Blood Stocks Management Scheme

Inventory Management

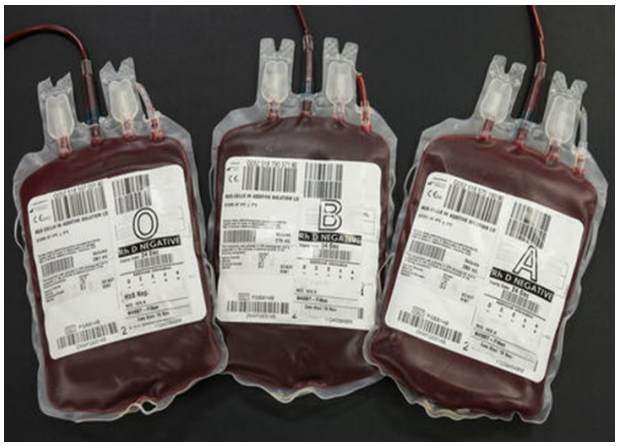
Best Practice Guide

September 2024

INTRODUCTION

Voluntarily donated blood components are precious, finite resources where effective inventory management practice is essential, not only to support and maintain the supply chain, but to minimize wastage without jeopardising service to patients. Smart decision making together with the processes performed across the whole supply chain are based on a trade-off of shortage against wastage with potentially lethal consequences in the case of a 'stock out', therefore the need to ensure both the safe storage and efficient use of this threatened resource is paramount.[1]

The aim of this document is to focus on **inventory management of blood components** within the hospital blood transfusion laboratory setting, to provide recommendations to the user for determining an appropriate stock level, reducing wastage, performance monitoring and ultimately achieving best practice.



Continual periodic review of blood inventory management practice enables hospital staff to monitor and adjust stock levels, whilst reducing wastage due to time expiry (TIMEX), and promotes the efficient use of blood[1].

Facilitated by the collaboration between hospital laboratory management and the Blood Stocks Management Scheme (BSMS), current stock data is shared, analysed and then reported back to the hospital[2]. The effectiveness of these cross-functional teams and sharing of data allows for evidence-based improvements, drawing out examples of best practice, helping to protect our blood stocks nationally now and for the future.[3]

Previous initiatives, designed to target inappropriate blood use and reduce wastage, have been highly successful [4,5] however with a vulnerable donor base and continued adherence to stringent regulation,[6] the situation remains evermore challenging.

When managing your blood stock inventory, there are ***two key elements to consider:***

1. ***Product availability*** *where an appropriate minimum stock level is set, reordering patterns and delivery schedules are carefully considered and optimized, and clinical demand is continually met.*
2. ***Product integrity*** *where environmental factors are considered to maintain the cold chain and provide safe storage along with robust stock movement and handling procedures.*[7]

This document also provides information and insights into for preparing for a shortage or how to manage your stocks during an IT laboratory information management system (LIMS) downtime, whether it be a planned or unplanned, short term or long term. There is also guidance for laboratory staff for any VANESA downtime.

This document will cover the following products: (1) **Red blood cells**, (2) **Platelets**, (3) **Fresh Frozen Plasma** (FFP) and (4) **Cryoprecipitate**.

CONTENTS

1. LABORATORY STAFF – TRAINING AND RESPONSIBILITY

- The Blood Transfusion lead, or designated inventory manager, will be responsible for regularly monitoring local blood stocks and identifying any areas for concern, including overstocking and increases in wastage. They must promote areas of good practice and provide support and guidance to staff during times of unplanned shortages or fluctuations in demand.
- Overall stock control awareness for laboratory staff and regular training in handling blood components is key to managing the blood component inventory and minimising wastage.[7]
- Comprehensive standard operating procedures (SOP's) in blood component inventory management should be written, regularly reviewed and followed (see section 3).[1]
- All staff involved in the handling of blood components should receive training and be competent in performing crucial tasks such as placing routine and urgent orders to the blood service, particularly the requisition of components with special requirements, handling and prioritising deliveries, loading and rotating stock.
- Experienced, skilled staff are key to setting stock levels, reviewing ordering patterns, reducing wastage and pre-empting demand. However, all laboratory staff should be made aware of changes to policies and/or procedures and be provided with adequate ongoing training.
- All staff involved within the blood transfusion process will receive Good Manufacturing Practice (GMP) awareness training[6].
- Staff should have sufficient knowledge regarding the suitability of unused specialised components for patients without such requirements, to prevent the unnecessary wastage of such components.
- Staff should understand the consequences of ineffective stock handling and blood wastage, including the detrimental affect it may have on their availability of stock, the financial penalties it may carry, the potential impact to the national blood supply and ultimately the subsequent risk to patients.[1]

- Collaboration between the laboratory and clinical area is encouraged and allows the laboratory to keep up to date with changes in demand. Good communication and actively working together can help improve processes.
- BSMS component reports should be reviewed each month and be presented and discussed at local hospital transfusion committee meetings to identify areas for improvement.
- Contingency procedures should be in place for any unplanned fluctuations in usage or demand. These procedures should provide instructions on how and when to increase or decrease stocks, as well as how to plan for any long-term deviations.[8]

Participation in the **Blood Stocks Management Scheme** is key to capturing blood stock inventory information. Appropriate, key personnel should have access to VANESA (the BSMS data portal) and be trained in its use and functions. [2,9,10]

2. APPROPRIATE STOCK LEVELS AND ORDERING PATTERNS

There is a clear link between over-stocking and increased wastage due to time expiry and as such, setting appropriate stock levels is vital. Maintaining the critical balance between shortage and wastage of blood components is the key to a safe service.[1,9]

RED CELLS

The following key factors should be considered when setting a stock level.

- Various types of health provider will require different stock levels to achieve a safe and efficient service delivery, for example high users with major trauma centres may turnover large volumes of components within a short period of time and this will be reflected in their inventory management.[1,11]
- Hospitals with designated clinical specialties may require specialist components to be stocked in addition to their usual stock.
- Distance from your stock holding unit (SHU)/supplier may also be a consideration as this will influence the time it takes to receive additional deliveries. A higher stock level may be justified for hospitals situated further away from their supplier, whereas it may be viable for hospitals situated close to their SHU to hold less stock.[9]

- Hospitals within a network may 'share' stock (see section 5). With good communication between sites, this situation offers increased availability of components ultimately benefitting patients and is advantageous for rotation of short expiry stock and the potential for an overall reduction in stock at each site. Platelet availability may increase and accessibility to components with special requirements e.g. antigen negative, will reduce direct ordering from the SHU.[3]

- Setting a maximum stock level is advised to prevent overordering. If you exceed your maximum stock level, measures should be in place to ensure stock is used judiciously, this may include offloading stock to a partner site, reducing other blood groups of red cells temporarily in favour of the excess blood group stocked and ensuring future blood stock orders are checked, delayed or cancelled.
- A minimum stock level should also be established. This is the lowest amount of safe inventory required before replenishment of stocks. This quantity is never static and should be adjusted as needed. Adjustments based on inventory data from monthly component reports, forecasting and local intelligence regarding blood use, ensures that the laboratory will not run into 'stock-outs' during peak seasons, as well as enabling the laboratory to hold fewer units during low seasons, therefore avoiding TIMEX wastage.[1]
- Demand forecasting forms the basis of predicting inventory requirements and includes an awareness of seasonal changes and/or threats to the donor population. Levels previously set should be flexible to accommodate long term changes if required.[12,13] Examples of seasonal changes include, but are not limited to, a reduction in demand during the summer months and around bank holidays, reduced donations during the winter/flu season and increased stockholding in preparation for large local events. Any of these factors can influence the demand for blood components, hereby affecting the amount of stock required.

- Performing regular stock counts within the blood stock fridge will provide an accurate, real time picture of your inventory totals and allow for reorganisation of expiry dates if required. This may be a manual process or via electronic tracking systems and should be built into daily staff tasks.
- Enter daily red cell stock levels into VANESA (including weekends and bank holidays) to reflect activity is vital and must be recognised as an essential task.

Determine a suitable **dereservation period** for components. Previously issued, unused blood should be returned to stock preferably within a **24-hour** period. This will ensure good stock rotation and prevent over-ordering.[9,14] This should be included within the local laboratory procedure.

Dereservation periods should ideally not exceed 24 hours, however there are some exceptions to the rule including the following;

Patients with special requirements where crossmatching has been performed at a referral laboratory or suitable blood has been difficult to obtain and cannot be reassigned easily.

High-risk maternity/surgical cases or patients with clinically significant antibodies. Unused units should be returned to general stock, where suitable, at the earliest opportunity.

Accessibility of satellite fridges for allocated stock, where there is an internal system for retrieval of such units.[15]

- Determining an appropriate red blood cell stock level can be complicated, however calculation of your '**issuable stock index'** (ISI) will inform you of how many days of stock you have currently in your blood bank and can be used as an indicator for setting stock levels (see section 7).[1,9]
- When large quantities of red cells are required, consider ordering smaller amounts, spreading it over your scheduled deliveries, where possible, rather than a single large order. This will lower the number of red cells available within your inventory with the same expiry date, hereby reducing the pressure on laboratory staff and ultimately minimising wastage.

Stocking **all** blood groups according to your patient population is good practice and will lessen the inappropriate overreliance on group O (red cells). Non-group O patients should receive **group specific** red cells where possible. This will prevent mixed field reactions and subsequent delays in blood provision, whilst preserving O negative red cells.

- Good visibility of stock, including the status of each component, contributes to efficient inventory management. Information related to the location, expiry date and quantity of all blood components leads to more appropriate ordering decisions.[1]
- There should be a process to review standing orders regularly and in a timely manner. Requests no longer required should be cancelled immediately once confirmed.
- Consideration should be given to all methods of delivery, in addition to pre-arranged delivery times. Less regular deliveries could prompt users to hold higher stocks.
- Consider different stock management models for example **Vendor-managed inventory**' (VMI) (*subject to availability*), where a blood service supplier has access to hospital transfusion laboratories inventory data via a designated laboratory system. This information identifies blood stock deficits, creating appropriate "top up" orders at NHSBT for laboratories to authorise or cancel, as appropriate.[16]

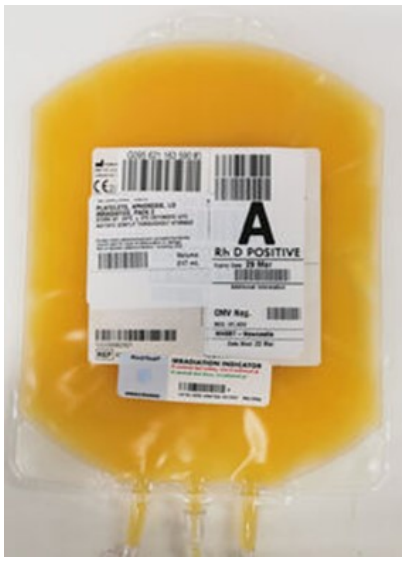
PLATELETS

There are key elements to stockholding platelets as these components have a limited shelf life.

- Hospitals should attempt to provide ABO matched platelets where possible, particularly for patients who require ongoing or regular platelet support.[17]
- Consider a dereservation period for platelets that have been issued to a patient but not collected/transfused (eg: 4-6 hours). Effective communication between the laboratory and the clinical area is key to understanding the likelihood of the platelets being transfused.

- It is acceptable to use non-ABO identical platelets to reduce wastage and prevent reorder. Components found to be negative for high titre haemagglutinins and non-group O platelets should be primarily considered for use, as they lower the risk of haemolysis. Pooled platelets suspended in PAS are also likely to reduce this risk.[17]
- Consider the use of **A D Positive platelets** (high titre negative) for emergencies/traumas in line with your patient demographic.[17]

  *(*D Negative females of childbearing potential <50years will require anti-D prophylaxis following any D Positive platelets transfused [17])*



- Issue emergency/trauma 'stock' platelets to non-trauma patients on or before their expiry date to avoid wastage, where clinically appropriate. Replenish on the day of the current platelet expiry.
- Standing orders should be reviewed regularly and cancelled at the earliest opportunity once an end date has been established.
- HLA matched platelet orders should also be reviewed regularly and cancelled at the earliest opportunity once an end date has been established. Where HLA matched platelets are no longer required, consider issuing these platelets, where appropriate, to patients without HLA-matched requirements to avoid wastage.
- Unreserved platelets held as stock should be entered into VANESA daily.

Rotation, dereservation periods and stock sharing of platelets between sites can contribute to reduced platelet wastage. Communication is key to reduce over-ordering when platelets are available at other sites.

FROZEN COMPONENTS

Fresh frozen plasma (FFP) and cryoprecipitate have considerably longer shelf-lives than red cells and platelets, therefore overstocking is unnecessary. The handling and storage of frozen components are important factors to consider when avoiding unnecessary wastage and preserving the integrity of the component.

- Minimum and maximum stock levels should be set for all frozen components.
- Receipt of frozen components should be dealt with swiftly to avoid part defrosting.
- Designated, labelled drawers/areas should be evident within the freezer or presented as a map on the freezer door, to ensure the separation between components. This will reduce errors in defrosting the incorrect component, causing a critical time delay.
- Regular checks and stock rotation should be carried out to check the expiry dates of each frozen component.
- Enter daily stock levels for adult FFP and cryoprecipitate into VANESA.

3. PROMOTING BEST PRACTICE

Best practice can be only be achieved if processes are regularly reviewed and adapted where necessary. Efficient inventory management relies on a balance between ensuring sufficient stock is always available but not so high that wastage rates are increased due to TIMEX.

SOPs should be comprehensive and include the following;

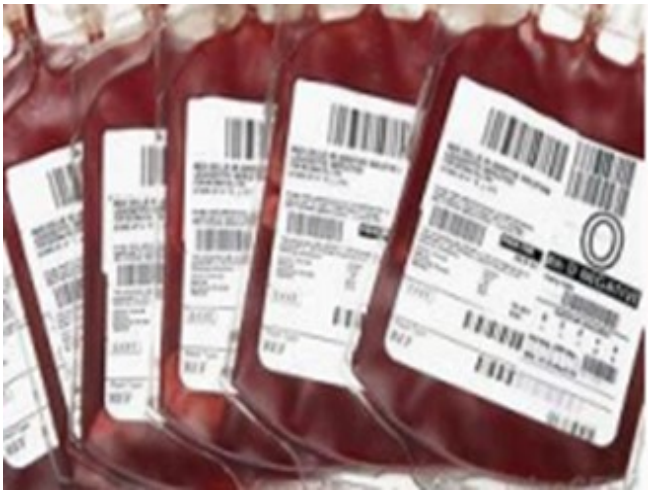
- ☑ Guidance for efficient stock rotation including dereservation periods, returning unused stock, ordering stock and provision of stock to and from satellite fridges and/or remote issue fridges.
- ☑ Inventory management where components are sorted by age, with an emphasis on using the oldest unit first, where possible. This is known as either the OUFO (oldest unit first out) policy or FIFO (first in first out) policy.[18,19] All fridge drawers will be organised with the oldest stock at the front of the drawers for easy access and selection.
- ☑ Emphasis on areas of good practice such as appropriate use of older blood for patients most likely to require it and issuing newer stock as stand-by units for patients who may require it.
- ☑ Clear instructions for setting up, monitoring and cancelling standing orders for blood components, overseen by senior staff.
- ☑ How and when to input data accurately into the BSMS data portal, VANESA, where the laboratory actively participates.[3,20]
- ☑ The inclusion and review of key performance indicators for **ISI** and **WAPI**, to monitor and improve performance.

- As few as possible red cells should be removed at the same time from their controlled storage facility and there should be no delay when handling the components or moving them between their storage locations.[21]
- Labelling of fridges/freezers/incubators with appropriate stock levels for each component and by blood group can provide a visual reminder to staff.
- Visual markers, whiteboards, handover logs etc that are easily accessible to all staff, should be considered to highlight any components that are **close to expiry** or are a **specialised component**.
- Consider highlighting expiring units **5 days prior to expiry**. Such units should ideally be selected for patients most likely to require them and not as a 'stand-by' component.

- 'Specialised' components should be separated from routine stock eg: irradiated, antigen negative, to avoid being selected unnecessarily. Such components will be stored in a labelled area, easily identifiable, monitored regularly and recycled back into general stock, before the expiration date, if no longer required, to minimize time expiry.

Where emergency O D negative units are held, consider the use of **K negative units only,** as the inclusion of C negative, E negative emergency units is not a recognised requirement unless clinically indicated.[22]

- To conserve O D negative red cells, the provision of **O D positive red cells** should always be considered for emergency use for **males >18 years** and all **females of non-childbearing potential (>50 years)**.[14]
- To conserve O D negative red cells, the provision of **O D positive red cells should be considered for emergency use in pre-hospital care settings** such as the Helicopter Emergency Medical Services and Blood on Board initiatives. [23,24]



- Where emergency group O red cells are reserved for unknown patients, they should be returned into general stock with sufficient expiry time, 5-7 days for example, allowing maximum usage to avoid wastage.
- Red cells with the longest expiry should be selected to replenish/replace the emergency standby stock, where possible. A visual reminder and method of communication should be in place to remind staff when to perform the exchange.

- Once the blood group of an emergency/trauma patient is known and can be confirmed, they should receive ABO matched products, where possible. Stocks should be checked, and appropriate supplies ordered if necessary.[14]
- Consider a reduced dereservation period for red cells issued for day-case patients or used as 'stand by units', 12 hours for example, to maximize efficiency and prevent surplus ordering.
- A procedure should be available for lab staff to follow when taking blood/blood component requests from clinical staff. Appropriate questions and indicators for challenging internal requests should be discussed and agreed at Hospital Transfusion Committee level. This will encourage appropriate requesting and subsequently keep assigned inventories under control, reducing 'just in case' requests.

- Electronic issue (EI) should be considered and implemented where possible. EI allows components to be issued upon demand rather than being allocated to a patient and stored for a period of time in an external issue fridge. Once a component is reserved for a patient it is effectively removed from the 'available' inventory within the laboratory, which may encourage unnecessary extra ordering.[1, 25, 26, 27]
- Where electronic issue is not available or appropriate, a **Maximum Surgical Blood Order Schedule** (MSBOS) should be agreed between the surgical team and laboratory, for all patients. Red cells selected as part of the MSBOS should have long expiry dates where possible.[1, 28]

- Staff should place issued components into the issue/ satellite/remote fridge with the oldest red cells at the front of the drawer to maintain efficient use of components. Those with an electronic blood tracking system should consider setting their system to ensure the oldest component issued to the patient is collected first.[15,29]
- Staff who collect red cells from an issue fridge should receive Good Manufacturing Practice (GMP) awareness training.[6,30]
- In the event of an unavoidable delay in the administration of blood, every effort should be made to return the unit to blood bank, within an agreed acceptable timeframe, to avoid 'out of temperature control' (OTCOL) wastage.
- Where red cells are removed from an issue fridge and placed into a blood transport box, an agreed time period, dependant on the box's limitations on temperature and validation findings, should be clearly indicated on the box to avoid unnecessary OTCOL wastage.
- Timely rotation of blood stocks held within satellite fridges/remote fridges/other sites etc will help to reduce wastage due to TIMEX. A visual reminder, e.g. white board, log etc could be revised regularly with dates for renewal or replacement of this stock.
- Sharing of information with other sites regarding blood components close to expiry or specifically ordered components that are no longer required, can be beneficial and should be included in daily tasks, handovers and standard operating procedures to avoid unnecessary ordering and increased wastage.
- Regular review of usage, wastage and delivery or transport schedules are important in determining appropriate inventory management systems as well as identifying areas for improvement.
- Trend analysis data and benchmarking information, provided on BSMS component reports, should be regularly reviewed and acted upon accordingly.

4. PATIENT BLOOD MANAGEMENT

Having a multidisciplinary **Patient Blood Management (PBM)** programme within the hospital/Trust enhances patient care and reduces inappropriate use of blood components.[32]

PBM key messages include the following:

- Training and education of clinical staff ensures appropriate requesting of components, reducing the need to over-order or cause patient harm with inappropriate transfusions.[32]
- Hospitals with intra and postoperative cell salvage processes have shown to contribute towards a significantly lower ISI.[9]
- Recognised anaemia pathways have contributed to a reduction in inappropriate requests for red cells, hereby limiting unnecessary exposure to patients.[33]

5. MOVEMENT OF STOCK

Movement of stock includes the collection of blood components from a blood bank/storage area to a different internal location or the transfer of blood components to different hospital sites or organisations, however the main principles are the same. Good Distribution Practice (GDP) compliance requires us to – "*ensure that storage conditions are observed at all times, including during transportation*". This is referred to as **cold chain compliance**.[34]

- There is a legal requirement to preserve the safety, efficacy, and integrity of a component at all times[6].
- Transfer policies should be robust and accessible for both the 'sending' and 'receiving' site, and a standard operating procedure must be available for all staff to follow.
- All staff involved in the transportation of blood components should receive GMP awareness training. This information should be current and up to date.
- The transfer of blood components must be auditable from the time leaving the fridge to reaching the planned destination. Receipt of the component(s) should be acknowledged by **the receiving party** to ensure the units have not been out of temperature or compromised in any way.
- All transport boxes should be validated annually, cleaned regularly and remain fit for purpose.

- A visible warning label on the blood transfer box to indicate the time permitted for the components to remain in transit is essential. The time is dependent on the transport carriers' limitations to hold its temperature, without compromising the integrity of the component.
- All transport carriers should be labelled clearly with the correct department and address of its destination.
- Effective communication between destinations, where applicable, should occur to allow the receiving site time to prepare for the arrival of components.
- Blood components should be transferred to the intended destination with sufficient expiry, where possible, to maximize the likelihood of it being used.
- Red cell components should be transferred separately from other components, to help maintain their temperature for the maximum time possible. Warm or room temperature components, such as recently defrosted FFP or platelets, should be transferred separately, where possible, unless the delivery of components will have a detrimental effect upon a patient.
- Consider the use of separate colour-coded labels or carriers for components, for example red for red cells and yellow for plasma components. This can aid unnecessary opening of boxes, where the content is not yet required.
- All components will be packaged correctly and as far as practicable, ideally, transit containers should be equilibrated to their storage temperature prior to filling with components.
- If a transport box arrives at a different destination than the desired area, staff at the point of receipt must be adequately trained to accept the box or have access to contact details provided upon the box, allowing them to take appropriate action as soon as possible to maintain integrity of the components.

Where a component has been moved out, it should be documented (in LIMS or manually) as a stock move. The ***fate*** *of the unit must then be captured. Components reserved for a patient must have their fate linked to the patient record.*

Stock components that are to be wasted can be fated at ***either the giving or receiving site****, based upon local agreement, but must be recorded as wastage* ***once*** *when entered into VANESA, to avoid duplication.*[20]

6. SATELLITE FRIDGES AND REMOTE ISSUE

Satellite fridges are a secondary storage fridge, not located within the Blood Transfusion laboratory. Their main function is to hold emergency red cells, issued red cells or assist with remote issue[36].

Generally located close to where the red cells are needed, clinical staff can gain rapid access at the point of requirement. Implementation and overall use of the satellite fridges must comply with all MHRA and UKAS standards, mirrored with those in a working blood transfusion laboratory.[30]

ROLES AND RESPONSIBILITIES

- Ownership and overall responsibility of the fridge(s) should be clearly defined within an SLA, between the laboratory and clinical area/organisation.
- The owner is responsible for ensuring that all members of staff within the clinical area served by the fridges as well as laboratory staff who manage the fridge are trained and competency assessed before obtaining access to the fridge.
- Consideration must be given to the number and types of components to be held, including, emergency group O red cells (ideally both D positive and D negative) or general stock. This should be agreed between the Blood Transfusion lab and the clinical area.

PROCEDURES

There should be procedures in place for the following.

- Gaining access and removal of the appropriate units.
- Labelling and release of the units (for remote issue).
- Responding appropriately to alarms and communicating with the laboratory.
- Informing the laboratory when blood has been removed.
- Preventative maintenance and general housekeeping of the equipment.
- Management of any temperature deviations, labelling issues or any unforeseen events.

SECURITY AND ALARMS

- Access should only be given to appropriate, trained personnel.[30] There should be a robust system in place, overseen by a senior member of staff, to register and record all staff who have been granted access, as well as the removal of access when it is no longer appropriate.
- A written procedure is required for management of alarms, both at the clinical area and within the laboratory. This process should include a backup plan if the integrity of the components within the fridge become compromised. It should consider the desired actions required during and outside of routine working hours.

TRANSFER OF RED CELLS AND LOADING THE FRIDGE

- Red cells must be transported from the laboratory to the fridge under controlled conditions to maintain the cold chain. A record of the time of collection from the lab, either electronic or as a manual recording must be taken and verified. If the time has breached, the red cells cannot be placed in the fridge and the blood will be quarantined/discarded.

- Details of all red cells loaded into the fridge must be recorded, manually or electronically. Electronic blood tracking systems are the preferred platform, however if red cells are recorded manually, the information must be clearly written, correct, with no ambiguity and clear signature or initials present.
- Components should be loaded in alignment with designated areas identified within the fridge, blood groups or emergency units for example, and separation of such units must be evident to avoid collection errors.
- Consider the additional use of coloured bags/labels for emergency units, where O D positive an O D negative units are held e.g. blue for D Positive and pink/red for O D negative. This will avoid collection errors in an emergency.
- Red cells loaded for remote electronic issue should be positioned to accommodate shorted expiry first.

REMOVAL OF RED CELLS

- When red cells are removed from the fridge for clinical use, the date and time of removal must be documented/recorded.
- If the red cells are returned unused, a robust system must be in place to calculate the time allowance and recognise any deviations.
- If red cells are returned past the defined ‘out’ time, there must be a system in place to identify the component and prevent further collection. Electronic tracking systems are the preferred system, however manual recording can also be used if the staff are adequately trained, recognise time deviations and manage the components appropriately.
- Where red cells are collected but not transfused and are returned unused, details of the return must be recorded. Such details must be stored.

- It is the responsibility of the laboratory to ensure there is 100% compliance for recording the movement of all red cells in and out of the satellite fridge. The lab must be able to demonstrate regular audit of compliance, and for putting corrective actions in place if compliance is found to be less than 100%.

There should be a robust system in place to alert transfusion laboratory staff immediately if the emergency group O red cells have been removed from a satellite refrigerator so that stocks can be replaced as soon as possible.

REPLENISHMENT OF RED CELLS/ROTATION BACK TO INTO STOCK

- There should be a documented procedure for the replenishment of or rotation of emergency group O red cells within the satellite fridge.
- Unused red cells should be rotated back into stock with sufficient time expiry, to allow for maximum usage, 5 days for example. The lab should consider weekends and bank holiday cover.
- All other unused 'issued' red cells in the fridges should be removed within 24 hours after delivery, or at the dereservation time permitted to the unit (whichever comes first), there may be exceptions (see section 2).
- Staff must be aware of the dates/times for replenishment or replacement of stock. Electronic tracking systems can help to offer this function however visual reminders, logs or handover sheets could also be incorporated to provide this information.

POWER FAILURE/BREAKDOWN PROCEDURE

- In the event of a satellite fridge failure, procedures must be in place to alert the laboratory staff immediately. This may lead to the removal of red cells from the satellite fridge back into the laboratory or at an approved location.

All staff in the clinical area served by the satellite fridge must be aware of the procedure to follow in the event of a fridge power failure or breakdown. Access the laboratory contact details must be readily available.

7. DATA TOOLS AND BENCHMARKING

This section provides valuable data tools for hospital users to employ when managing their stockholding or reviewing wastage. Evidence driven targets, derived from the correlation of hospital data, can be used as key performance indicators (KPI's), allowing users to compare their progress in relation to a specific goal, encourage best practice and allow for benchmarking.[37]

KPI's discussed within this document include the **issuable stock index** (**ISI**), used to identify the number of day's red cell stock held in the blood bank and the **wastage as percentage of issues** (**WAPI**) which provides a percentage of the total stock wasted in relation to your total component issues, regardless of hospital size. A target WAPI can be determined for both red cell and platelet wastage.

When to review?

Stock holding practices should be reviewed regularly, at least annually, or following a significant change. Examples of a significant change can include the amalgamation of hospital services, where the ability to share stock has been established, seasonal changes and unpredictable demand in both the summer or winter months, or where the blood donor pool may have been compromised, large events where surplus stock has been accrued or even during a pandemic where demand may fluctuate. These tools can be applied to one or more blood groups, depending on the requirement.

CALCULATING THE ISI

The **issuable Stock index** is the estimation of the number of day's red cell stock held in your laboratory based on current usage. It is derived by dividing the "issuable stock" by the "nominal stock".

- "Issuable Stock" is the number of unreserved ADULT red cell units of all groups, available for cross matching. (If the laboratory enters data into the BSMS VANESA data portal, this parameter is located on the stock entry screen)[13].
- "Nominal Stock" is the number of red cell units despatched to the hospital in 12 months divided by 365. (If the laboratory enters data into the BSMS VANESA data portal, this number is recalculated every month to show approximately one day's worth of hospital stock and is located on the stock entry screen)[13].

Example:

Issuable stock = 60, nominal stock = 20, ISI = 60/20 = 3.0 (days).

High ISI values can be directly linked to high wastage, as stock is unreserved for longer. It is important to note that the ideal ISI differs between blood groups and can be **influenced by hospital type and size**[1].

CALCULATING THE WAPI

BSMS also provides users with a performance indicator for wastage, known as "**wastage as percentage of issues**" (WAPI).

WAPI shows the percentage of components (either red cell or platelets) wasted over the period analysed.

The lower the ratio, the better the performance. WAPI allows for comparison independent of hospital type and size [1].

Example:

$$\textbf{WAPI}\ (\%) = \frac{\text{Sum of wasted components during period}}{\text{Sum of components issued during period}} \times 100$$

BENCHMARKING AND KPI'S

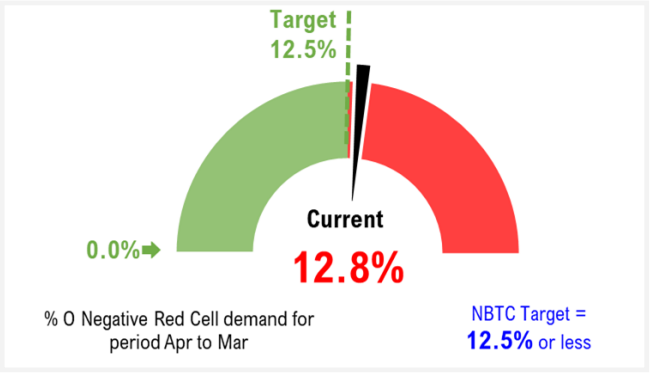
Benchmarks are reference points used to compare performance against others. With regards to blood stocks management, benchmarking can allow us to compare processes amongst our peers, highlighting areas of good practice.

KPIs are decision-making and monitoring tools allowing us to track performance in relation to strategic goals. KPIs can be an early warning system, flagging up where things might be heading off-course and where action might be required.

It is important to recognise the complexity of Blood Transfusion services and that targets provided within this section are not able to truly reflect the unpredictable nature of this service and are available for guidance only.

BSMS provides KPI's for both ISI and WAPI. These targets are based on data provided by VANESA over a rolling period and correlated to give overall achievable targets.

The results can then be used to compare or monitor performance and identify opportunities for improvement.



KPI for Red Cell ISI

This KPI provides the ideal ISI (issuable stock index) for each hospital category (determined by BSMS)[38] and relates to the amount of days worth of red cell stock you have for each blood group. The lower the KPI, the more turnover is expected and therefore the amount of time that a unit of red cells in expected to be unreserved within a blood fridge. Numbers higher than the targeted amount may indicate overstocking and a stock level review would be recommended.

User Category	O+	O-	A+	A-	B+	B-	AB+	AB-
Very High	3-4	4-5	3-4	4-5	4-5	4-5	n/a	n/a
High	4-5	5-6	4-5	5-6	5-6	5-6	n/a	n/a
Moderate	4-6	5-7	4-6	5-7	5-7	5-7	n/a	n/a
Low	6-8	7-9	6-8	7-9	7-9	7-9	n/a	n/a
Very Low	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

KPI for Red Cell WAPI

This KPI provides each user category with a WAPI target for red cells. This metric is compiled of different types of wastage including time expiry (TIMEX), out of temperature control (OTCOL), refrigerator failure (FF) and miscellaneous (MISC) and is then calculated to give a value.[1,13] The lower the WAPI, the less wastage you have accumulated.

User Category	A,B & O % WAPI	O Neg % WAPI
Very High	<2.5%	<4.5%
High	<2.5%	<4.5%
Moderate	<2.5%	<4.5%
Low	<5.0%	<7.0%
Very Low	n/a	n/a

KPI for platelet WAPI

This KPI provides each user category with a WAPI target for platelets. This metric is compiled of different types of wastage including medically ordered not used (MONU), surgically ordered not used (SONU), stock platelet time expired (STEX), wasted out of laboratory (WOL), wasted import (WI) and miscellaneous (MISC) and is then calculated to give a value. The lower the WAPI, the less wastage you have accumulated.

The targets provided have been calculated using hospital data, taken over a rolling period for each category. A tolerance of 2 standard deviations has been considered to provide a target for platelet WAPI.

User Category	PLT % WAPI Target
Very High	<4.0%
High	<5.0%
Moderate	<7.0%
Low	<7.5%
Very Low	n/a

What action should I take if I am out of consensus?

ISI

If you have a higher than average KPI for ISI this could indicate that your stock levels are set too high. It is important to note that ISI targets may not be suitable for every site/organisation as there are many factors to consider.

However, if your wastage KPI's are also higher than average, stock levels should be reviewed and reduced where applicable. This can be performed in stages to increase staff confidence.

WAPI

If you have a higher than average KPI for WAPI (red cell or platelet) this could be attributed to different reasons. A breakdown of the wastage categories will provide you with a main cause for the wastage, allowing you to target an area and suggest improvements.

It is important to note that WAPI targets may be complex as there are many factors to consider. However, if your wastage KPI's are mainly attributed to TIMEX/STEX, then stock levels should be reviewed and reduced where applicable.

Where can I get help?

BSMS can provide you with a detailed breakdown of stock issues, levels, usage and wastage to provide you with evidence to promote changes where applicable. For advice and guidance on specific KPI's contact Blood Stocks Management Scheme at ✉ **BSMS@nhsbt.nhs.uk**

8. EFFECTIVE COLLABORATION

Collaboration between departments and organisations have proven to be beneficial by increasing flexibility, reducing wastage and enhancing overall performance.[1,39] By encouraging clinicians to understand the fragility of our blood supply we can minimise the number of unnecessary requests. Component reports provided by BSMS should be reviewed and shared at local meetings to encourage continuous improvement and reduce wastage.

INTERNAL COLLABORATION

- There should be open communication between all laboratory staff, who may wish to highlight poor areas of inventory management practice.
- Regular internal team meetings should include usage and wastage figures to compliment ongoing improvement within the department.
- KPI's should be reviewed internally to monitor performance, identify trends and promote best practice.[37]

ORGANISATIONAL COLLABORATION

- Regular Hospital Transfusion Committee/Team meetings will be held to discuss usage and wastage as well as ISI and WAPI as key performance indicators.
- Clinicians may ask laboratory staff for advice when ordering blood components, all qualified staff should have sufficient knowledge of appropriateness of requests.
- Patient Blood Management compliance and inclusion should be discussed at local Hospital Transfusion Committee/Team meetings.
- Staff should also have knowledge of local policies as well as national guidance and where to obtain the information.

EXTERNAL COLLABORATION

- Building good relationships with staff involved in the supply, handling and use of blood components can help with managing your inventory.
- Laboratories should engage with their suppliers regularly to understand demand and supply on a larger scale.
- Laboratories should adopt good practice guidance from external sources where appropriate to improve their inventory management processes.

9. BLOOD MANAGEMENT PLANNING AND CONSERVATION

There may be unforeseen events that lead to a threatened supply of blood components within NHSBT. Organisations should develop local policies, known as emergency blood management plans (EBMP) concerning the management of shortages and conserving blood for both short and long term.[8]

Emergency Blood Management Plans (EBMP) where roles and responsibilities are clearly defined, should be written and agreed at local Hospital Transfusion Committees. Content should be regularly reviewed and updated.

- A responsible person should be identified to communicate information regarding shortages to both internal and external users. This will usually be a laboratory manager or senior who will have access to national stock levels.
- Laboratories will have an identified point of contact (Haematology Consultant) to aid with decision making during times of shortage. This be written into the local emergency blood management plan. They will prioritise and assess clinical need to maximize the most appropriate use of the component(s).
- Laboratories must consider strategies for single or multiple blood group shortages. Details of actions will be included within the EBMP.[8]
- Use of alternatives, risks and benefits should always be considered. Consult Patient Blood Management guidance.[32]
- Laboratories can consult the Blood Stocks Management Scheme Blood Shortage Guide for blood conservation tips.[40]

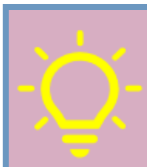
Group O Negative red cell shortages

- Consider your stock levels, can you make any reductions? 1 unit per site can make a big difference nationally.
- Implement or maintain the provision of O D Positive red cells to males >18 and females >50 years old in emergency situations.[32]
- Consider the use of O D Positive red cells to males >18 and females >50 years old routinely during prolonged O Negative shortages.
- Consider the temporary closure of satellite fridges (that stock O Neg), providing clear instructions for staff on how to request them if required, for tighter control over emergency stock. (Discuss this locally with the HTC members).
- Consider setting up partnerships with local hospitals to share stock if possible.

10. MANAGING STOCKS DURING IT DOWNTIME

Laboratory downtime

There may be occasions when there is limited or no access to the Laboratory Information Management System (LIMS), therefore possibly preventing data retrieval for VANESA data entry. These occasions may be planned or short term, where information will be gathered/retrieved and submitted to VANESA at a later date/time, or they could be unplanned or long term, where a suitable back-up plan is required.



It is important to continue to record your daily stock levels and wastage data manually, so that they can be inputted into VANESA retrospectively.[20] The Blood stocks team can offer support with this.

During prolonged periods of downtime, for example a cyber-attack, where there is no access to the LIMS, there should be a manual, alternative method for recording blood stocks information. The data required includes:

- **Daily component stock levels**
- **Wastage, including wastage category for each component**

BSMS have provided a template for each type of data collection, available to print off and use if required. These can be found in Appendix A and Appendix B.

- **Appendix A** - Contingency document - Record of daily stock levels (during downtime)
- **Appendix B** - Contingency document - Record of monthly component wastage (during downtime)

These forms may be used by the laboratory site to enter the data retrospectively once they are active again, or can be emailed to the BSMS team regularly to be inputted by a member of the team. This will lessen the impact of any missing data on the monthly component reports.

VANESA downtime

Planned VANESA downtime will be highlighted to users on the VANESA home screen as an alert under '***Messages and announcements***'. [20]

We would ask all hospitals to complete their data entry as soon as possible following the return of VANESA to full use.

Prolonged downtime of VANESA may prompt the use of the contingency documents, as well as post downtime support from the laboratory to enter the data retrospectively.

11. USEFUL LINKS/PUBLICATIONS

There are various publications on the Blood Stocks website to support hospitals with their inventory management practice.

Visit: https://www.bloodstocks.co.uk/resources/publications/

1. Inventory management audit tool record template.

BSMS have provided a handy audit tool based off this best practice guide to support hospital laboratory processes and identify any gaps that may assist with local inventory management improvements.

2. Blood shortage alert support document.

This document was produced to assist hospitals with their inventory management practices during threats to the supply chain. Shortage alerts may be component specific where either all or individual blood groups are affected or they may be blood group specific where all associated components will be impacted. The document highlights specific actions that can be taken to promote best practice for inventory management and to contribute to improving and maximising stock holding practices during each phase of a blood shortage alert.

3. Blood shortage alert inventory management audit tool.

BSMS have provided an audit tool to support hospital laboratories during component shortages to help prepare the laboratory and maximise their inventory management practice.

4. VANESA guide

BSMS have produced a helpful guide for navigating the VANESA data portal. From entering stock and wastage data to retrieving and exporting information to allow users to make informed decisions regarding their performance.

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APPENDIX A

Blood Stocks Management Scheme

RECORD OF DAILY STOCK LEVELS DURING DOWNTIME

Blood Stocks Management Scheme

Hospital name

Month.....Year.....

	RED CELL DAILY STOCK LEVEL								PLATELET STOCK LEVEL							
	O POS	O NEG	A POS	A NEG	B POS	B NEG	AB POS	AB NEG	O POS	O NEG	A POS	A NEG	B POS	B NEG	AB POS	AB NEG
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Blood Stocks Management Scheme

RECORD OF DAILY STOCK LEVELS DURING DOWNTIME

Blood Stocks Management Scheme

Hospital name	FRESH FROZEN PLASMA DAILY STOCK LEVEL				CRYOPRECIPITATE DAILY STOCK LEVEL			
Month.....Year.....	O	A	B	AB	O	A	B	AB
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APPENDIX A

Blood Stocks Management Scheme

RECORD OF WASTAGE DURING DOWNTIME

Blood Stocks Management Scheme

Hospital name	RED CELLS				PLATELETS					
Month.....Year.....	Time expired (TIMEX)	Out of temperature control (OTCOL)	Fridge Failure (FF)	Miscellaneous (MISC)	Medically ordered not used (MONU)	Surgically ordered not used (SONU)	Time expired stock (STEX)	Wasted out of lab (WOL)	Wasted import (WI)	Miscellaneous (MISC)
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APPENDIX B

Blood Stocks Management Scheme

RECORD OF WASTAGE DURING DOWNTIME

Blood Stocks Management Scheme

Hospital name	FRESH FROZEN PLASMA							CRYOPRECIPITATE						
Month.....Year.....	Time expired (TIMEX)	Split damaged leaked (SDL)	Pre-thawed for procedure not used (PTPRO)	Thawed MHP not used (TTMH)	Thawed Non-MHP not used (TNTMH)	Freezer Failure (FZF)	Miscellaneous (MISC)	Time expired (TIMEX)	Split damaged leaked (SDL)	Pre-thawed for procedure not used (PTPRO)	Thawed MHP not used (TTMH)	Thawed Non-MHP not used (TNTMH)	Freezer Failure (FZF)	Miscellaneous (MISC)
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APPENDIX B

Acknowledgments

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