.

Rigor
A sudden feeling of cold with shivering accompanied by a rise in temperature, often with sweating.

Risk Assessment
The process of evaluating potential risks and hazards associated with a particular situation, action, or decision.

Ristocitin Co Factor
A component used in testing to assess the function of blood platelets.

Root Cause Analysis
A methodical process of investigating and identifying the fundamental cause or causes of an issue or problem.

Rotational Thromboelastometry
A laboratory test that assesses blood clotting dynamics, providing information about coagulation function.

Regional Transfusion Committee
A committee responsible for coordinating and overseeing transfusion practices within a specific region.

Regional Transfusion Tea
A team dedicated to managing and facilitating blood transfusion services within a specific geographic region.

Rubella
A viral infection that can cause rash, fever, and congenital disabilities if contracted during pregnancy.

SaBTO - Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) Safety of Blood, Tissues and Organs
A group that advises UK ministers and health departments on the most appropriate ways to ensure the safety of blood, cells, tissues and organs for transfusion or transplantation.

Serious Adverse Blood Reactions & Events (SABRE)
An online system that allows blood establishments and blood banks to electronically submit these reports direct to the MHRA

Serious Adverse Event
A significant and unexpected event or incident that has a detrimental impact on a patient's health.

Safety 1 Approach
A safety management approach focusing on preventing errors and adverse events.

Safety 2 Approach
A safety management approach emphasising system resilience and learning from incidents.

SAGM
A solution used for preserving red blood cells during storage, consisting of saline, adenine, glucose, and mannitol.

Saline
A sterile solution of sodium chloride used for various medical purposes, including intravenous infusion.

Sample Validity
Assurance that a sample used for testing is appropriate.

Serious Adverse Reaction
A severe and unintended response to a medical treatment or intervention.

Satellite Fridges
Refrigerators located in remote locations for storing blood or medications.

Scottish National Blood Transfusion Service
The blood service in Scotland, ensuring a safe and sufficient blood supply for healthcare needs.

Second Sample
A follow-up or confirmatory sample collected for testing, often used in blood typing and compatibility checks.

Secondary Care
Medical care provided by specialists and hospitals, typically following primary care.

Sensation
The perception or awareness of stimuli through the senses.

Serological Cross Match
A laboratory test to ensure compatibility between donor and recipient blood by mixing their blood samples and checking for reactions.

Service Level Agreement (SLA)
A formal agreement between a service provider and a customer specifying the level of service expected, including response times, performance metrics, and responsibilities.

Severe Aortic Stenosis
A medical condition characterised by the narrowing of the aortic valve in the heart, leading to restricted blood flow.

Shock
A medical emergency characterised by inadequate blood flow to tissues, often resulting in organ failure.

Serious Hazards of Transfusion (SHOT)
An organisation or program focused on monitoring and reporting serious hazards and adverse reactions related to blood transfusions.

Sickle Cell Anaemia
A genetic disorder characterised by abnormal haemoglobin, leading to distorted red blood cells and various health complications.

Sickle Cell Disease
A group of inherited disorders affecting red blood cells, including sickle cell anaemia.

Sickle Cell Trait
The carrier state for the sickle cell gene without displaying symptoms of sickle cell disease.

Sickle Screen
A test or screening process to identify the presence of sickle cell trait or disease.

Single Unit Transfusion
Administering a single unit of blood or blood product to a patient at a time and reassessment of the patient clinically and with a further blood count to determine if further transfusion is needed.

SmPC (Summary of Product Characteristics)
A document containing information about a medicinal product's properties, indications, dosage, and more, approved by regulatory authorities.

Sodium Citrate
An anticoagulant used in blood collection and processing to prevent clotting.

Solid Organ Transplant
The surgical transplantation of organs such as the heart, liver, kidney, or lungs.

Specialist Services Electronic
Reporting using Sunquest's Integrated Clinical Environment (ICE)
A system for electronic reporting of specialist services, utilising the Sunquest Integrated Clinical Environment.

Stand Down
The deactivation or cessation of a particular process or operation.

Standard Operating Procedure (SOP)
A set of step-by-step instructions outlining the procedures for carrying out specific tasks or operations.

Stem Cells
Undifferentiated cells with the ability to differentiate into various cell types, important in tissue regeneration and repair.

Strategic Executive Information System (StEIS)
A system designed to provide strategic executive information for decision-making.

Subcutaneous
Administration or placement under the skin.

Syphilis
A sexually transmitted infection caused by the bacterium Treponema pallidum.

Systolic Blood Pressure
The higher of the two numbers in a blood pressure reading, representing the pressure in the arteries when the heart beats.

T Cell
A type of lymphocyte involved in the immune response, including cytotoxic T cells and helper T cells.

Tachycardia
Abnormally rapid heart rate.

Transfusion Associated Circulatory Overload
A condition where the volume of blood transfused exceeds the recipient's circulatory system capacity.

Thromboelastography
A laboratory test assessing the clotting ability of blood by measuring its viscoelastic properties.

Tetanus
A potentially serious bacterial infection causing muscle stiffness and spasms.

Thalassaemia
A a genetic blood disorder causing anaemia due to abnormal haemoglobin production.

Three Pillars of PBM (Patient Blood Management)
PBM focuses on optimising the care of patients who might need transfusion.

The three pillars are:
Optimisation of blood mass and function

Minimisation of blood loss
Optimisation of patient tolerance to anaemia

Thrombopoietin
A glycoprotein hormone that regulates the production of platelets in the bone marrow.

Thrombotic Event
The formation of a blood clot (thrombus) that can obstruct blood vessels, leading to various medical conditions.

Thrombotic Thrombocytopenic Purpura (TTP)
A rare blood disorder characterised by blood clot formation in small blood vessels, leading to low platelet levels and potential organ damage.

Total Iron Binding Capacity (TIBC)
A blood test that measures the blood's capacity to bind iron, providing information about iron levels in the body.

Transfusion Laboratory Manager
A professional responsible for overseeing the operations of a transfusion laboratory, ensuring quality and compliance.

Tolerable Blood Loss
The amount of blood loss that a patient can withstand without adverse effects.

Tourniquet
A device used to temporarily constrict blood vessels, typically applied to control bleeding during medical procedures.

Toxin
A poisonous substance produced by living cells or organisms, capable of causing harm to the body.

Traceability
The ability to trace and track the history, location, or application of a blood component, throughout its lifecycle.

Transfusion-Related Acute Lung Injury (TRALI)
A rare but serious reaction to blood transfusion, characterised by acute respiratory distress.

Tranexamic Acid
A medication that helps prevent excessive bleeding by inhibiting the breakdown of blood clots.

Transfusion Practitioner
A healthcare professional specialised in overseeing and managing the transfusion process, ensuring safe and appropriate blood use.

Transfusion Reaction
Adverse reactions that can occur in response to a blood transfusion.

Transfusion
The process of administering blood or blood components to a recipient.

Transfusion 2024
A Five-year Plan for Clinical and Laboratory Transfusion Practice

Transfusion History
The record of a patient's past blood transfusions, including details of the components and products received.

Transplantation
The surgical procedure of grafting or transplanting organs or tissues from one person to another.

Thrombolysis
Treatment to dissolve or break up blood clots using medications called thrombolytics.

Trunk
Typically refers to the main part or central portion of the body, excluding the head, neck, arms, and legs.

Trust (NHS Trust)
A legal entity, set up by order of the Secretary of State to provide goods and services for the purposes of the health service.

TSATS (Transferrin Saturation)
A measure of the percentage of transferrin saturation with iron in the blood.

Two Sample Rule
A rule or protocol specifying the requirement to collect and verify two samples before issuing blood components.

UK Cell Salvage Action Group
A group focused on promoting and advancing the use of cell salvage in the UK healthcare system.

UKAS (United Kingdom Accreditation Service)
The national accreditation body for the United Kingdom, ensuring the competence and quality of organisations.

The United Kingdom Transfusion Laboratory Collaborative (UKTLC)
The United Kingdom Transfusion Laboratory Collaborative (UKTLC) was formed in 2006 in response to 30-40% of the wrong blood events reported to SHOT originating in the hospital transfusion laboratory.

Unit Integrity
The condition and viability of a blood unit or blood product. Ensuring unit integrity is essential to maintain the quality and safety of blood components during storage and transportation.

Unknown Male
Refers to a situation where the identity or details of a male patient are not known or are unidentified in a medical context.

Urticaria
A skin condition characterised by raised, red, and itchy welts. It is often caused by an allergic reaction or other factors that release histamine into the skin.

Uterine Atony
A condition characterised by the lack of normal uterine muscle contractions after childbirth. It can lead to postpartum haemorrhage and is a concern during the delivery process.

Validation
The process of assessing and confirming the accuracy, effectiveness, and compliance of procedures, equipment, or systems to meet predefined standards and requirements.

Vital Appropriate Knowledge Enhances Stock Analysis (VANESA)
A data management system, where hospital and blood service data is collected. In return participants can view real-time data and charts.

Varicella
An infectious disease caused by the varicella-zoster virus, commonly known as chickenpox.

Vasoconstrictor
A substance or medication that causes the narrowing (constriction) of blood vessels, leading to increased blood pressure.

Variant Creutzfeldt-Jakob Disease (vCJD)
A rare and fatal neurodegenerative disorder.

Venepuncture
The medical procedure of puncturing a vein, typically with a needle, for the purpose of collecting blood or administering medications.

Verification
The process of confirming the accuracy and correctness of information, procedures, or processes through careful examination and validation.

Virology
The branch of microbiology that studies viruses and viral diseases.

Viscoelastic Assays
Laboratory tests that assess the clotting properties of blood, providing information about coagulation and fibrinolysis.

Vitamin B12
A crucial vitamin involved in various bodily functions, including red blood cell formation and neurological health.

Vitamin K
An essential vitamin for blood clotting and bone health.

Vitamin K Antagonist
A type of medication that interferes with the action of vitamin K, often used as an anticoagulant.

von Willebrand Disease
A genetic bleeding disorder caused by a deficiency or dysfunction of von Willebrand factor.

Warfarin
An anticoagulant medication used to prevent blood clotting.

Warm Antibodies
Blood group antibodies that are active at body temperature, often associated with autoimmune haemolytic anaemia.

Washed Cells
Red blood cells that have undergone a washing process to remove plasma or unwanted substances before transfusion.

Wrong Blood in Tube (WBIT)
Blood is taken from the wrong patient and is labelled with the intended patient's details.

Welsh Blood Service
The blood service in Wales, ensuring a safe and sufficient blood supply for healthcare needs.

World Health Organisation (WHO)
A specialised agency of the United Nations responsible for international public health.

Yellow Card Scheme
A system for reporting and monitoring adverse drug reactions and incidents related to medical devices in the United Kingdom.